Arid Lands Environment Centre

Office: 90 Gap Road Alice Springs NT
Mail: PO Box 2796 Alice Springs 0870 NT
Web: www.alec.org.au
Phone: 08 89522497
Email: policy@alec.org.au

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Senate Inquiry into 'Australia's Faunal extinction crisis' submission

The Arid Lands Environment Centre (ALEC) is Central Australia's peak community environmental organisation that has been advocating for the protection of nature and growing sustainable communities in the arid lands since 1980. ALEC actively contributes to the development of biodiversity and conservation policy, through participation on Alice Springs Regional Weeds Reference Group, participation and engagement with the New Established Weeds Priority Framework, written submissions, community education and advocacy.

ALEC welcomes the opportunity to contribute to the Senate Inquiry into 'Australia's Faunal Extinction Crisis' (Senate Inquiry).

In this submission we first outline the arid zone context, considering the current state of the environment, Central Australia's extinction crisis and current and future climate change impacts. Then we use two case studies to demonstrate how existing policies, plans and programs are failing Central Australia's threatened species. The first focuses on buffel grass management which is a key threatening process for 19 threatened fauna species. The second focuses on resourcing constraints and focuses on Northern Territory Parks. These case studies emphasise the need for structural issues contributing to the extinction crisis to be central to the Senate Inquiry's Final Report.

1. Background: the arid and semi-arid zone

a. The environment is in a state of collapse

Four of the Northern Territory's iconic ecosystems are undergoing ecological collapse[1]. These are western-central arid zones, Georgina Gidgee woodlands, Australian tropical savanna and mangrove forests. Collapse is understood as an ecosystem which has undergone 'a change from a baseline state beyond the point where an ecosystem has lost key defining features and functions and is characterised by declining spatial extent, increased environmental degradation, decreases in, or loss of, key species, disruption of biotic processes, and ultimately loss of ecosystem services and functions'[2]. In Central Australia, this is due to temperature and precipitation changes, heatwaves and fire weather. Regional human pressures are a result of habitat change and loss, invasive species such as buffel grass, livestock, agriculture and water extraction[3]. We are observing Central Australia's unique, diverse and vibrant environments transforming due to these pressures. It is unsurprising in this context that Central Australia is amidst a faunal extinction crisis, we discuss this more below.

[1] **Bergstrom, D, Wienecke, B, van den Hoff, J, Hughes, L, Lindenmayer, D, Ainsworth, T, Baker, C, Bland, L, Bowman, D, Brooks, S, and Canadell, J. 2021**. Combating ecosystem collapse from the tropics to the Antarctic. Global change biology, 27(9), pp.1692-1703.
[2] Ibid, p.1693.
[3] Ibid, p.1694.

Biodiversity decline, ecosystem collapse and the extinction crisis is the current reality across the Northern Territory.

b. Faunal extinctions

There have been 11 recorded extinctions in the Northern Territory. All 11 of these have been based in Central Australia. It places Central Australia at the forefront of the extinction crisis nationally. Further, 10 of these species have been mammals, granting Central Australia the unwanted status as a world leader in mammalian extinctions.

'Since colonisation, Australia has lost 34 mammals, which is about the same number as the rest of the world combined over the past 200 years', with all 10 having had distributions in Central Australia (*Table 1*)[4]. A further 8 mammals are now locally extinct across the Northern Territory. The Thick-billed grasswren (*Amytornis modestus modestus*) is another Central Australian species that has gone extinct.

A 2018 article stated that 'there are almost 500 threatened fauna species across Australia - 101 of which are in the Northern Territory'[5]. In 2022, there are now 556 species threatened nationally, and 141 threatened in the Northern Territory[6][7]. The trend is declining and severe.

Table 1. Extinction of fauna in the Northern Territory. All 11 had distributions within Central Australia[8]

Number	Animal group	Common Name of extinct fauna	Scientific name of extinct fauna
1	Mammal	Burrowing bettong (inland)	*Bettongia lesueur graii*
2	Mammal	Central Hare wallaby	*Lagorchestes asomatus*
3	Mammal	Crescent nailtail wallaby	*Onychogalea lunata*
4	Mammal	Desert bandicoot	*Permeles eremian*a
5	Mammal	Desert bettong	*Bettongia anhydra*
6	Mammal	Lesser bilby	*Macrotis leucura*
7	Mammal	Lesser stick-nest-rat	*Leporillus apicalis*
8	Mammal	Long-tailed hopping mouse	*Notomys longicaudatus*
9	Mammal	Pig-footed bandicoot	*Chaeropus ecaudatus*
10	Mammal	Short-tailed hopping mouse	*Notomys amplus*
11	Bird	Thick-billed grasswren	*Amytornis modestus modestus*

[4] **Foley, M, 2020.** 'Why is Australia a global leader in wildlife extinctions?' Sydney Morning Herald.
[5] **Smith, E, 2018**. 'Central Australia may have seen the world's worst rate of mammal extinction - but it could get worse'. Accessed 14th September 2022.
[6] **Department of Climate Change, ENergy, the Environment and Water, 2022.** 'EPBC Act List of Threatened Fauna'. Accessed 14th September 2022.
[7] **Northern Territory Government, 2022.** 'Threatened animals'. Accessed 12th September 2022.
[8] Ibid

There are 141 threatened fauna (and 84 threatened flora species) in the Northern Territory[9]. Table 2 outlines by animal group the breakdown of threatened species across the Northern Territory. More than 60% of threatened mammals and birds have or have had distributions in Central Australia.

Table 2: Threatened Fauna in the Northern Territory and Central Australia by animal group. Threatened fauna in the Northern Territory includes species that are vulnerable, endangered, critically endangered and extinct.

Animal Group	**Mammal**	**Bird**	**Reptile**	**Amphibian**	**Fish**	**Invertebrate**	**Total**
Total number of species with recorded distributions in the NT	47	31	19	1	11	32	141
Number of species with recorded distributions in Central Australia	29	19	5	0	1	23	77

These species are diverse across a range of animal groups that are based in Central Australia such as: for mammals, the greater bilby (*Macortis lagotis*) and central rock-rat (*Zyzomys pedunculatus)*; for birds, the princess parrot (*Polytelis alexandrae*), Mallefowl (*Leipoa ocellata*) and night parrot (*Pezoporus occidentalis*); for reptiles, the great desert skink (*Liopholis kintorei),* slater's skink and bronzeback (*Ophidiocephalus taeniatus*); and for invertebrates, the many different snail species endemic to this region.

While this may seem excessive, to demonstrate the crisis that is unfolding across the Northern Territory, Table 3, targets one group of threatened fauna, mammals, and lists all 37 species that have not yet gone extinct nationally but have or have had distributions in the Northern Territory. This includes the 8 mammals that are locally extinct in the Northern Territory, but still have populations in other jurisdictions. We are illuminating the crisis one species at a time. We have found that 19 of the 37 species have or have historically had distributions across Central Australia. This is in addition to the 10 extinct mammals that have already gone extinct nationally that were based in Central Australia.

c. Climate

While the Territory is already a place of climate extremes, climate change is increasing the intensity, frequency and variability of climatic events[10]. In Central Australia this means hotter temperatures, more intense heat events, longer periods in drought, more intense rainfall events, more erratic rainfall and aquifer recharge, an increase in the likelihood of major flood events, drier soils, increased evapotranspiration, more wildfires and increased risks of erosion[11].

9

[10] **Intergovernmental Panel on Climate Change**, 2022. 'Chapter 11: Australasia'. IPCC WGII Sixth Assessment Report: Full report.

[11] **CSIRO. 2020**. 'Climate change in the Northern Territory: State of the science and climate change impacts'.

Table 3: Threatened mammals that are or have had habitat in the Northern Territory.

Number	Common name	Scientific name	Conservation status
1	Arnhem leaf-nosed bat	*Hipposideros inornatus*	Vulnerable
2	Arnhem rock-rat	*Zyzomys maini*	Vulnerable
3	Bare-rumped sheath-tailed bat	*Saccolaimus saccolaimus nudicluniatus*	Vulnerable (Listed nationally but not in the NT)
4	**Black-footed rock-wallaby (central Australian)**	***Petrogale lateralis centralis***	**Vulnerable (Listed nationally but not in the NT)**
5	Black-footed tree-rat (Kimberley and mainland NT)	*Mesembriomys gouldii gouldii*	Endangered
6	Black-footed tree-rat (Melville Island)	*Mesembriomys gouldii melvillensis*	Vulnerable
7	**Brush-tailed bettong**	***Bettongia penicillata***	**Endangered (extinct in the NT)**
8	Brush-tailed rabbit-rat	*Conilurus penicillatus*	Endangered
9	Butler's dunnart	*Sminthopsis butleri*	Vulnerable
10	Carpentarian rock-rat	*Zyzomys palatalis*	Endangered
11	**Central rock-rat**	***Zyzomys pedunculatus***	**Critically endangered**
12	**Common brushtail possum (central and south eastern)**	***Trichosurus vulpecula vulpecula***	**Endangered**
13	Common brushtail possum (north-western)	*Trichosurus vulpecula arnhemensis*	Vulnerable (Listed nationally but not in the NT)
14	**Crest-tailed mulgara**	***Dasycercus cristicauda***	***Vulnerable***
15	**Dusky hopping-mouse**	***Notomys fuscus***	**Endangered**
16	Fawn Antechinus	*Antechinus bellus*	Endangered
17	**Fawn hopping-mouse**	***Notomys cervinus***	**Least concern (extinct in NT)**
18	**Ghost bat**	***Macroderma gigas***	**Vulnerable (listed nationally but not in the NT)**
19	**Golden bandicoot**	***Isoodon auratus***	**Endangered**
20	Golden-backed tree-rat	*Mesembriomys macrurus*	Critically endangered
21	**Greater bilby**	**Macrotis lagotis**	**Vulnerable**
22	Humpback whale	*Megaptera novaeangliae*	Vulnerable (listed nationally but not in the NT)
23	**Kowari**	***Dasyuroides byrnei***	**Vulnerable (extinct in the NT)**
24	**Mala**	***Lagorchestes hirsutus Central Australian subspecies***	**Endangered (extinct in wild in NT)**
25	Nabarlek (Top End)	*Petrogale concinna canescens*	Endangered

26	Nabarlek (Victoria River district)	*Petrogale concinna concinna*	Critically endangered (possibly extinct)
27	Northern brush-tailed phascogale	*Phascogale pirata*	Endangered
28	Northern hopping-mouse	*Notomys aquilo*	Vulnerable
29	Northern Quoll	*Dasyurus hallucatus*	Critically endangered
30	**Numbat**	***Myrmecobius fasciatus***	**Endangered (extinct in the NT)**
31	**Pale field-rat**	***Rattus tunneyi***	**Vulnerable**
32	**Plains mouse**	***Pseudomys australis***	**Endangered**
33	**Red-tailed phascogale**	***Phascogale calura***	**Vulnerable (extinct in the NT)**
34	**Sandhill dunnart**	***Sminthopsis psammophila***	**Endangered**
35	**Shark Bay mouse**	***Pseudomys fieldi***	**Vulnerable (extinct in the NT)**
36	Water mouse	*Xeromys myoides*	Vulnerable (listed nationally but not in the NT)
37	**Western Quoll**	***Dasyurus geoffroii***	**Vulnerable (extinct in NT)**

*species in bold have or have had distributions in Central Australia.

Comparing the 10-year average from 1942-1951 with the last ten years, Alice Springs has warmed already by 2 degrees C, with many of its hottest years on record occurring in the last 5 years (Figure 1). In Alice Springs, there were six times more days above 44℃ annually between 1990-2019 than in 1960-1989. Tennant Creek across the same period has experienced 7 days a year above 44℃ compared to zero in the 30 years prior[12]. In January 2019, the average daily maximum temperature in Alice Springs was 41.5℃, 5℃ above the average maximum temperature for January[13].

Under a high emissions scenario, by the end of the century we can expect every second day in Alice Springs to be above 35 degrees, nearly double the historical average[14]. Tennant Creek and Elliott will see close to an extra 100 days above 35℃ across the same period[15].

In Central Australia under a high-emissions scenario, by 2046-75 climate change is modelled to: reduce median rainfall by 5-10%, with minor reductions in summer and major reductions in winter rain; reduce mean annual runoff by 5-20%; result in a 5-20% decrease of median flows during dry years, and a 5-50% increase in median flow during wet years[16]. During very dry and very wet years a >50% decrease and >50% increase in flows can be expected respectively[17]. This may have substantial water insecurity implications for environments and ecosystems that are dependent on shallow groundwater systems and recharge.

Increased temperatures, more heatwaves and longer time spent in drought, combined with more erratic and variable rainfall result in a high likelihood that 'fire weather will become more frequent

[12] Ibid

[13] **Bureau of Meteorology. 2021**. 'Climate data online: Monthly mean maximum temperature: Alice Springs Airport'. Accessed March 2022.

[14] CSIRO. 2020, p.14. 'Climate change in the Northern Territory: State of the science and climate change impacts'.

[15] Ibid.

[16] **Zheng, H, Chiew, F, Potter, N, Kirono, D, 2019**. 'Projections of water futures for Australia: an update.

[17] Ibid.

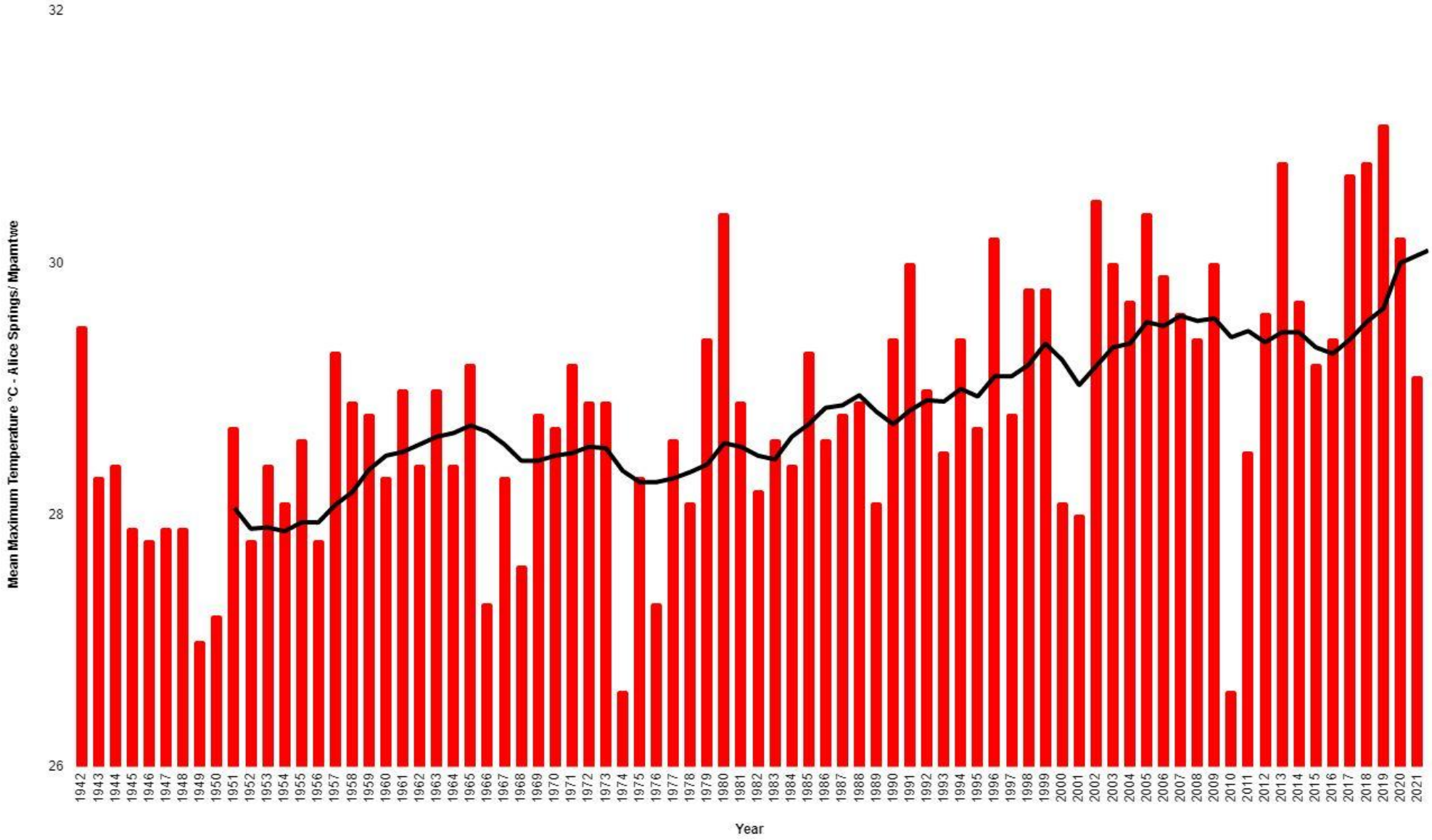

Figure 1. Mean Maximum Temperature in Alice Springs between 1942-2021, with a 10-year moving average trendline.

and harsher' in the Northern Territory[18]. The *Climate change in the Northern Territory: State of the Science and climate change impacts report* goes further stating that:

> 'in the southern and central parts of the Territory changes to fire frequency depend on rainfall changes. With higher temperatures and lower rainfall, climate change will result in a harsher fire-weather climate in the future; that is, when bushfires occur, more extreme fire behaviour can be expected'[19].

Wildfires place the Northern Territory's unique, diverse and threatened environments at risk, while infrastructure that supports tourism, land management and remote communities will also be under threat (e.g. 2021 wildfires at Watarrka National Park, 2018-19 wildfires in the Tjoritja/ West MacDonnell Ranges National Park).

The previous Minister for Environment, Climate Change and Water Security, echoed this strong warning, stating 'if we don't do anything [about climate change], the NT will become unlivable'[20]. The realities of climate change are stark with its impacts cascading and compounding, further threatening already at-risk ecosystems[21].

There is a major deficit in knowledge in understanding how threatened species will be impacted by climate change. 'Assessing species' vulnerability to climate change is a prerequisite for developing effective strategies to conserve them'[22]. The climate crisis and the nature crisis need to be considered as twin crises'. They are connected and solutions will be required to address both simultaneously.

Intergovernmental Panel on Climate Change report 'Climate Change 2022: Impacts, Adaptation and Vulnerability'

New and updated scientific reporting by the Intergovernmental Panel on Climate Change (IPCC) serves as a stark reminder of the climatic trends impacting Australia. This new report emphasises that a 'step change' is required to mitigate and adapt to the impacts of climate change. Early investment and planning will minimise costs and promote opportunities. This directly applies to biodiversity and conservation policy, plans and programs. The report's focus on vulnerability is particularly relevant to the Northern Territory. The report states that[23]:

1. 'Ongoing climate trends have exacerbated many extreme events (very high confidence)';
2. 'Climate trends and extreme events have combined with exposure and vulnerabilities to cause major impacts for many natural systems, with some experiencing or at risk of irreversible change in Australia (very high confidence)';
3. 'Climate trends and extreme events have combined with exposure and vulnerabilities to

[18] **CSIRO. 2020, p.21**. 'Climate change in the Northern Territory: State of the science and climate change impacts'.
[19] Ibid.
[20] **Allam, L, Evershed, N, Bowers, M, 2019.** 'Too hot for humans: First Nations people fear becoming Australia's first climate refugees'. The Guardian.
[21] **Intergovernmental Panel on Climate Change**, 2022, p.3. 'Chapter 11: Australasia'. IPCC WGII Sixth Assessment Report: Full report.
[22] **Foden, W.B., Young, B.E., Akçakaya, H.R., Garcia, R.A., Hoffmann, A.A., Stein, B.A., Thomas, C.D., Wheatley, C.J., Bickford, D., Carr, J.A. and Hole, D.G., 2019**. Climate change vulnerability assessment of species. *Wiley interdisciplinary reviews: climate change*, *10*(1), p.e551.
[23] **Intergovernmental Panel on Climate Change, 2022, p.3-6**. 'Chapter 11: Australasia'. IPCC WGII Sixth Assessment Report.

cause major impacts for some human systems (high confidence)'.

4. 'Climate impacts are cascading and compounding across sectors and socio-economic and natural systems (high confidence). Complex connections are generating new types of risks, exacerbating existing stressors and constraining adaptation options';
5. 'Increasing climate risks are projected to exacerbate existing vulnerabilities and social inequalities and inequities (high confidence)';
6. 'Further climate change is inevitable, with the rate and magnitude largely dependent on the emission pathway (very high confidence)';
7. 'Climate risks are projected to increase for a wide range of systems, sectors and communities, which are exacerbated by underlying vulnerabilities and exposures (high confidence)';
8. 'There are important interactions between mitigation and adaptation policies and their implementation (high confidence)'.

These challenges and solutions were identified:

9. 'The ambition, scope and progress of the adaptation process has increased across governments, non government organisations, businesses and communities (high confidence)';
10. 'Adaptation progress is uneven, due to gaps, barriers and limits to adaptation, and adaptive capacity deficits (very high confidence)';
11. 'A range of incremental and transformative adaptation options and pathways is available as long as enablers are in place to implement them (high confidence)';
12. 'New knowledge on system complexity, managing uncertainty and how to shift from reactive to adaptive implementation is critical for accelerating adaptation (high confidence)';
13. 'Aboriginal and Torres Strait Islander Peoples and Tangata Whenua Māori can enhance effective adaptation through the passing down of knowledge about climate change planning that promotes collective action and mutual support across the region (high confidence)';
14. 'A step change in adaptation is needed to match the rising risks and to support climate resilient development (very high confidence)';
15. 'Delay in implementing adaptation and emission reductions will impede climate resilient development, resulting in more costly climate impacts and greater scale of adjustments (very high confidence)'

Recommendations 1: Conduct climate change vulnerability assessments and climate change risk assessments for threatened species nationally.

Recommendation 2: Embed climate change considerations into conservation and biodiversity policies, plans and programs.

2. Case Study 1: Buffel grass crisis

Buffel grass is a useful case study in understanding how key threatening processes are contributing to ecosystem collapse, biodiversity decline and extinction. Understanding the faunal extinction crisis cannot be decoupled from the systems and processes that are contributing to species decline.

a. The problem

Buffel grass is the greatest invasive species threat to environment and culture across Central Australia[24]. It was also identified as a 'high-impact environmental grass species' in the State of Environment Report 2021[25]. Buffel outcompetes native grasses, destroys shrubs and large trees, has a positive fire-invasion feedback and monocrops entire landscapes[2627] (Figure 2). It is a transformer of habitats and landscapes with severe and widespread impacts upon local flora and fauna[2829]. It is deep rooted, hardy, long-lived and drought tolerant, making it a particularly difficult invasive species to remove once it is established. It has a high-biomass and fruits and flowers rapidly after rain which can see its distribution quickly expand. Ultimately, it is its promotion of fire that is dramatically altering desert ecology.

One buffel-fuelled fire event in Tjoritja/ West MacDonnell Ranges National Park destroyed over a quarter of the large trees in the area[30]. Buffel grass is resulting in the destruction of stands of ancient trees (including trees greater than 500 years old) along the riparian zone, destroying critical bird and bat habitat and reducing biological diversity and abundance of many reptile species [313233].

The presence of buffel grass substantially exacerbates the threat and impact of fire across Central Australia. Buffel grass fires can be as tall as 7.5 metres, and have been directly and indirectly recorded to hit temperatures of 871℃ and 900℃ respectively[3435]. Buffel has a fuel load substantially greater than native grasses[3637]. Its ability to alter the fire regime ensures that it is a significant and direct threat to areas of high conservation and cultural value[38]. As its expansion is enhanced by fire, the threat and risk increases after buffel-promoted wildfires[39].

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[24] **Read, J, Firn, J, Grice, A, Murphy, R, Ryan-Colton, E, and Schlesinger, C**, 2020. Ranking buffel: Comparative risk and mitigation costs of key environmental and socio-cultural threats in central Australia. *Ecology and Evolution*, *10*(23), pp.12745-12763.

[25] **Murphy, H, & van Leeuwen, S, 2021, p.95.** Australia state of the environment 2021: biodiversity, independent report to the Australian Government Minister for the Environment, Commonwealth of Australia, Canberra, DOI: 10.26194/ren9-3639.

[26] **Schlesinger, C., White, S. and Muldoon, S., 2013.** Spatial pattern and severity of fire in areas with and without buffel grass (C enchrus ciliaris) and effects on native vegetation in central A ustralia. *Austral Ecology*, *38*(7), pp.831-840.

[27] **Miller, G, Friedel, M, Adam, P, Chewings, V, 2010, p.26**. Ecological impacts of buffel grass (Cenchrus ciliaris L.) invasion in central Australia–does field evidence support a fire-invasion feedback?. *The Rangeland Journal*, *32*(4), pp.353-365.

[28] **Schlesinger, C.A. and Westerhuis, E.L., 2021.** Impacts of a single fire event on large, old trees in a grass-invaded arid river system. *Fire Ecology*, *17*(1), pp.1-13.

[29] **Schlesinger, C.A, Kaestli, M, Christian, K.A. and Muldoon, S, 2020.** Response of reptiles to weed-control and native plant restoration in an arid, grass-invaded landscape. *Global Ecology and Conservation*, *24*, p.e01325.

[30] **Schlesinger, C.A. and Westerhuis, E.L., 2021.** Impacts of a single fire event on large, old trees in a grass-invaded arid river system. *Fire Ecology*, *17*(1), pp.1-13.

[31] **Schlesinger, C.A. and Westerhuis, E.L., 2021.** Impacts of a single fire event on large, old trees in a grass-invaded arid river system. *Fire Ecology*, *17*(1), pp.1-13.

[32] **Westerhuis, E.L., Schlesinger, C.A., Nano, C.E., Morton, S.R. and Christian, K.A., 2019**. Characteristics of hollows and hollow-bearing trees in semi-arid river red gum woodland and potential limitations for hollow-dependent wildlife. *Austral Ecology*, *44*(6), pp.995-1004.

[33] **Schlesinger, C.A., Kaestli, M., Christian, K.A. and Muldoon, S., 2020.** Response of reptiles to weed-control and native plant restoration in an arid, grass-invaded landscape. *Global Ecology and Conservation*, *24*.

[34] **National Park Service, 2022.** 'How bad are buffelgrass fires?'. Saguaro: National Park Arizona. https://www.nps.gov/sagu/learn/nature/how-bad-are-buffelgrass-fires.htm

[35] **Palin, M, 2014.** 'Gamba grass spreads throughout the Northern Territory'. NT News.

[36] Ibid

[37] **Beaumont, T, Keily, T, Kennedy, Simon, 2018.** 'Counting the cost: Economic impacts of gamba grass in the Northern Territory'.

[38] **Schlesinger, C, White, S,Muldoon, S, 201**3. Spatial pattern and severity of fire in areas with and without buffel grass (C enchrus ciliaris) and effects on native vegetation in central Australia. *Austral Ecology*, *38*(7), pp.831-840.

[39] **Miller, G, Friedel, M, Adam, P, Chewings, V, 2010, p.26**. Ecological impacts of buffel grass (Cenchrus ciliaris L.) invasion in central Australia–does field evidence support a fire-invasion feedback?. *The Rangeland Journal*, *32*(4), pp.353-365.

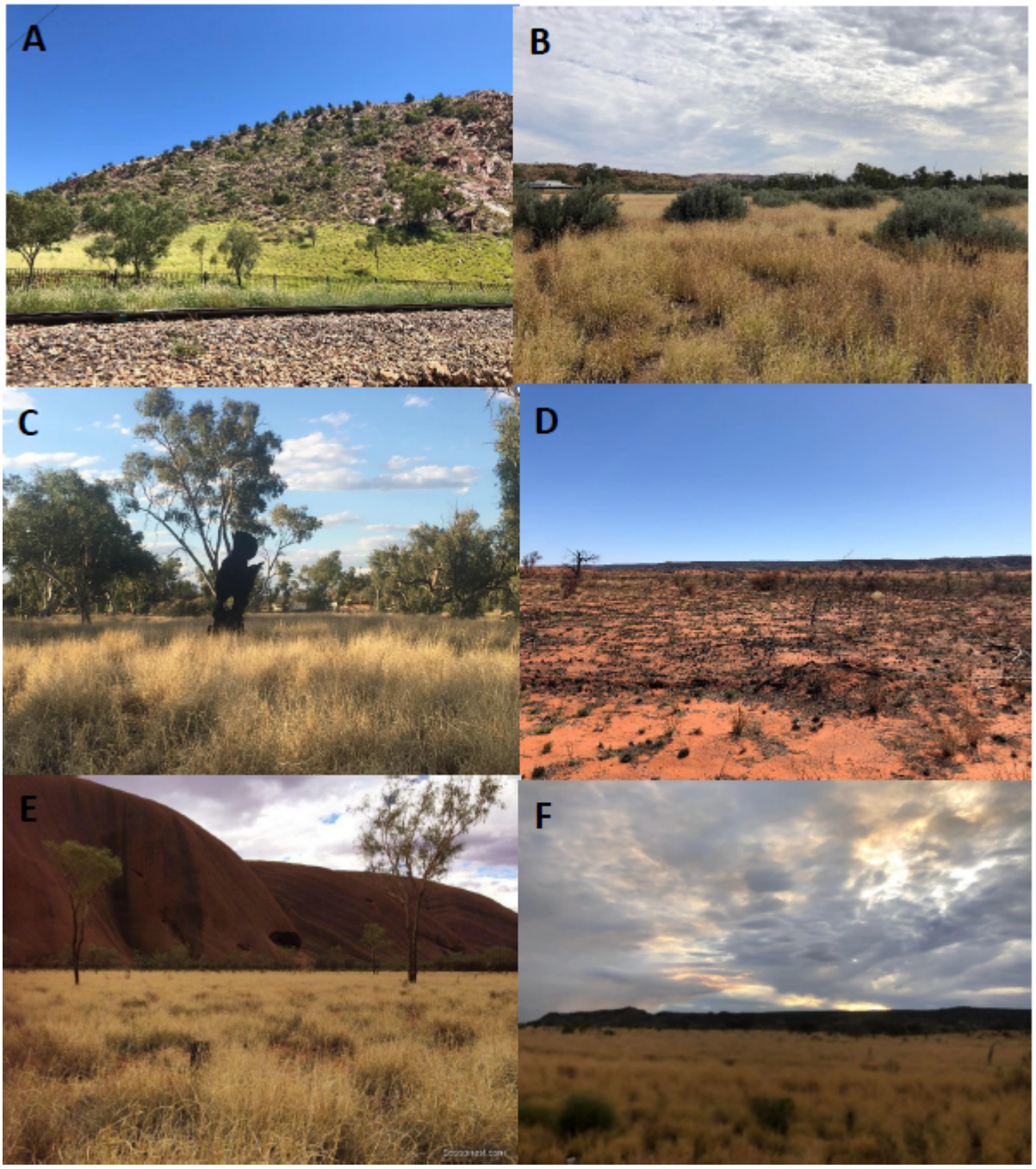

Figure 2. Buffel grass across Central Australia. (A) Buffel grass displacing spinifex and climbing up a hillside; (B) buffel outcompeting native grasses and surrounding shrubs; (C) Buffel grass in the riparian zone with evidence of a large tree destroyed by fire; (D) landscape post fire; (E) buffel grass at Uluru; (F) monocrop of buffel grass.

Buffel grass directly impacts cultural values, threatening bush foods, bush medicine and hunting practices[40]. Buffel also puts sacred sites, waterholes and special places at risk due the introduction of fire, or its huge biomass overgrowing important sites[41]. 'Together with the loss of species, this inhibits the transfer of cultural knowledge from one generation to another'[42]. The State of the Environment Report highlights this further, stating that buffel has 'had cascading negative effects on cultural transmission to younger generations and maintaining cultural practices. Indigenous people of central Australia are now reluctant or unable to conduct traditional fire management due to the increased intensity of buffel grass fires and quick recovery of buffel grass after fires'[43].

While the risk has been known and growing for decades in Australia and abroad[44][45][46][47], buffel grass management continues to be uncoordinated, unstrategic and most commonly non-existent (outside of South Australia). This is despite buffel being found in every mainland state and the Northern Territory, with nearly 70% of the continent suitable for its growth[48].

In the Commonwealth managed Uluru-Kata Tjuta National Park, the buffel grass invasion continues to expand, let alone National Parks such as Watarrka, Finke Gorge and the Tjoritja/ West MacDonnell Ranges which are overrun with buffel grass. In addition, the buffel grass invasion in and around Alice Springs, also brings with it the real potential to endanger human life and sacred sites, such as those along the Lhere Mparntwe (Todd River).

In the Northern Territory, buffel is still not a declared weed meaning there are no restrictions of its use or generally any obligations for management. Subsequently, the buffel invasion continues to expand. Targeted and strategic funding, basic mapping of its distribution and educational resources outlining the risks posed are all not occurring. Sites of ecological and cultural significance are still not adequately protected across Central Australia.

b. Threatened fauna currently or potentially impacted by buffel grass

There are 19 threatened fauna that are currently or potentially impacted by buffel grass (Table 4).

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[40] **Read, J, Firn, J, Grice, A, Murphy, R, Ryan-Colton, E, and Schlesinger, C**, 2020. Ranking buffel: Comparative risk and mitigation costs of key environmental and socio-cultural threats in central Australia. *Ecology and Evolution*, *10*(23), pp.12745-12763.

[41] Ibid; **Caron, V., Brim Box, J., Dobson, V.P., Dobson, V., Richmond, L., Thompson, R.M. and Dyer, F., 2021.** Restoring cultural plant communities at sacred water sites. *Australasian Journal of Water Resources*, *25*(1), pp.70-79.

[42] **Schlesinger, C, Ryan-Colton, E, Firn, J, Read, J, 2020**. 'The buffel kerfuffle: how one species quietly destroys native wildlife and cultural sites in arid Australia'. The Conversation.

[43] **Murphy, H, & van Leeuwen, S, 2021, p.96.** Australia state of the environment 2021: biodiversity, independent report to the Australian Government Minister for the Environment, Commonwealth of Australia, Canberra, DOI: 10.26194/ren9-3639.

[44] **Jackson, J, 2004.** *Impacts and management of Cenchrus ciliaris (buffel grass) as an invasive species in northern Queensland* (Doctoral dissertation, James Cook University).

[45] **Friedel, M, Puckey, H, O'Malley, C, Waycott, M, Smyth, A and Miller, G 2006**. Buffel grass: both friend and foe. An evaluation of the advantages and disadvantages of buffel grass use and recommendations for future research, Desert Knowledge Cooperative Research Centre, Alice Springs

[46] **Burquez-Montijo, A, Miller, M, Martinez-Yrizar, A, 2002**. 'Mexican Grasslands, Thornscrub, and the Transformation of the Sonoran Desert by. *Invasive Exotic Species in the Sonoran Region'*. Invasive Specieis in the Sonoran Region.

[47] **Read, J, Firn, J, Grice, A, Murphy, R, Ryan-Colton, E, and Schlesinger, C**, 2020. Ranking buffel: Comparative risk and mitigation costs of key environmental and socio-cultural threats in central Australia. *Ecology and Evolution*, *10*(23), pp.12745-12763.

[48] **Lawson, B.E., Bryant, M.J. and Franks, A.J., 2004.** Assessing the potential distribution of buffel grass (Cenchrus ciliaris L.) in Australia using a climate-soil model. *Plant Protection Quarterly*, *19*(4), pp.155-163.

Table 4. Threatened fauna currently or potentially at risk due to buffel grass. Fauna below are listed under Commonwealth, South Australian and/ or Northern Territory laws, or were recommended for change in state conservation status by the Threatened Species Schedule Review in 2015-17. AUS = Australia; CR = critically endangered; EN = endangered;; NT = Northern Territory; RA = rare; SA = South Australia; ssp = subspeciesTSSR = Threatened Species Schedule Review panel. VU = vulnerable;

Common name	Scientific Name	Conservation status	Why buffel grass is a threat[49][50]
Slater's skink	*Liopholis slateri*	EN (AUS) VU (NT)	'Reduced food and feeding success in buffel dominated habitats. Increase in fire frequency'
Mallee Emu-wren	*Stipiturus mallee*	EN (AUS)	'Mallee Emu-wrens are restricted to Triodia and heath of particular age since fire. The invasion of buffel grass on the sandy country in which they live would result in an increase in fire frequency and replacement of native vegetation with buffel grass which is inappropriate for mallee emu-wrens replacement by buffel will remove habitat'
Great Desert Skink	*Liopholis kintorei*	VU(Aus) EN (SA) VU (NT) CE (TSSR*)	'Ongoing spread of buffel grass, and the subsequent likelihood of more frequent wildfires, will change the habitat structure, particularly the open feeding grounds known to be important for Great Desert Skink
Dusky hopping-mouse	*Notomys fuscus*	VU (AUS) EN (NT)	'The refuges of the dusky hopping-mouse are in fire sensitive habitats which will be destroyed with the large fires that buffel grass monocultures can carry. The distribution of the dusky hopping-mouse corresponds with highly suitable buffel grass habitat, particularly along the ephemeral'
Black-footed rock wallaby	*Petrogale lateralis ssp. lateralis (McDonnell Ranges race)*	VU (Aus EN (SA) VU (NT)	'Buffel grass promotes hot wildfires which can destroy fire sensitive vegetation, such as figs (Ficus brachypoda) and spearwood (Pandorea doratoxylon) that are important food sources for black-footed rock wallaby. Buffel grass already surrounds two warru populations and its uncontrolled spread would threaten other sites'
Malleefowl	*Leipoa ocellata*	VU (AUS) VU (SA) CE(NT)	'Continued invasion of buffel grass into arid mulga / minyura woodlands and shrub lands and mallee woodlands will increase the fire frequency, removing key food plants and habitat in which they build their mounds.'
Spinifex bird	*Eremiornis carter*	EN (SA)	'Quality spinifex important; habitat decline due to buffel grass spread'
Spinifex pigeon / plumed pigeon	*Geophaps plumifera*	RA (SA)	'Lives in spinifex, which is being replaced by buffel grass on hills and in rocky gorges and creek lines, causing a change in habitat structure and ood availability'
Night parrot	*Pezoporus occidentalis*	EN (SA) EN (NT)	Occurs in spinifex; habitat quality in decline due to buffel grass spread.
Western bowerbird	*Chlamydera guttata*	RA (SA)	Habitat quality is in decline due to the spread of buffel grass.
Giant desert ctenotus	*Ctenotus grandis*	RA (SA)	Occurs in spinifex; habitat quality in decline due to buffel grass spread.

[49] **Biosecurity SA, 2019.** 'South Australia Buffel Grass Strategic Plan 2019–2024: A plan to reduce the weed threat of buffel grass in South Australia'. Government of South Australia.
[50] **Read, J, 2012**. 'Key threatening Process Nomination Form: 2012 Assessment Period'.

Paleface ctenotus	*Ctenotus piankai*	RA (SA)	Spinifex obligate; habitat quality in decline due to buffel grass spread.
Short-tailed pygmy goanna	*Varanus brevicauda*	RA (SA)	Occurs in spinifex; habitat quality in decline due to buffel grass spread.
Desert rainbow skink	*Carlia triacantha*	EN (TSSR*)	Prefers large spinifex clumps; threatened by buffel grass spread.
Clawless gecko	*Crenadactylus ocellatus*	EN (TSSR*)	Prefers spinifex; habitat quality in decline due to buffel grass spread.
Dusky grasswren	*Amytornis purnelli*	VU (TSSR*)	Breeds in spinifex, which is being replaced by buffel grass on hills and on the sand plains.
Pin-striped ctenotus	*Ctenotus ariadnae*	RA (TSSR*)	Occurs in spinifex; habitat quality in decline due to buffel grass spread.
Narrow-lined ctenotus	*Ctenotus dux*	RA (TSSR*)	Spinifex obligate; habitat quality in decline due to buffel grass spread.
Western grey-striped dragon	*Diporiphora paraconvergens*	RA (TSSR*)	Occurs in spinifex; habitat quality in decline due to buffel grass spread.

c. Threatened flora currently or potentially impacted by buffel grass

There are 30 threatened flora species that are currently or potentially threatened by buffel grass in South Australia alone[51]. The degradation of flora has direct flow on implications for fauna dependent on those vegetation communities.

d. Federal Government position and responsibilities

Buffel grass is recognised as a key threatening process through the general category 'novel biota and their impact on biodiversity' under the *Environment Protection and Biodiversity Conservation Act* 1999. Despite its significant risk, buffel grass was not listed as a separate taxa specific key threatening process in 2012 and 2013 when attempts were made to have it listed[52]. In October 2014, the Federal Government issued its Threat Abatement Advice 'for ecosystem degradation, habitat loss and species decline in arid and semi-arid Australia due to the invasion of buffel grass (*Cenchrus ciliaris* and *C. pennisetiformis*)[53]. It is considered by many to be the 'most debilitating weed of natural ecosystems in arid and semi-arid Australia where it can directly or indirectly displace and threaten a large number of native and endemic plants and animals'[54].

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[51] **Biosecurity SA, 2019.** 'South Australia Buffel Grass Strategic Plan 2019–2024: A plan to reduce the weed threat of buffel grass in South Australia'. Government of South Australia.

[52] **Department of Environment, 2015**. THREAT ABATEMENT ADVICE FOR ECOSYSTEM DEGRADATION, HABITAT LOSS AND SPECIES DECLINE IN ARID AND SEMI-ARID AUSTRALIA DUE TO THE INVASION OF BUFFEL GRASS (Cenchrus ciliaris AND C. pennisetiformis). Australian Government.

[53] Ibid.

[54] **Department of Environment, 2015**, p.2. THREAT ABATEMENT ADVICE FOR ECOSYSTEM DEGRADATION, HABITAT LOSS AND SPECIES DECLINE IN ARID AND SEMI-ARID AUSTRALIA DUE TO THE INVASION OF BUFFEL GRASS (Cenchrus ciliaris AND C. pennisetiformis). Australian Government.

The Threat Abatement Advice issued for buffel grass is comprehensive and robust. However, buffel grass was not listed as a Weed of National Significance, a Threat Abatement Plan was never developed, the Threat Abatement Advice was never implemented, a national taskforce was never created, and targeted funding lacking . Beyond this advice, it appears that the Federal Government has not made any progress or commitments around buffel grass management.

The Federal Government has failed to implement its own advice where it has a role to[55]:

- Prevent the further introductions of buffel grass
    - 'Establish, maintain and participate in a national buffel grass taskforce to coordinate management at a national level';
    - 'Work with the Invasive Plants and Animals Committee to encourage state and territory weed declarations for Cenchrus ciliaris, C. pennisetiformis and any new varieties or strains of buffel grass';
    - 'Seek national restriction of the development, introduction, release, sale, movement and propagation of Cenchrus ciliaris, C. pennisetiformis and any new varieties or strains of buffel grass';
    - 'Investigate harmonisation of legislation, strategies and procedures for monitoring and surveillance of inter/intra-jurisdictional invasion pathways and management of outbreaks';
    - 'Prevent the introduction and development of new genetic material (including closely related species that may hybridise with buffel grass) which would increase the invasive potential of existing buffel grass populations.'
- Guide and support relevant buffel grass research
    - 'Improve knowledge of national buffel grass distribution and potential future distribution using a standardised mapping methodology';
    - 'Increase understanding of the extent and impact of buffel grass infestations'.
- Identify and prioritise key assets and areas for strategic management
    - Identify and prioritise geographic areas requiring protection, based on the presence of biodiversity and Indigenous cultural assets and the current level of threat from buffel grass in combination with other threats.
- Support and facilitate coordinated on-ground management in high-priority areas
    - 'Implement relevant actions in national and state/territory recovery plans';
    - 'Implement relevant actions in conservation advices for ecological communities listed under the Environment Protection and Biodiversity Conservation Act 1999';
    - 'Conduct ex-situ protection of threatened flora and fauna species through the National Seed Bank, Australian Seed Bank Partnership, zoos and wildlife sanctuaries';
    - 'Conduct in-situ protection of threatened flora and fauna species through conservation agreements, bush regeneration and buffel grass control activities (integrated approach)';
- Raise awareness of the impacts of buffel grass
    - 'Promote awareness of the impacts of buffel grass to Traditional Owners, land managers (including the mining and petroleum sector, managers of transport corridors), community groups, tourists, industry stakeholders and the general public

[55] Ibid.

and encourage their advocacy of the issue. Do so in a way that is relevant to the community and the local context, i.e. using culturally appropriate language and materials';
    - 'Promote awareness within the pastoral industry of the risks and costs associated with the use of buffel grass, including risk to life, property and tree fodder, depletion of soil nutrients, decline in buffel grass nutritional value over the long term and transformation of pastoral land to a buffel grass monoculture';
    - 'Promote awareness to policy-makers, decision-makers and others of the impacts of buffel grass on Traditional Owners and on their cultural practices'.
- Build capability among stakeholders to abate the threat
    - 'Actively involve Traditional Owners, land managers and the community in buffel grass management';
    - 'Work collaboratively with stakeholders and Traditional Owners to expand and support positive actions in their progress to address the buffel grass threat'

e. Next steps

In Central Australia, there is an ever growing research base outlining the significant impact buffel grass is having upon ecological and cultural values, in addition to particular threatened species. However, there is a huge body of research and political commitment that is missing. Until then, it is unlikely a solution will be found. There is an urgent need for national coordination, supporting place-based and targeted programs. Whilst more funding for IPA's and Indigenous ranger programs is excellent, in Central Australia working towards solutions for the buffel crisis also needs to be prioritised. The Commonwealth's own Threat Abatement Advice provides a detailed and comprehensive breakdown of next steps.

The nature crisis and extinction crisis will not be overcome in Central Australia unless there is a commitment to address the buffel crisis.

Recommendation 3: Provide necessary resourcing and funding to ensure that Threat Abatement Advice for key threatening processes under the EPBC Act are implemented as intended.

3. Case Study 2: Resourcing issues

The State of the Environment Report 2021 provided a very grim update on the health of Australia's biodiversity. In particular it emphasised the huge funding and resourcing gap between what is currently invested and what is required. The report stated that 'of concern is that scientists have estimated that the cost of recovery of threatened species in Australia is much greater than the amount we spend. Wintle et al. (2019) estimated the cost to be close to $1.69 billion dollars per year, compared with an estimated $49.6 million spent by the Australian Government on targeted threatened species in 2018–19'[56].

Unless the resourcing issues that have plagued biodiversity and conservation are adequately addressed, there is limited optimism that a reversal of biodiversity decline will occur.

The ongoing under-resourcing of biodiversity and conservation work has meant that in the Northern

[56] **Murphy, H, & van Leeuwen, S, 2021, p.150.** Australia state of the environment 2021: biodiversity, independent report to the Australian Government Minister for the Environment, Commonwealth of Australia, Canberra, DOI: 10.26194/ren9-3639. p.150

Territory there is a limited understanding on the state of the environment. In fact, the Northern Territory is consumed in uncertainty, where it is majorly deficient in basic flora and fauna baselines.

We use a case study of Northern Territory Parks to demonstrate some of the structural issues that need to be overcome to address Australia's faunal extinction crisis. While it is not the jurisdiction of the Commonwealth, it is useful in understanding the constraints that currently exist in the Northern Territory.

a. Northern Territory Parks and their capacity for biodiversity conservation

National Parks are in theory a key vehicle for conservation work and biodiversity protection. This was emphasised recently in the Northern Territory Government's 'Draft Parks Masterplan 2022-2052' which stated that 'Territory parks and reserves are an important asset for biodiversity conservation, and their management to a high standard can help reduce threats such as inappropriate fire regimes, weeds, and feral animals. Public feedback regarding Parks and Wildlife's role in biodiversity management was very clear. The NTG should remain a leader in protected areas management, especially in biodiversity conservation'.

However, this aspiration has not historically played out on the ground.

There is limited reporting on Northern Territory parks publicly available. What is available makes it clear how extremely underfunded parks are. In 2014, a series of report cards were developed for six major parks across the Northern Territory. They were Tjoritja/ West MacDonnell, Watarrka, Nitmiluk, Litchfield, Judburra/ Gregory and Casuarina[57]. Table 5 provides an overview of these parks and the number of rangers present.

While these figures are outdated, they are suggestive of the major issues that constrain Territory parks. At Watarrka, there are less than 5 rangers to manage nearly a quarter of a million tourists as well as manage the parks estate there, which includes many ecologically and culturally significant sites. 4-5 staff can never succeed in stopping the buffel grass crisis that is unfolding at Watarrka. Similarly at Tjoritja, there are 9 rangers to manage a 225km hiking trail that includes 12 trail heads, as well as countless campsites and all the other day-trip destinations along Tjoritja. The Larapinta trail is an extremely popular trail that navigates very remote environments. It brings tourists from across the country to Central Australia. Despite this, it remains majorly underfunded to actually do biodiversity and conservation work.

Table 6 provides a breakdown on ranger time across these 6 parks. Table 7 unpacks the programs that rangers spend their time on when they say they are doing 'biodiversity' matters. Table 8 highlights how much time was spent on each biodiversity program as a percentage of all ranger time.

[57] **Department of Environment, Parks and Water Security, 2022. '**Park Report Cards'. Accessed 10th June, 2022. https://depws.nt.gov.au/consultation-publications/parks-and-wildlife-publications/park-report-cards

Table 5: Park Report Cards 2014 - Overview

	Number of visitors	Size (hectares)	Number of Rangers	Hectares per rangers	Visitors per ranger	Visitor satisfaction
Tjoritja/ West MacDonnell	139,400	252,800	9.3	28,089	15,000	95%
Watarrka	237,000	105,000	4.8	21,875	49,520	98%
Nitmiluk	246,900	295,000	13	22,700	19,000	88%
Litchfield	329,000	145,000	9	16,100	36,600	94%
Judburra/ Gregory	30,900	1,300,000	5.9	220,300	5200	N/A
Casuarina	935,000	1361	3.2	425	292,200	95%

The rangers are set-up to fail. They have so little time to actually deal with threats, let alone time to evaluate (i.e. research and monitoring) whether what they are doing is actually effective. Rangers do a phenomenal job with the very limited resources they have, however this arrangement is not sustainable.

Despite major underinvestment in parks, we hear that even then parks are struggling with high turnover and recruiting new staff. The unsustainable arrangement illustrated above provides some insight as to why that may be the case where rangers spend limited time on core activities (i.e. fire management, weeds management, research, monitoring and so on).

These results make it abundantly clear how under-resourced parks were at this point in time. In Tjoritja, only 1% of rangers' time was spent on fire management, 5% on weeds, 2% on ferals, 10% on planning and 2% on monitoring and research. At Watarrka, 3% of time is spent on fire management, 5% on weeds, 4% ferals, 3% planning, 0% on research and monitoring and 5% on the mala program.

Table 6: Park Report Cards 2014 - Ranger time

	Biodiversity %	Cultural heritage %	Visitors %	Stakeholders %	Administration %	Number of rangers
Tjoritja/ West MacDonnell	**20**	5	30	10	35	9.3
Watarrka	**20**	2	43	15	20	4.8
Nitmiluk	**23**	2	60	5	10	13
Litchfield	**20**	4	60	1	15	9
Judburra/ Gregory	**55**	5	20	5	15	5.9
Casuarina	**15**	5	65	10	15	3.2

Table 7: Park Report Cards 2014 - Ranger time: biodiversity programs

	Fire %	Weeds %	Feral animals %	Planning %	Research/ monitoring %	Other %
Tjoritja/ West MacDonnell	5	25	10	50	10	0
Watarrka	15	25	20	15	0	25
Nitmiluk	30	49	10	10	1	0
Litchfield	45	25	5	10	15	0
Judburra/ Gregory	30	50	5	10	5	0
Casuarina	30	45	0	10	5	10

Table 8: Park Report Cards 2014 - time spent on biodiversity programs as a percentage of ranger time

	Fire %	Weeds %	Feral animals %	Planning %	Research/ monitoring %	Other %
Tjoritja/ West MacDonnell	1	5	2	10	2	0
Watarrka	3	5	4	3	0	5
Nitmiluk	6.9	11.3	2.3	2.3	0.2	0
Litchfield	9	5	1	2	3	0
Judburra/ Gregory	16.5	22.5	2.75	5.5	2.75	0
Casuarina	9	13.5	0	3	1.5	10

Recommendation 4: Commonwealth Government provides assistance to ensure that baseline flora and fauna surveys are completed across key bioregions and ecosystem types nationally., particularly in regions that inhabit threatened species.

4. Conclusion

Central Australia is at the forefront of the faunal extinction crisis nationally. Its environments are undergoing biodiversity decline and collapse. This is due to invasive species such as buffel grass, land-use changes, fires, habitat destruction and water extraction.

This submission has attempted to emphasise the severity of the extinction crisis from a Central Australian perspective. We have provided an overview of the current state of the environment, a summary of the extinction crisis and an update on current and future climate change impacts.

Then, we used two case studies to demonstrate the systemic issues which are contributing to declining ecological values across Central Australia. The first is highlighting a key threatening process in buffel grass, which is contributing to landscape change and impacting 19 different threatened fauna species. Second, we focus on the ongoing issue of resourcing biodiversity and conservation work. These two case studies emphasise the challenges involved in reversing declining biodiversity.

This Senate Inquiry is an important milestone in acknowledging the dire state of ecological values across the nation. It also presents an opportunity to be a turning point to reverse the trend and build a positive future for biodiversity and conservation.

Thank you for considering this submission.

Kind regards,

Alex Vaughan

Policy Officer at the Arid Lands Environment Centre