REVIEW

Justice, culture, and relationships: Australian Indigenous prescription for planetary health

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Indigenous communities shoulder a disproportionate burden of ill health compounded by climate change. In Australia, the oldest surviving cultures have adapted their ecological knowledge over millennia and across climatic ages. However, European colonization has severely curtailed Indigenous peoples' ability to adjust to climate change. An effective response to the climate crisis requires decolonizing processes to reform our relationship with the planet. From an Australian Indigenous perspective, precursors for a self-determined and healthier future are justice, culture, and relationships. We review existing studies on Indigenous-led contemporary climate and health initiatives to assess these precursors. There are examples that highlight the need to attend to issues of restorative justice as the basis for respectful valuing of culture and genuine collaboration to address the climate crisis.

Indigenous scholars globally view anthropogenic climate change as an extension of colonialism, further eroding the rights of Indigenous peoples to practice their culture and live on traditional lands (*1*, *2*). Colonization, capitalism, and climate change all reflect the continued dominance of Western individualistic ("egocentric") philosophies that place humans above and separate from their environment, commodifying and exploiting the environment for power and profits (*2*). By contrast, the collectivistic ("ecocentric") Indigenous cultures focus on deep, holistic connections to the environment in which valuable knowledge systems have developed from careful custodianship through which ecosystems flourished over millennia (*1*–*4*).

Australia is home to the oldest continuing cultures on Earth (*5*), where Aboriginal knowledge systems have survived for more than 60,000 years. Because Aboriginal knowledge is holistic and relational, the environment (land, sea, and sky) and peoples' place within it are intertwined. The knowledge has been shared within and across generations through storytelling, songs, dance, and ceremonies, presenting sophisticated understandings of geological history (*6*), astronomy (*7*), agriculture (*8*), and other domains. Specific responsibilities were allocated through customary law and totemic systems—sacred associations that meant individuals must protect their designated plant and/or animal totems (*9*). Culture and survival relied on a deep understanding of complex ecological interconnections between night skies, seasonal cues, animal behavior, and plant physiology that provided knowledge on where and when to plant, sow, harvest, and source bush food and medicinal resources (*8*). For example, the Kamilaroi and Euahlayi peoples were guided by the position of the celestial "dark emu" about appropriate times to sustainably hunt emus and collect eggs (*7*, *10*). Ancient caring for Country management practices, such as cultural burns, illustrate the integral role of Aboriginal people in maintaining rich biodiversity and sustainability of bush resources (Box 1) (*3*). Aboriginal and Torres Strait Islander communities continue to apply knowledge of caring for Country because it is an important healing practice and the foundation to Aboriginal and Torres Strait Islander health and well-being (*9*).

European dispossession severely disrupted Aboriginal and Torres Strait Islander connections to Country and undermined their mental health. European colonization also hindered intergenerational transference of languages and knowledge integral to their traditional caring obligations, cultural identity, and well-being. The policies of Australian governments were designed to socially isolate Aboriginal and Torres Strait Islander communities on missions and reserves where every aspect of their lives was controlled (for example, movement on and off the reserves and regulated marriages) and cultural practices were forbidden (*11*). Children of mixed European-Indigenous heritage were forcibly removed from their Indigenous parents, fracturing kinship systems. Collectively, these policies violated human rights and amounted to systemic genocide of Aboriginal and Torres Strait Islander communities and cultures (*12*). The historical trauma continues today in many Aboriginal and Torres Strait Islander families and has manifested as posttraumatic stress, depression, and suicidal ideation, substance misuse, antisocial behavior, and dysfunction (*13*). Loss of connection to traditional lands has contributed to intergenerational trauma from an inability to care for Country and the healing that comes from undertaking cultural responsibilities (*9*).

There are stark health and socioeconomic disparities between Indigenous and non-Indigenous Australians published in annual Australian government "Closing the Gap" reports (*14*). Instituted in 2008, these reports monitor efforts to improve social determinants of health such as early childhood development, education, housing, criminal justice, and economic participation. Years later, there has been minimal progress in closing the gap. For example, Aboriginal and Torres Strait Islander life expectancy is estimated to be around eight years less than that of the non-Indigenous Australian population, and burden of disease rates are 2.3 times that of the non-Indigenous population (*15*). Although links between colonial legacies and present-day inequities are complex, colonization is recognized as a primary driver of Indigenous health (*16*, *17*). Colonization has historically impeded access to social and economic resources for Aboriginal and Torres Strait Islander people, and its vestiges persist in present-day Australian governance institutions (*18*). Recently, a coronial inquiry into a "cluster" of rheumatic heart disease (RHD) deaths of three young Aboriginal women in the remote community of Doomadgee concluded that privilege, institutional racism, lack of cultural competency, and poor communication contributed to substandard health care and these avoidable deaths (*19*). Understanding links between colonialism and health inequities will enable design of effective solutions (*17*). Both the 2022 Closing the Gap and RHD cluster coronial report emphasize the importance of listening to and working with Aboriginal and Torres Strait Islander communities for place-based solutions that target structural health reforms (*14*, *19*).

However, Indigenous voices are largely absent from Australian political and policy-making structures. Unlike other colonized, high-income countries, Australia's constitution does not recognize Aboriginal and Torres Strait Islanders as its Indigenous Peoples (*20*). By the end of 2023, a national referendum will be held offering Australians an opportunity to vote for constitutional recognition and to establish a body called the Aboriginal and Torres Strait Islander Voice ("the Voice") that can provide advice to the Australian Parliament and government. The Voice extends constitutional recognition beyond symbolism to permanently guarantee Indigenous participation in policy dialogues on matters relating to Aboriginal and Torres Strait Islander peoples (*20*). Although there are differing views about its likely effectiveness, it provides a permanent vehicle for

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local Aboriginal and Torres Strait Islander voices at the policy-making table on issues such as health, housing, Country, and climate change.

Climate change and Aboriginal and Torres Strait Islander health

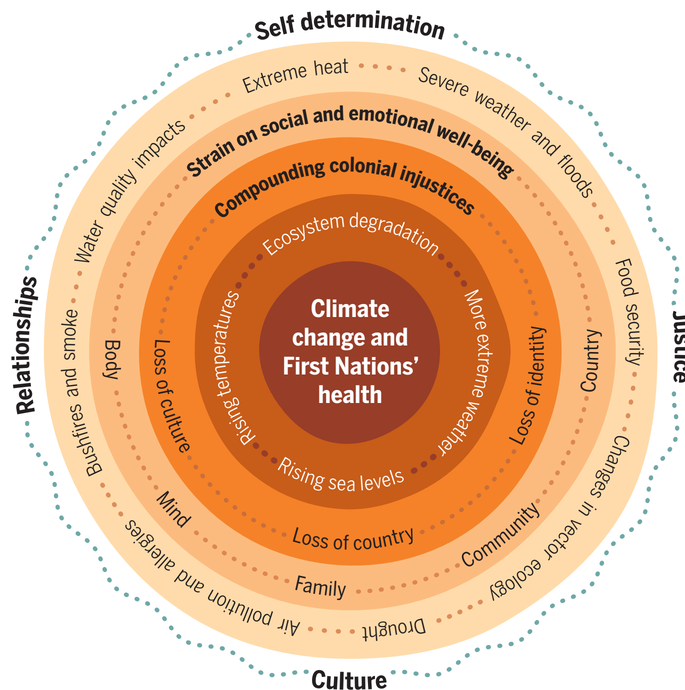
Like many countries, Australia is also experiencing the tragic effects of climate change: an intense and widespread "Black Summer" 2019–2020 bushfire season, followed by catastrophic flooding across many parts of the country in 2022 and 2023. Low socioeconomic households (often Aboriginal and Torres Strait Islander families) tend to live in flood zones and bushfire hazard areas (*21*–*24*). For example, during the Black Summer season, although Aboriginal people comprised 2.3% of the population in Victoria and New South Wales, 5.4% lived in the fire-affected areas in these two states (*22*). Similarly, although Aboriginal people comprised 4.5% of the population in Northern New South Wales in 2022, they accounted for 40% of residents who were still homeless 6 months after unprecedented floods (*25*). Climate scientists are predicting more frequent and intense extreme weather unless we radically reduce carbon emissions. Aboriginal and Torres Strait Islanders are already disproportionately affected because of increased exposure to extreme weather, existing health disparities, and the close spiritual bond they hold with Country (Fig. 1). Community stories related to excessive heat and sea level rise are presented in Box 2.

In 2021, the Lowitja Institute led a national roundtable discussion on climate change and Aboriginal and Torres Strait Islander health centered on the voices of Indigenous community leaders and advocates (*26*). Community members shared their stories about being on the front lines of climate change (Box 2). These stories are examples of inequitable power structures, lack of decision-making authority, and lack of access to resources that are hindering Aboriginal and Torres Strait Islander peoples' ability to build adaptive capacity and effectively apply their knowledge to respond to climate challenges (*27*). They demonstrate a continuation of injustice metered out to Australian Indigenous communities since colonization. Roundtable participants signaled an urgent need for inclusive climate action planning that addresses and does not perpetuate existing inequities, strengthens and values Indigenous culture and knowledges, and works in respectful partnership with Aboriginal and Torres Strait Islander communities. As one participant stated, "There is no climate justice without First Nations justice" (*26*).

Several themes surfaced during the roundtable to restore planetary health: justice, strengthened cultural knowledge, and respectful relationships, underpinning a self-determined and healthier future. These prescriptions align with a global Indigenous consensus of the determinants of planetary health: (i) respecting Country and Indigenous governance that draws on knowledge from, and gives voice to, Country; (ii) rights of Indigenous people to land, language, health, and intergenerational connections; and (iii) healthy connections and relationships between Country and people (*4*). Planetary ill health has largely come about as humans have forgotten their relationship and responsibility to Country (*4*). The restoration of this relationship is crucial for planetary well-being.

This Review was prompted by the roundtable to assess the current state of justice, culture, and relationships in climate mitigation or adaptation projects led by Aboriginal and Torres Strait Islander communities. We aim to identify good practice and enabling factors as well as gaps for future focus.

A comprehensive search strategy was designed with five broad concepts for inclusion of Australian peer-reviewed literature, including "Aboriginal and Torres Strait Islander people," "climate change," "health," "mitigation or adaptation," and "strategy or intervention." The search was applied to five online databases. Publications were dated from January 2007 to January 2023. Only a handful of published



Water quality impacts
Harmful algae blooms
Saltwater intrusion
Waterborne diseases

Bushfires and smoke
Injury and fatalities
Loss of homes
Cardiovascular and respiratory disease

Food security
Malnutrition
Food insecurity
Higher food prices
Foodborne illnesses

Extreme heat
Heat-related illness and death
Cardiovascular failure

Drought
Water supply impacts
Dust storms
Bushfire risk

Sever weather and floods
Injuries and fatalities
Loss of homes
Indoor mold

Air pollution and allergies
Asthma and allergies
Cardiovascular and respiratory issues

Changes in vector ecology
Ross River virus
Japanese Encephalitis virus
Dengue fever

Fig. 1. Climate change and Aboriginal and Torres Strait Islander health. Summarized here are the connections between climate change and Aboriginal and Torres Strait Islander health and well-being. Existing health disparities and the close spiritual bond that Indigenous people hold with Country exacerbate adversity from climate change for Aboriginal and Torres Strait Islander people. Along with direct impacts—deaths, injuries, and worsening health from excessive heat, bushfires, floods, and sea level rise—there are indirect "cascading consequences" for communities resulting from altered natural systems (air quality, water and food security, and vector-borne and infectious diseases) and from altered social systems (employment and workforce productivity, housing comfort, and health service delivery) (*26*). Adverse health effects from climate change include poor social and emotional well-being, heat-related disorders, vector-borne diseases, food and waterborne diseases, respiratory disorders, and exacerbation of chronic diseases, including heart and kidney disease (*26*).

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studies were found that describe application of Aboriginal- and/or Torres Strait Islander–led climate mitigation and adaptation strategies that included human health outcomes.

Summary of peer-reviewed studies

Our review of the peer-reviewed literature identified nine studies that describe Aboriginal- and/or Torres Strait Islander–led climate mitigation or adaptation strategies that directly or indirectly referred to health outcomes. Many studies (n = 4) focused on different aspects of Aboriginal ranger programs that use traditional knowledge and practices such as cultural burns to manage land and sea Country (*28*–*30*) and, in some cases, to participate in formal carbon emission abatement schemes (*31*). Ranger group programs address more than environmental conservation: It is core to individual and community well-being, supporting Aboriginal and Torres Strait Islander identity and belief systems. There is a positive link between ranger and "caring for Country" activities and health and well-being, with improved indicators for diabetes, hypertension, renal disease, and psychological distress (*32*) and very high life satisfaction and family well-being (*33*). Such positive health and economic correlates have led to development of frameworks to integrate activities related to "caring for Country" into primary health care (*30*). Other topic areas included documentation of traditional knowledge into seasonal calendars (*34*, *35*) and development of cogovernance and participatory processes to manage Country for climate adaptation (*36*–*38*).

The studies are presented in table S1, structured around the key principles of self-determined climate action: justice, culture, and relationships. In table S1, green cells indicate that there is clear evidence within the paper that the principles were applied; amber cells indicate some uncertainty that the principles were applied; and red cells indicate that there is no evidence of the principles' application.

Our traffic-light assessment of published Aboriginal- and Torres Strait Islander–led climate and health strategies shows mixed results. However, Aboriginal ranger programs demonstrated all key principles. Combined with land rights tenure and long-term security working on Country, this intervention used traditional knowledge systems (sometimes in conjunction with other knowledge) and passed the knowledge and practices on to future generations.

Justice

Colonization and enduring institutional racism in public and political institutions have stripped Aboriginal and Torres Strait Islander people of their governance over traditional land and waters and have resulted in vastly inequitable distribution of power and resources to support local community decision-making. There is yet to be a nationwide reckoning that acknowledges and accepts the true history of Australia. From an Aboriginal and Torres Strait Islander perspective, there is a need for restorative justice—a reflective process of understanding and acceptance by the Australian population of the harm created by colonization, and commitment to address that harm and its intergenerational consequences. Appropriate reparations to enable climate adaptation and improvements in health would be access to Country; equitable power sharing and cogovernance arrangements over land and waters; and enabling supports to strengthen adaptive capacity, including appropriate housing and access to quality education and employment opportunities.

Perhaps Aboriginal ranger programs are successful because an innate feature is that they are carried out on traditional lands and seas where local communities have already secured a form of land rights. Aboriginal and Torres Strait Islander ranger programs are funded through the Australian government to provide employment opportunities for local communities to use traditional knowledge to conserve and manage their land and sea Countries. Traditional activities that historically protected the land and sea include cultural fire practices for wildfire mitigation, native ecosystem restoration and protection of threatened species, research and education partnerships, and generation of additional income through carbon abatement (*31*). There are more than 100 Indigenous ranger groups funded, located on land with varying tenure.

Land rights and cultural heritage legislation is complex, with different systems operating at national and state levels (*39*). Native Title and Land Rights and Indigenous Protected Areas uphold and protect the rights of Aboriginal and Torres Strait Islander peoples on the basis of their ancestral relationships with the land and seas as well as traditional customs. They provide traditional custodian group access and decision-making authority over activities, increasing their ability to lead planning and implementation of climate mitigation and adaptation programs. However, these laws do not always provide full autonomy over use of Country, as recently demonstrated by the extinguishment of Native Title by the Queensland government for a coal mine and the willful destruction by a mining company of a 46,000-year-old sacred rock shelter at Juukan Gorge in the Kimberley region of Western Australia (*26*). Power imbalances remain in land rights legislation, which limits development of trust and collaboration.

Similarly, land rights do not extend to waterways (such as lakes, rivers, and underground aquifers) that are just as culturally important as the land on which they are located. Legislation separates rights to water and land, even where Native Title and Land Rights have been granted (*40*). Water policy in Australia has enhanced its commodification of water through trading schemes, and although it explicitly recognizes Aboriginal rights and interests, these are relegated to one of many minority "other public benefits" among recreation, tourism, and fisheries (*40*, *41*). Cultural governance systems that existed before colonization unified neighboring clans through key values, ethics, and

Box 1. Key terminology.

Aboriginal and Torres Strait Islander Peoples: Indigenous peoples of Australia, of which there were more than 500 different language groups before British colonization.

Country: Traditional lands and waters of Aboriginal and Torres Strait Islander peoples and their interconnecting system of reciprocal caregiving (known as "caring for Country"). Country is used as a reference point for introductions when meeting other Aboriginal and Torres Strait Islander people (*47*).

Cultural burns: Traditional "patch" burning of the landscape during dry months while weather is cool. Removes dry fuel load to prevent uncontrolled wildfires, which release substantial amounts of carbon emissions into the atmosphere. These also stimulate under-canopy regrowth and forage for animals (*31*), which stimulates ecosystem biodiversity.

Elders: Senior Aboriginal and Torres Strait Islander people recognized by their community as leaders and cultural knowledge holders.

Indigenous: The earliest known inhabitants of lands and seas across the globe, also referred to as "First Nations people."

Indigenous cultural and intellectual property rights: The rights that Indigenous peoples have to protect their cultural heritage, including knowledge systems, arts, languages, resources, and related documentation about their heritage and histories (*48*).

Indigenous data sovereignty: The rights of Indigenous peoples to access data about themselves and to govern the collection, ownership, and application of data about their communities, lands, and resources, regardless of where the data are held (*49*).

Social and emotional well-being: Indigenous holistic concept of mental health that encompasses domains such as connection to Country, culture, family, and community.

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codes of conduct to promote equitable sharing and to protect their collective well-being. Similar Indigenous systems of cogovernance proposed for water management of the Martuwarra are seen as important power-sharing arrangements, as opposed to participatory models in which colonial structures of power are maintained (*38*). It remains to be seen whether these equitable systems of governance will be adopted by the Australian government.

Strengthened cultural knowledge

Restorative justice acknowledges the strength of Aboriginal and Torres Strait Islander culture and valuable knowledge systems that have accumulated over 60,000 years. As the oldest continuous living culture, Aboriginal knowledge holders intimately understand their Country and have adapted to various climactic shifts. This knowledge must be celebrated, preserved, and protected by strengthening intergenerational transmission, Indigenous cultural and intellectual property rights, and Indigenous data sovereignty (*42*). Sharing and bringing together Indigenous and Western knowledge systems will enhance understanding of ecological processes and improve effectiveness of climate adaptation and mitigation strategies (*43*). A collaboration between Yugul Mangi rangers and university-based ecologists in northern Australia demonstrates the benefit of two-way sharing of information that has increased understanding of species presence to inform land-management practices and protection of biodiversity in changing climate conditions (*28*).

Two studies reported the development of seasonal calendars as education and communication tools for Aboriginal and Torres Strait Islander communities. They demonstrate Aboriginal and Torres Strait Islander peoples' holistic systems approach to understanding Country. Rather than measuring the passing of time, they record seasonal activities according to the presence of biological indicators. As such, seasonal calendars can be used to monitor climate and environmental change over time (*44*). The seasons documented in Australia are more varied than the Western-oriented four seasons; for example, the Ngan'gi People of Naiuyu record 13 overarching seasons (*34*). Climate change is modifying seasonal calendars to an extent that communities are being required to adjust this knowledge (*45*). In this way, seasonal calendars can be an important advocacy and communication tool as Aboriginal and Torres Strait Islander people witness changes to Country.

Ensuring appropriate protection of Indigenous cultural and intellectual property and Indigenous data sovereignty will be key to providing security and certainty to communities against exploitation of their knowledge, as demonstrated by genuine worry of Elders deciding not to include in the Ngan'gi seasonal calendar information about medicinal use of plants or any knowledge deemed to have potential economic interest (*34*).

Relationships

Restorative justice also requires respectful engagement with Aboriginal and Torres Strait Islander people that in turn creates trust required for enduring partnerships. Equitable power and cogovernance arrangements are a crucial ingredient, along with firm commitments to appropriately resource adaptation initiatives. Having initiatives led by Aboriginal and Torres Strait Islanders enhances the cultural integrity of processes and ensures that projects feature relationality (centering community and their relationship to Country) and reciprocity (cobenefits for community and Country) (*4*, *42*).

Climate change provides an immediate opportunity for "two-way seeing" (*42*)—the weaving together of Aboriginal, Torres Strait Islander, and Western science to inform mitigation and adaptation approaches. The transformational change required in the way we treat Country will require an embrace of diverse knowledge systems and being open to different perspectives (*42*). From our review, it is evident that close collaboration with Indigenous communities takes time and commitment of resources. Community-led adaptation planning is vulnerable to the stop-start nature of research initiatives (*36*) and the current way that service provision and planning related to caring for Country and health promotion activities are conducted in siloes; this is not conducive to Indigenous ways of holistic thinking (*30*).

Gaps in literature

At present, there are very few examples in peer-reviewed literature of Aboriginal- and Torres Strait Islander–led climate action that report health outcomes. There were gaps geographically with no Torres Strait Islander community–led adaptation that met our search criteria or projects relating to emerging opportunities such as renewable energy transitions. However, we acknowledge that our search strategy focused on climate change and health initiatives and may have missed other papers that describe implementation of Indigenous-led climate adaptation and mitigation strategies. Additionally, our assessments were limited to the information provided in each article. However, rigorous documentation of the implementation and evaluation of Aboriginal- and Torres Strait Islander–led climate change strategies is essential for the spread of best practices according to the principles of restorative justice, strengthening culture and knowledge, and respectful enduring partnerships.

Box 2. Stories from the Climate Change and Aboriginal and Torres Strait Islander Health Roundtable.

Increasing heat, poor housing, and energy insecurity for Warumungu community (Central Australia)

Prolonged excessive heat raises body temperatures, inducing heat stroke, body fluid imbalances, and increased cardiac stress from internal thermoregulatory responses that may exacerbate heart and kidney disease (*50*). Norman Frank Jupurrurla, a Warumungu Elder from Tennant Creek, discussed the poorly insulated and low-quality housing in his community that is not suited to the increasing number of very hot days in Central Australia (*51*). These same households also experience energy insecurity owing to mandatory prepaid power card systems. With limited financial resources and high levels of chronic disease, householders are often deciding whether to air condition homes or keep the refrigerator running for food and critical medicines (*51*). Remote community housing tenants are not afforded access to rooftop solar technology that is available to most other Australian households in urban and regional areas, which are often subsidized. Frank Jupurrurla led a long-term campaign to install solar panels on his roof, overcoming many bureaucratic hurdles to benefit from a cheaper and more secure renewable energy supply. It remains the only remote Aboriginal public community house in the Northern Territory connected to solar power (*52*).

Rising sea levels in Zenadth Kes (Torres Strait Islands)

Sea level rises and coastal surges lead to salt inundation of freshwater sources and may result in forced relocation and loss of economic livelihood (*53*). At the very northern tip of Australia, communities of the Torres Strait Islands are losing their land, food sources, and livelihoods as well as important cultural and burial sites to rising sea levels. A group of eight Torres Strait Islanders led by Daniel Billy lodged a complaint to the United Nations (UN) claiming that the Australian government neglected its duty to protect their rights to life and culture by failing to take appropriate climate mitigation and adaptation measures (*54*). In 2022, the UN Human Rights Committee found in the Torres Strait Eight's favor, taking into account their close, spiritual connection to their traditional lands and compelling Australia to increase adaptation and mitigation strategies for the Torres Strait and compensate the Islanders for the harm they have suffered (*55*).

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Given the importance of Country for health and well-being, studies should factor in processes and indicators to assess these connections (*46*).

Conclusions

Despite historic and contemporary systemic racism, Aboriginal and Torres Strait Islander communities are strong and resilient, maintaining the oldest continuing culture on the planet. There is a climate emergency, and scientists are realizing the central importance of Indigenous knowledge in informing climate change mitigation and adaptation strategies.

We used an Australian Indigenous prescription for planetary health—justice, culture, and relationships—to assess Indigenous-led climate adaptation and mitigation strategies in terms of issues related to the colonial context of Australia and the role that colonization has played in limiting community adaptive capacity. Examples of published research in academic literature are few and far between, perhaps representing that as a society, we have a long way to go in redressing past wrongs and embracing the strengths of Aboriginal and Torres Strait Islander culture.

To build a shared evidence base relating to Aboriginal- and Torres Strait Islander–led climate and environmental solutions, we need to address power structures and provide Aboriginal and Torres Strait Islander communities equitable governance over their traditional lands. After this is achieved, communities can revitalize and strengthen cultural practices that protect Country and simultaneously build respectful collaborations for two-way sharing of different knowledge systems necessary for the benefit of all. In the Australian context, an important first step in shifting policy processes to embed genuine and open engagement with Aboriginal and Torres Strait Islander communities will be a successful referendum on the Voice. Without a Voice to the Australian Parliament, the Aboriginal and Torres Strait Islander prescription for planetary health will be much harder to achieve in the limited time we have left to address the climate crisis.

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