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Rangeland conservation: courage and resiliency in the face of climate adversity

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Abstract

As climate change continues to impact rangelands worldwide, threatening the livelihoods of millions and the ecological integrity of these vital ecosystems, community-driven action has emerged as a powerful force for building resilience. Adapting to and mitigating the effects of climate change on rangelands requires courage from individuals and larger society and determination to overcome these challenges and drive positive change.

The integration of innovative management practices and technologies is essential for enhancing the resilience of these ecosystems. Digital technologies, such as monitoring databases, mobile applications and AI power, offer new insights and a way to enable land managers to adaptively manage rangelands amidst rapid changes. However, empowering communities to lead rangeland adaptation requires more than just technical solutions. It requires a fundamental shift in how we approach conservation and development, one that values local voices, respects traditional knowledge, funds research in region that are not deemed 'profitable', and fosters sincere partnerships embedded with trust and mutual learning. Courage and resiliency are crucial – to challenge entrenched power structures, to embrace uncertainty and experimentation, and to work in solidarity with local rangeland communities that are on the frontlines of these challenges.

It is time we welcome a new paradigm for rangeland management – one that recognises the value of these ecosystems goes far beyond economics, the inherent resilience of local people, and the transformative power of collective ambition to take care of precious rangeland environments.

Rangeland Significance

Rangelands represent far more than agricultural landscapes or locations for extractive industries – they are critical ecosystems that teem with biodiversity when in a healthy state, and that require shared stewardship and collective responsibility for their future. These vast territories, covering approximately 30-40% of Earth's land surface and supporting 1-2 billion people (Sayre et al., 2013), embody the intricate relationship between human communities and natural systems. Yet, despite their extent and importance, rangelands are often neglected in research and funding for development, whilst becoming increasingly vulnerable to climate change due to their low and variable rainfall, and poor soil fertility.

In Australia, rangelands occupy about 70% of the country, approximately 6 million km^2 (Guerin et al., 2017). Many rangelands support pastoral activities, contributing significantly to global food security (Herrero et al., 2016). They hold critical importance to global ecosystem services, including carbon sequestration and biodiversity conservation (Sala et al., 2017).

Climate Change and Rangelands

For rangeland managers, climate patterns form the cornerstone of decision-making processes. Temperature and rainfall guide crucial determinations on stocking rates, grazing rotations, and land management strategies (Briske et al., 2015; Eldridge and Beecham, 2018). This dependency on natural rhythms makes the disruption of traditional climate patterns particularly concerning for rangeland communities. Increasingly, generational knowledge passed down through communities no longer aligns with current conditions. These observations are validated by scientific evidence: anthropogenic greenhouse gas emissions have disrupted global climate systems, with rangelands experiencing warming at rates above global averages (IPCC, 2022).

Rangeland managers, working in close connection with natural systems, serve as front-line witnesses to climate change impacts. Rising temperatures manifest in more frequent and heatwaves, while increased evaporation hastens soil moisture loss, leading to droughts (Howden, 2017). Due to the ancient and weathered nature of Australian soils, rangelands are particularly susceptible to degradation processes such as erosion, compaction, salinization, acidification, and contamination, ultimately leading to fertility loss, increased desertification, and thus a decline in agricultural production and food security, which are exacerbated by climate change (Dadzie et al., 2023). Native vegetation communities are shifting in rangelands, affecting livestock nutrition and habitat availability for native species (Godde et al., 2020). These disruptions are reshaping viable agricultural activities across regions. Globally, mounting pressures on rangeland communities drive rural-to-urban migration, deepening socioeconomic inequalities among those who maintain these vital landscapes (Herrero et al., 2016).

The implications extend far beyond local communities. Rangelands function as crucial carbon sinks, storing approximately 30% of global soil carbon (Wang et al., 2016), while serving as biodiversity hotspots and essential components of global food security. Their deterioration threatens not just local livelihoods but larger planetary health. In recent decades, rangelands worldwide have faced mounting pressures from climate change, overgrazing, feral animal explosions and other land-use changes. Human-driven degradation of the Earth’s land surface is affecting the well-being of over 3.2 billion people, accelerating the planet toward a sixth mass extinction of species, and leading to biodiversity and ecosystem service losses amounting to over 10% of the annual global GDP (IPBES, 2018).

Courage for Rangeland Conservation

A central challenge emerges: how can societies simultaneously achieve good ecological health and community resilience in rangelands? One answer lies in cultivating what can be termed "climate courage" - the moral and practical strength to confront and act against climate change challenges, despite the uncertainty and anxiety they invoke. This concept encompasses both individual determination and collective action, building on social-ecological resilience (Folke et al., 2016). Climate courage moves beyond mere adaptation to actively promote positive environmental change, positioning planetary health as a central determinant in decision-making and action. It manifests through community-driven initiatives that combine traditional knowledge with innovative solutions, fostering resilience while acknowledging the deep interconnections between human wellbeing and ecosystem health.

The relationship between humanity and the biosphere is fundamentally reciprocal - we shape our environment and it in turn shapes us. This interconnection has led to growing recognition that development strategies and scientific research must account for the deep links between human welfare and the health of our planet's living systems, as exemplified in frameworks like the Sustainable Development Goals. By viewing these challenges through the lens of interlinked social-ecological resilience, we see that human development must be grounded in and compatible with the biosphere's capacities and finite resources (Pedro et al., 2024). The recognition of our dependence on Earth's living systems will help in stewarding human development in harmony with the biosphere - a crucial requirement for both sustainable development and maintaining human dignity, particularly in fragile rangeland ecosystems.

The magnitude and urgency of climate change impacts on rangelands demand more than incremental responses or business-as-usual approaches. Climate courage means acknowledging that conventional management

practices and policy frameworks are insufficient for the challenges ahead. It requires embracing transformative changes in how we manage, value, and protect these landscapes. This includes supporting innovative practices that may challenge current approaches, advocating for policy changes that prioritise long-term sustainability over short-term productivity, building new partnerships that bridge the divide between scientific and traditional knowledge systems, and supporting community-led co-creation (Lavhelesani et al., 2024).

Looking to the Future

The path forward demands a fundamental shift in how we think about rangelands and their management approaches. We must move beyond viewing these landscapes solely through the lens of production or extraction, recognising their vital role in climate regulation, biodiversity conservation, and cultural heritage (Stafford Smith et al., 2020). To appreciate these precious landscapes and look after them in the manner required, there must be empowered local communities who are active decision-makers, who integrate traditional and scientific knowledge, and who build supportive networks that transcend individual properties to catchments and outwards to reach business and policy.

Success are stories are emerging. Pastoral networks share knowledge about drought-resistant native species and innovative water management techniques, improving resilience to climate variability (Marshall et al., 2018). National Drought Resilience Adoption and Innovation Hubs have been established to help with this. The national farmer movement, Farmers for Climate Action, exemplifies climate courage, uniting farmers and agricultural leaders across Australia to advocate for climate solutions while building resilient farming communities. There are research teams working in remote rangeland locations. The Wild Deserts field site, covering 35,000 ha in north-west New South Wales, aims to bring back seven locally extinct mammals. Similarly, Arid Recovery, an independent not-for-profit running a 123 km^2 wildlife reserve in South Australia's arid north, is pioneering conservation science to help threatened species thrive across the Australian outback. Nearby, Boolcoomatta is a 63,000 ha former sheep station now conservation reserve.

One more controversial topic in Australia's rangeland management is that of dingos. Recent studies suggests that dingoes, Australia's largest terrestrial predator, can play a crucial role in maintaining healthy rangeland ecosystems while potentially increasing profits for farmers. Dingoes suppress populations of kangaroos and feral animals, reducing unmanaged grazing pressure that contributes to landscape deterioration (Campbell et al., 2022; Letnic et al., 2013). This effect from dingo presence can lead to increased pasture biomass, improved livestock condition, and higher profit margins for pastoralists (Prowse et al., 2015; Pollock, 2021). Additionally, dingoes may indirectly benefit small mammals and vegetation by controlling invasive species like foxes and cats (Letnic et al., 2013; Newsome et al., 2015). While dingo reintroduction has been proposed to restore degraded rangelands, it remains controversial due to concerns about livestock predation and conservative community views (Newsome et al., 2015). This is indeed an area for further research and community education – coupled with courageous conversations – so that there is greater understanding of dingoes' ecological impacts and to develop management strategies that balance predator conservation with livestock production.

These are just some of the many examples and areas for research throughout Australia's rangelands that are both encouraging and inspiring and that are helping to protect rangelands in our climate challenged world.

Conclusion

Despite the grand and complex challenge that climate change presents, there are people who are stepping up and speaking out to look after rangelands. Climate courage means facing hard truths about environmental change while taking decisive action. This type of courage isn't just about bravery or rose-tinted optimism - it's about maintaining hope and taking practical action in the face of serious environmental challenges, all while preserving the cultural and ecological heritage of rangeland systems now and for future generations.

Securing a resilient future for rangelands requires cultivating climate courage within individuals and communities. It depends on us truly acknowledging our dependence on healthy, thriving natural ecosystems

and the relationship of reciprocity. This determination to care for the planet's precious rangelands can radiate from local initiatives, the amplification of traditional knowledge, the embracing of innovation, and fostering collective resilience in the face of change. Through coordinated action and shared determination, communities can enable positive transformation in rangeland management and conservation.

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