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Editorial

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Prisms *Drylands*: Synthesising multiple disciplines, themes and management practices across Earth's drylands

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Drylands are defined as areas where the ratio of precipitation to potential evapotranspiration (Aridity Index) is 0.65 or less. Drylands are critically important globally because they currently support about 38% of the global human population and occupy about 45% of Earth's terrestrial land surface (FAO, 2021). Ecosystem degradation currently occurs in about 15% of drylands and affects about 250 million people, mostly in the Global South. Many of these people are tied to pastoralism, so their well-being is closely linked to forage production. Drylands are geographically important and situated in particularly politically unstable parts of the world. The people are often marginalised, among the poorest, closely associated with natural and semi-natural systems, heavily dependent on primary production for their livelihoods, and are therefore susceptible to the vagaries of climate and global conflicts. Many drylands are also hotspots of human conflict, and this presents serious social and environmental challenges for governments. The majority of global studies based on the Aridity Index, a proxy for drylands, predict an increase in dryland extent by the end of the century (e.g., Polade et al., 2014), largely due to increased global warming (Feng et al., 2022). In some areas, however, the extent of drylands may decline due to predicted higher rainfall (Huang et al., 2016).

Drylands face a number of critical environmental, social and political challenges over the next century as we move to a hotter, drier world. Foremost among these challenges are climate change and climate variability. The IPPC predicts a greater frequency of extreme events (Foster et al., 2021), and an expansion in the area covered by drylands (Feng and Fu, 2013; Huang et al., 2016), but this will likely lead to reductions in the extent of temperate drylands (Schlaepfer et al., 2017). Attendant issues associated with greater climate variability are reductions in primary production, reduced crop yields and lower livestock production, resulting in potential threats to human livelihoods and pastoral production (Gherardi and Sala, 2015; Ndlovu et al., 2022).

Land degradation and in extreme cases, desertification (aridification) caused by changing climates and exacerbated by human-induced land use change, pose greater challenges to drylands than other biomes. Recent studies indicate that 6% of dryland areas, mostly in western Asia and South America, have undergone some type of degradation since 1982 (Burrell et al., 2020). An additional 20% of dryland areas risk future degradation due to unsustainable land use practices and human-induced climate change (Burrell et al., 2020). Thus, land degradation has not only direct effects, but there will likely be legacy effects on ecosystem production (Bunting et al., 2017) and soil-geomorphic processes (Monger et al., 2015) that impact peoples and their ability to produce food and survive in dryland areas.

Water and food insecurity are critical challenges of drylands under regimes of spatially and temporally variable precipitation (Feng and Fu, 2013). Water insecurity is exacerbated by poor water management (Stroosnijder et al., 2012; Wang et al., 2022), such as overexploitation of water resources, unsustainable irrigation practices and changes in water supply delivery mechanisms and structures (Piemontese et al., 2024). Despite this, significant progress has been made in developing land management practices in drylands that improve water use efficiency. These include more efficient storage, the use of wastewater, improved water harvesting techniques for smallholders (Oweis and Hachum, 2006) and improvements in precision agriculture (Arrúe et al., 2019).

Malnutrition and food insecurity are pervasive challenges in drylands where smallholders produce almost half of the world's food from rainfed crops and pastures (Squires and Gaur, 2020). Yet, food production policies have failed many smallholders, and supply is largely controlled by large corporations and agribusiness (Martinez-Valderrama et al., 2020). Food production in drylands will need to double to feed a growing population by 2050 (Dar and Laxmipathi Gowda, 2013). Food shortage will lead to price instability, which is exacerbated by a declining rural workforce (Nel and Hill, 2008), despite accelerating population growth in drylands (Kniveton et al., 2012; Spinoni et al., 2021). The challenges faced by policy makers and land administrators should not be underestimated. In Zimbabwe, for example, about 90% of the population is dependent on rain-fed agriculture (Unganai and Murwira, 2010).

Malnutrition and lack of access to clean water and sanitation exacerbate the cycles of poverty and vulnerability in dryland communities.

New technologies will enhance the ability of pastoralists, ranchers and farmers to improve their management skills and their economic returns. For example, the Land Potential Knowledge System (Herrick et al., 2016) is a mobile phone-based system designed to help managers adopt sustainable land management practices across the world. Mobile phone connectivity and GPS technologies are available almost everywhere. In Burkina Faso, Fulbe pastoralists use mobile phone technology to access weather and forage status information (Rasmussen et al., 2015). Phone communication allows a more efficient selection of potential grazing land and can reduce the risk of encroaching on the grazing lands of neighbouring pastoralists (Asaka and Smucker, 2016). Mobile phones allow improved demographic surveillance of pastoral communities, which is critical for effective vaccination programs (Brinkel et al., 2014), and they provide useful information on livestock health and migration patterns (Jean-Richard et al., 2014). These and other technologies such as the use of low-cost drones to deliver vaccines to isolated locations (Griffith et al., 2023) can improve the well-being of pastoralists and even reverse migration trends towards large cities.

The demands placed on drylands are increasing rapidly, and despite an uncertain *future*, there are substantial opportunities and challenges (Coppock et al., 2017). The global transition to clean energy production often uses the 'wasteland' narrative to view drylands as areas to locate large-scale solar and wind farms for energy production, yet this may threaten potential pastoral livelihoods. Any changes that these developments bring to drylands will not be distributed evenly, with a range of opportunities that will vary among regions. New energy initiatives in drylands can potentially bring employment to dryland regions but may disrupt local communities. The outcome of these changes will depend on society's ability to cope with these changes.

The future of drylands. There are reasons to worry about global drylands but there is hope through novel understanding and new technologies. Prisms Drylands aims to play a central role in supporting the understanding that will reverse negative trends and sustain the cultural and biological diversity of drylands. The multidisciplinary nature of drylands, the nuances of environmental, social, political and structural complexity, and the huge global extent of drylands means that there is an increasing need for a truly interdisciplinary outlet for research, management and sociology of drylands; topics that are not well serviced by current scientific journals. Cambridge Prisms: *Drylands* aims to be a forum for rapid publication of cross-disciplinary science relating to the understanding and social challenges of dryland ecosystems. The future of drylands is full of opportunities in terms of changing people's perception, new technologies and new demands for drylands.

We are excited about a new scientific journal dedicated to the world's drylands. We welcome manuscripts based on observational, theoretical or experimental studies of terrestrial, marine or freshwater systems, provided they have a dryland focus. Emphasis will be placed on new contributions to theory, bodies of empirical knowledge, or the practice of drylands management that have potential regional or global impact. Manuscripts that integrate fundamental questions associated with how drylands function, their sustainable development, and how they relate to social-human systems are particularly welcome. Drylands also welcomes original open-access reviews, perspectives, editorials and comments.

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