

Science & Society

Rangeland stewardship envisioned through a planetary lens

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Rangelands comprise approximately 50% of ecologically intact landscapes available to mitigate biodiversity loss and to provide natural climate solutions. However, their planetary value is often overshadowed by local priorities on select provisioning services. A transformative stewardship strategy will require an inversion of priorities placed on ecosystem service categories supplied by rangelands.

Rangelands are critical to planetary stewardship

The United Nations (UN) General Assembly designated 2026 as the International Year of Rangelands and Pastoralists (IYRP) on 15 March 2022¹. This resolution was endorsed by 102 countries, demonstrating the importance of **rangelands** (see [Glossary](#)) and their inhabitants to the global community. Indigenous people (including **pastoralists**) represent <5% of the world's population, but steward 25% of the terrestrial area, which represents 40% of the ecologically intact landscapes [1]. Rangelands represent approximately 50% of these ecologically intact landscapes, which justifies the importance of pastoralists and rangelands to sustainable **Earth stewardship** [2].

Rangelands represent the largest land cover type on Earth (54%) and contain 30% of the global terrestrial carbon pool, eight of 25 biodiversity hot spots, 24% of all languages, and numerous world

heritage sitesⁱⁱ [3,4] (Figure 1). Yet, in spite of their importance to planetary sustainability, rangelands are often associated with natural resource degradation and human poverty. The extent of degradation remains controversial, but it may represent approximately 20% of the total rangeland areaⁱⁱ. Pastoralists in developing nations herd livestock and engage in small-scale cultivation; they represent some of the poorest and most marginalized people in the world [4,5].

The distinction between these two perspectives of rangeland value is a function of the lens through which rangelands are viewed. The marginalization perspective embracing degradation and poverty is representative of a localized lens narrowly focused on provisioning **ecosystem services**, primarily forage and livestock production (Figure 2). By contrast, a planetary lens embraces the total value of ecosystem services contributing to Earth stewardship. The aggregate value of regulating, supporting, and cultural services provided by global rangelands may be of equal or greater value than those of the select provisioning services currently emphasized [6]. These provisioning services, however, are vital to the livelihoods of millions of pastoralists [4,5]. Therefore, it is imperative that an alternative stewardship strategy expand upon synergies between extensively managed pastoral systems and their critical contribution to Earth stewardship [1,7].

Accelerating global drivers – human population growth, climate change, globalization, and ineffectual governance – have contributed to tradeoffs among local and planetary services that currently challenge the sustainability of pastoral systems [5]. These drivers place greater demands on select provisioning services, while only marginally increasing benefits to rangeland residents. Simultaneously, greater demands for provisioning services decreases the ecological capacity of rangelands to

Glossary

Communal land: land tenure in which a community holds exclusive collective rights to use and manage natural resources within a designated area.

Earth stewardship: approaches to shaping trajectories of social–ecological change at local to global scales to enhance ecosystem resilience and human well-being.

Ecosystem services: benefits that humans derive from ecosystems, which are categorized as provisioning, supporting, regulating, and cultural.

Externality: cost or benefit of an economic activity experienced by an unrelated third party; the external cost or benefit is not reflected in the final cost or benefit of a good or service.

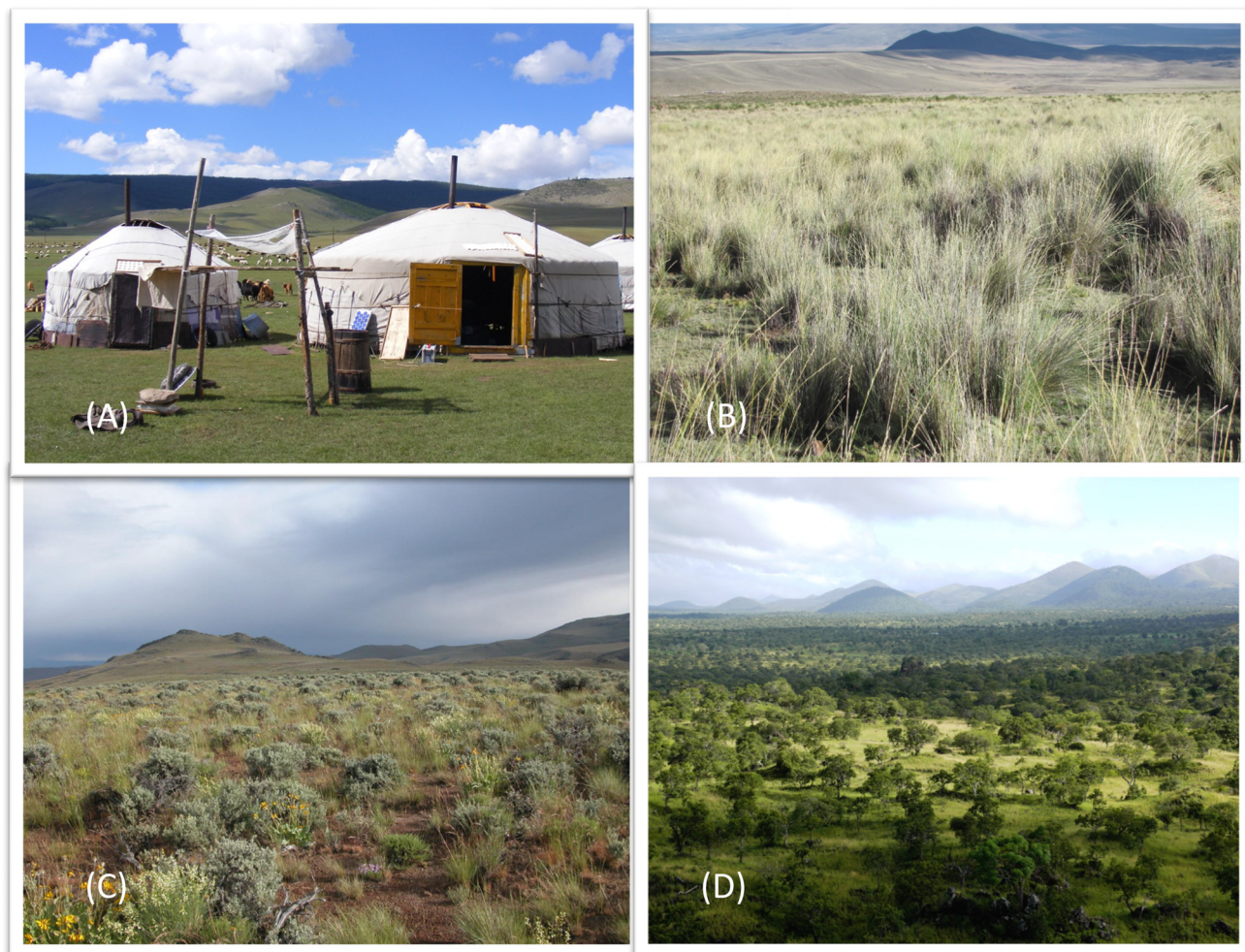
Pastoralists: people who derive a portion of their livelihood by raising grazing animals on extensively managed rangelands; they may be sedentary, seminomadic, or nomadic.

Polycentric governance: power and authority are shared among local, regional, and national levels to increase representation, legitimacy, and equity; it is founded on nested goal-setting, transparent monitoring, and graduated sanctions.

Rangelands: land dominated by native or naturalized vegetation – primarily grasses, forbs, and shrubs – that is managed as a social–ecological system to supply diverse ecosystem services to benefit human well-being.

provide a diverse portfolio of ecosystem services to global citizens [6]. The central component of a transformative stewardship strategy is an inversion of the priorities placed on categories of ecosystem services supplied by rangelands (Figure 2).

Adverse tradeoffs among local and planetary services originate from land use and policy decisions focused on select provisioning services, in which other ecosystem service categories become an **externality** [6,7]. Consequently, the planetary value of regulating, supporting, and cultural services supplied by 53% of the Earth's land area is unrecognized or undervalued. The local lens on rangeland stewardship overrides the planetary lens, in part, because an intergovernmental institution does not exist to bring the planetary lens into focus. A transformative stewardship strategy will require the capacity to sustain rangelands on both local and planetary scales. This may be achieved



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Figure 1. Landscapes illustrating the diversity of global rangelands. (A) Herder yurts in Mongolian grasslands (credit: María Fernández-Giménez), (B) altiplano grassland, Peru (credit: Cecilia Turin), (C) sagebrush steppe, USA (credit: Kirk Davies), and (D) African savanna, Kenya (credit: Urs Kreuter).

most effectively through a **polycentric governance** system capable of sharing authority at local, national, and global levels [7].

The crux of stewardship transformation

Stewardship founded on a more complete accounting of ecosystem services provided by rangelands in support of global human well-being, in addition to that of rangeland residents, would prove transformational [6]. This strategy posits that sustainably managed pastoral systems are vital for biodiversity conservation and natural climate

solutions by mitigating natural resource degradation and preventing rangeland conversion to alternative uses [1]. For example, **communal lands**, including rangelands, have been found to provide greater total value in ecosystem services than commercially managed rangelands when both monetary and non-monetary benefits were assessed [8].

This strategy is consistent with the ‘Half-Earth’ proposal [9] advocating that intensive management of the most productive terrestrial regions could spare extensively managed areas that supply diverse

ecosystem services essential for Earth stewardship. It has been estimated that 34.6% of the planet’s land area is ‘ecologically intact’, in addition to 14.9% currently in protected areas [10]. Rangelands represent approximately 50% of these ecologically intact regions [1], but only 12% are designated as protectedⁱⁱ. Consequently, effective rangeland stewardship provides an opportunity to mitigate the rapid loss of these essential services by conserving intact ecological systems. Rangelands also contribute to natural climate solutions because regions of high biodiversity often coincide with high carbon storage [2].

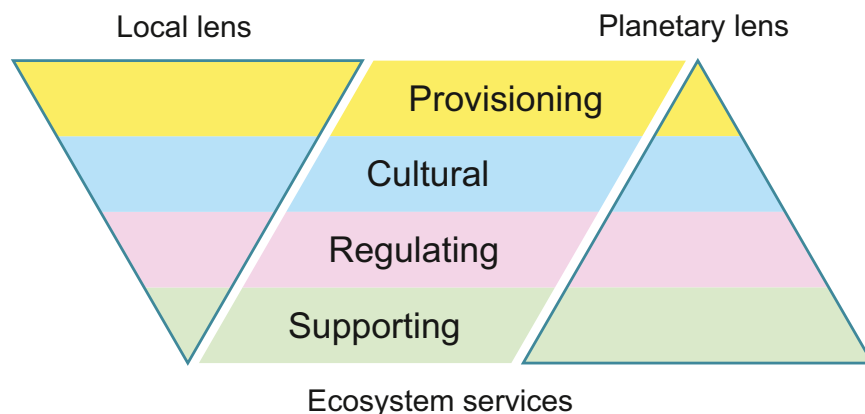


Figure 2. Inversion of priorities placed on ecosystem service categories when rangeland stewardship is envisioned through a local and planetary lens. Provisioning services are goods consumed by society (i.e., food, water, fuel wood, fiber); cultural services are social forces influencing human–nature relationships (i.e., spiritual, recreational, esthetic, educational); regulating services influence processes beyond the ecosystem of origin (i.e., climate, disease, and erosion regulation); and supporting services are processes controlling ecosystem structure and function (i.e., nutrient cycling, energy flow, primary production, biodiversity) [4].

The fundamental challenge confronting global rangeland stewardship is how to most effectively transform social–ecological systems to provide optimal combinations of ecosystem services to global citizens, while improving the well-being of millions of rangeland residents who are highly dependent upon provisioning services [6] (Figure 2). Complex tradeoffs and potential synergies among individual beneficiaries of provisioning services and the maintenance of ecosystem capacity to provide diverse ecosystem services to benefit global citizens defines the crux of this transformation [6,11]. This stewardship strategy is predicated on global investment commensurate with the entire portfolio of rangeland ecosystem services to reduce the demand for provisioning services by rangeland residents, especially those with a high degree of resource dependency. Investments will need to be sufficient to limit rangeland conversion to alternative uses, and additional investments would support additional conservation and restoration programs. This may provide a means to confront chronic underfunding of biodiversity conservation, especially in developing countries [2,12].

An ecosystem services framework is essential

Accounting procedures and feedback mechanisms are desperately needed to identify and assess potential tradeoffs and synergies among ecosystem service categories prior to implementation of land use and policy decisions [11]. These procedures could identify the relative proportion of specific categories of ecosystem services considered optimal for effective stewardship of individual ecological regions. The aggregate of all ecosystem service categories for multiple regions would comprise ecosystem service portfolios that would facilitate identification and implementation of national stewardship goals [11].

The economic and ethical challenges encountered with monetary valuation of ecosystem services may be circumvented by assignment of deliberative values. Deliberative monetary valuation is based on social rationality, where people act as responsible citizens for a common good, rather than on individual rationality, as in the case of cost–benefit analysis [13]. The procedure further reveals individual motives for the

assignment of specific values, which reflects regional and cultural perspectives. Deliberative evaluation is appropriate for valuation of biodiversity and other ecosystem services because they are heterogeneous and difficult to directly compare and prioritize. Development of an acceptable assessment procedure and institutional framework in which deliberation is conducted may represent the greatest challenge in the implementation of this alternative strategy.

An ecosystem services framework will strengthen existing rangeland programs and investments by creating greater capacity to assess and leverage rangeland value relative to alternative land uses and the costs of resource degradation. Land degradation neutrality (LDN) has emerged as a prominent initiative for land stewardship within the UN Commission to Combat Desertification (UNCCD), and it is specifically referenced in Sustainable Development Goal (SDG) 15.3 [14]. The objective of LDN is to maintain or enhance land-based natural capital and its associated ecosystem services. An ecosystem services framework would further support this objective by identifying benchmarks against which achievement is measured, and strengthen the necessary counterbalancing mechanisms by identifying critical feedbacks to minimize adverse tradeoffs among ecosystem services [14].

Explicit emphasis on ecosystem services may provide a common currency to enhance synergistic partnerships among intergovernmental organizations addressing rangelands, including the UNCCD, UN Convention on Biological Diversity, UN Framework Convention on Climate Change, and the International Union for the Conservation of Nature (IUCN), as recommended by ‘SDG 17 – Partnerships for the Goals’ [11,14]. Rangelands are not explicitly referenced in the SDGs, even though two targets specifically address forests in ‘Goal 15 – Life on Land’. Increased awareness of rangelands and pastoralists

created by the IYRP may contribute to increased global coordination.

An ecosystem services framework could be developed parallel to, or in conjunction with, the LDN framework [14]. This could be accomplished by disaggregation of the LDN land-cover indicator, one of three indicators in addition to land productivity and carbon stocks, into broad ecological regions. The major categories of ecosystem services supplied within these regions would provide the foundation of an ecosystem services framework as previously described. A cost-effective, scalable monitoring system would be needed to assess accountability in achieving agreed-upon targets [7]. This framework would provide greater recognition of the interdependencies among ecosystem services, biodiversity, and sustainable development goals [11].

Enhancing coordination among intergovernmental institutions

Global rangeland stewardship would be enhanced by greater international cooperation given that rangelands exist on all continents and in numerous countriesⁱⁱ [12,15]. As a case in point, the Food and Agriculture Organization (FAO) recently completed a Global Forest Reassessment in which numerous global and national forest metrics were referenced to a 1990 baselineⁱⁱⁱ. However, a specific intergovernmental organization has not been designated, or has not assumed responsibility, for global rangeland stewardship. Consequently, a comparable in-depth assessment of global rangelands has yet to be conducted so that the extent and status of rangelands can be more explicitly defined. The recently published Rangeland Atlas provides a valuable starting point for documenting the extent and distribution of global rangelandsⁱ.

Rangeland programs and initiatives currently exist in multiple intergovernmental organizations, with few mechanisms for interorganizational coordination, which minimizes the impact of their collective

contributions and investments. Coordination among multiple intergovernmental organizations would optimize development of a robust, equitable, and credible ecosystem services framework [12,15]. Institutional leadership, policies, and financial resource availability – delivered as state–community partnerships – may represent essential requirements to successfully implement this transformational stewardship strategy [15]. Equitable wealth redistribution to pastoralists is critical to this strategy because increasing adaptive capacity and well-being within these societies represents a necessary prerequisite for maintenance of intact, extensively managed rangelands and the ecosystem services they supply [1,7].

A portal for transformational change in rangeland stewardship

Stewardship transformation from a localized lens to one that is envisioned through a planetary lens represents a daunting but necessary endeavor. It will require greater recognition and valuation of the diverse portfolio of ecosystem services that rangelands provide to humanity, and a mechanism through which society can invest in extensively managed pastoral systems, primarily in developing countries, to maintain the global supply of these services. A polycentric governance system, situated within an authorizing global institution, may convey legitimacy, justice, and equity, especially in developing countries in which the majority of rangelands occur. The proposed transformation is admittedly bold and aspirational, but necessary to promote stewardship on a planetary scale. The IYRP may provide a portal through which this transformational change can emerge and develop.

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D.D.B. framed the paper and D.L.C. provided content regarding pastoralism in developing countries.

Declaration of interests

Authors have no competing interests to declare.

Resources

ⁱ<https://iyrp.info/>

ⁱⁱwww.rangelandsdata.org/atlas/

ⁱⁱⁱwww.fao.org/forest-resources-assessment/2020/en/

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References

1. Garnett, S.T. *et al.* (2018) A spatial overview of the global importance of indigenous lands for conservation. *Nat. Sustain.* 1, 369–374
2. Dinerstein, E. *et al.* (2020) A “Global Safety Net” to reverse biodiversity loss and stabilize Earth’s climate. *Sci. Adv.* 6, eabb2824
3. Briske, D.D. (2017) Rangeland systems: foundation for a conceptual framework. In *Rangeland Systems: Processes, Management, and Challenges* (Briske, D.D., ed.), pp. 1–21, Springer Open
4. Satriel, U. (2005) Dryland systems. In *Ecosystems and Human Well-being: Current State and Trend of Assessment*, pp. 623–662, Island Press
5. Coppock, D.L. *et al.* (2017) Rangeland systems in developing nations: conceptual advances and societal implications. In *Rangeland Systems: Processes, Management, and Challenges* (Briske, D.D., ed.), pp. 569–630, Springer Open
6. Briske, D.D. *et al.* (2020) Strategies for global rangeland stewardship: assessment through the lens of the equilibrium–nonequilibrium debate. *J. Appl. Ecol.* 57, 1056–1067
7. Stafford-Smith, M. and Metternicht, G. (2021) Governing drylands as global environmental commons. *Curr. Opin. Environ. Sustain.* 48, 115–124
8. Favretto, N. *et al.* (2016) Multi-criteria decision analysis to identify dryland ecosystem service trade-offs under different rangeland uses. *Ecosyst. Serv.* 17, 142–151
9. Wilson, E.O. (2016) *Half-Earth: Our Planet’s Fight for Life*, Liveright
10. Kuempel, C.D. *et al.* (2020) Evidence-based guidelines for prioritizing investments to meet international conservation objectives. *One Earth* 2, 55–63
11. Meyers, B. and Selig, E.R. (2020) Global targets that reveal the social-ecological interdependencies of sustainable development. *Nat. Ecol. Evol.* 4, 1011
12. Barbier, E.B. *et al.* (2018) How to pay for saving biodiversity. *Science* 360, 486–488
13. Lienhoop, N. *et al.* (2015) Informing biodiversity policy: the role of economic valuation, deliberative institutions and deliberative monetary valuation. *Environ. Sci. Policy* 54, 522–532
14. Chasek, P. *et al.* (2019) Land degradation neutrality: the science-policy interface from the UNCCD to national implementation. *Environ. Sci. Pol.* 92, 182–190
15. van Kerkhoff, L. and Szlezak, N.A. (2016) The role of innovative global institutions in linking knowledge and action. *Proc. Natl. Acad. Sci. U. S. A.* 113, 4603–4608