

Bending the Curve of Land Degradation to Achieve Global Environmental Goals¹



Source: ©Shutterstock/Scott Book.

Note: Extreme drought in a cornfield under a hot sun.

Land Degradation Has Far Reaching Destructive Consequences

Land degradation, largely driven by how food is produced worldwide, is intensifying climate change, biodiversity loss, and global food insecurity. Food systems, which include production, processing, packaging, storage, transportation, consumption, distribution, and disposal, account for 25% of greenhouse gas emissions, 80% of deforestation, and 70% of freshwater withdrawals globally. Food production, alone, accounts for more land use than any other activity. Unsustainable production and consumption patterns, including food loss, overproduction, and excessive meat intake, are major drivers of soil depletion, water pollution, and habitat loss.

Given the interplay of these issues, land is the “critical nexus” for achieving the goals of all three Rio Conventions: The United Nations Convention to Combat Desertification (UNCCD), United Nations Framework Convention on Climate Change (UNFCCC), and Convention on Biological Diversity (CBD).³

The Bottom Line

- This new KAUST-led² study argues that three related actions can reverse land degradation: reducing food waste, restoring degraded land, and shifting diets toward sea-based foods.
- If implemented at scale, these steps can make global food supplies and land-use practices more sustainable and meet the goals of the Rio Conventions.
- To accomplish this transformation, the study also points to the need for inclusive governance that considers all stakeholders—including women and smallholders—to ensure effective, locally appropriate land management.
- Land degradation contributes substantially to climate change, habitat loss, water contamination, and food insecurity.



Source: ©UNCCD/NAGGW Mauritania

Note: The photo shows land restoration efforts in Mauritania using traditional dune stabilization and agroforestry techniques as part of the Great Green Wall initiative, transforming degraded land into productive landscapes.

Concerted Action Can Reverse Land Degradation by 2050

Interventions focus on reducing food waste, restoring land, and shifting diets

The study proposes three interventions with ambitious and achievable targets as well as specific steps (Table 1) for reversing land degradation:

- Reduce food waste by 75%
- Restore 50% of degraded land, including agricultural and non-agricultural land
- Shift 70% of red meat intake to sustainable seafood and 10% of vegetables to seaweed.

The study finds that these interventions, taken together, could reduce land degradation by 54% and decrease global land use for food production by 56% by 2050, relative to 2020 levels. The finding is based on a comparison of the estimated amount of land degradation by 2050 under two scenarios—business-as-usual and large-scale action.

Food waste is both a problem and a solution

Food waste accounts for one-third of food production, costing \$1 trillion annually. Reducing waste by 75% could ease land and emission pressures while freeing resources to close the \$278 billion UNCCD funding gap. However, this requires tackling overproduction incentives and food supply inefficiencies—especially in high-income countries.

Restoring degraded land can deliver multiple wins

Restoring half of the world's degraded agricultural and natural lands could reclaim 12.9 million km² and prevent nearly 150 gigatons of carbon-dioxide-equivalent emissions by 2050. It would also enhance biodiversity, food security, and rural incomes. Success hinges on equitable land tenure, local participation, and scaling sustainable land management practices.

Diets are a powerful lever for sustainability

Shifting from land-intensive red meat and vegetable consumption to sustainable seafood and seaweed could dramatically reduce environmental footprints while improving public health. While this dietary transition is most relevant in high-consumption countries, flexible strategies are needed in low-income or landlocked regions.

**Table 1. Proposals for Change with Specific Steps for Reversing Land Degradation by 2050**

Proposal	Description
Adopt Rio+ 2050 Targets	Reduce food waste by 75%, restore 50% of degraded land, and shift diets to aquatic-based foods
Integrate Food Systems into Global Frameworks	Mandate inclusion in CBD, UNFCCC, and UNCCD implementation plans
Create a Global Land Science-Policy Alliance	Coordinate assessments across the UNCCD Science-Policy Interface, Intergovernmental Panel on Climate Change, and Intergovernmental Science-Policy Platform on Biodiversity and Ecosystem Services
Reform Fiscal and Trade Policies	Introduce a "land tax," redirect subsidies to sustainable land management, and promote certified eco-labeling
Secure Land Tenure and Access to Resources	Engage especially with smallholders, women, and indigenous communities
Scale Community-Based Restoration	Support adaptive land management through local institutions and cooperatives
Promote Equitable Dietary Shifts	Align incentives for promoting aquatic-based diets. In regions where such a diet is not feasible, promote sustainable meat production and alternative protein sources

Source: Policy Institute synthesis of material presented in Maestre et al. 2025.

Transformation Requires Institutional Support, Inclusivity, and Coordination

Policy and governance mechanisms can provide necessary support

The study calls for inclusive governance, land tenure security, aligning subsidies with policy goals, integrating unintended costs and side effects into food pricing, and cross-convention coordination through mechanisms such as the Rio Conventions Joint Liaison Group.

Smallholders and women are essential actors

Implementing these changes will also require engaging family farms, which produce over one-third of the world's food and typically employ more sustainable methods. Their inclusion, especially through gender-responsive land policies and cooperatives, is crucial to implementing restoration and resilience strategies at scale.

Systemic transformation is needed

Under current practices, without transformative change, land degradation will continue to accelerate, undermining climate and biodiversity efforts. Integrated, land-focused policies across the Rio Conventions provide a unique opportunity to deliver lasting global benefits.

Summing Up

The evidence is clear: bending the curve of land degradation is technically achievable, financially feasible, and politically urgent. Land systems are the key to making progress across climate, biodiversity, and food agendas—but current institutions treat them in silos. The 2050 targets outlined in this brief offer a pragmatic and science-backed roadmap for course correction. Achieving them requires systemic shifts in how we govern food, finance agriculture, and manage natural resources. Momentum is building across the Rio Conventions, and the time to act is now.

Failure to act risks irreversible ecological and humanitarian consequences. Success promises a more resilient, equitable, and sustainable planet.



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1. This Policy Brief summarizes findings from Maestre, Fernando T., Emilio Guirado, Dolores Armenteras, Hylke E. Beck, Mashael Saud AlShalan, Noura Turki Al-Saud, Ralph Chami, Bojie Fu, Helene Gichenje, Elisabeth Huber-Sannwald, Chinwe Ifejika Speranza, Jaime Martinez-Valderrama, Matthew F. McCabe, Barron J. Orr, Ting Tang, Graciela Metternicht, Michael Miess, James F. Reynolds, Lindsay C. Stringer, Yoshihide Wada, and Carlos M. Duarte. 2025. "Bending the Curve of Land Degradation to Achieve Global Environmental Goals." *Nature* 644. <https://doi.org/10.1038/s41586-025-09365-5>. All rights and any third-party permissions remain with the respective rightsholders.
2. King Abdullah University of Science and Technology (KAUST) with international collaborators.
3. Often referred to as the Three Rio Conventions. The UNCCD is the sole legally binding international agreement linking environment and development to sustainable land management. Established in 1994, it aims to combat desertification and land degradation, especially in arid, semi-arid, and dry sub-humid areas, and to mitigate the effects of drought. Its core goal is to achieve land degradation neutrality by promoting sustainable land use practices. The UNFCCC, adopted in 1992, is the foundational international treaty for addressing climate change. It sets the framework for global efforts to reduce greenhouse gas emissions and adapt to climate impacts. Key agreements under the UNFCCC include the Kyoto Protocol and the Paris Agreement, which commits countries to limiting global temperature rise and enhancing climate resilience. The CBD is an international treaty adopted in 1992 to conserve biological diversity, promote sustainable use of its components, and ensure fair and equitable sharing of benefits arising from genetic resources. Its objectives focus on safeguarding ecosystems, species, and genetic diversity while promoting human well-being through sustainable development. The latest global framework under the CBD is the Kunming-Montreal Global Biodiversity Framework (2022).