Distributed from multiple cities

Media contacts:
Alison Carmody, alison.carmody@kaust.edu.sa
UNCCD Media, press@unccd.int
Terry Collins, +1-416-878-8712, tc@tca.tc

The full ***Nature*** paper, *"Bending the curve of land degradation to achieve global environmental goals,"* is available for media preview on request

Overhaul Global Food Systems to Avert Worsening Land Crisis

Imperative to 'bend the curve' of land degradation by reducing food waste, unlocking sustainable ocean-based food potential and restoring half of degraded lands by 2050

In **Nature,** 21 leading scientists today prescribe ways to use food systems to halt and reverse land degradation, underlining that doing so must become a top global priority to mitigate climate change and stop biodiversity loss.

The article breaks new ground by quantifying the impact by 2050 of reducing food waste by 75 per cent and maximising sustainable ocean-based food production, measures that alone could spare an area larger than Africa.

According to the paper: "Food systems have not yet been fully incorporated into intergovernmental agreements, nor do they receive sufficient focus in current strategies to address land degradation. Rapid, integrated reforms focused on global food systems, however, can move land health from crisis to recovery and secure a healthier, more stable planet for all."

The authors underline especially the importance of halting food waste and sustainably managing lands, and suggest an ambitious but achievable target of 50 per cent land restoration for 2050 (currently 30 per cent by 2030).

And, they emphasize, the measures outlined would enormously co-benefit the climate, biodiversity, and global health.

Says lead author Fernando T. Maestre of the King Abdullah University of Science and Technology (KAUST), Saudi Arabia: "This paper presents a bold, integrated set of actions to tackle land degradation, biodiversity loss, and climate change together, as well as a clear pathway for implementing them by 2050."

“By transforming food systems, restoring degraded land, harnessing the potential of sustainable seafood, and fostering cooperation across nations and sectors, we can ‘bend the curve’ and reverse land degradation while advancing towards goals of the UN Convention to Combat Desertification and other global agreements.”

Adds co-author Barron J. Orr, UNCCD’s Chief Scientist: “Once soils lose fertility, water tables deplete, and biodiversity is lost, restoring the land becomes exponentially more expensive. Ongoing rates of land degradation contribute to a cascade of mounting global challenges, including food and water insecurity, forced relocation and population migration, social unrest, and economic inequality.”

“Land degradation isn’t just a rural issue, it affects the food on all our plates, the air we breathe, and the stability of the world we live in. This isn’t about saving the environment, it’s about securing our shared future.”

Key recommendations:

1. Restoring 50 per cent of degraded land through sustainable land management practices would correspond to the restoration of 3 Mkm² of cropland and 10 Mkm² of non-cropland, a total of **13 Mkm²**.

Land restoration must involve the people who live on and manage the land — especially Indigenous Peoples, smallholder farmers, women, and other vulnerable people and communities, the article says.

To support them, the authors recommend:

- Support for small farmers: Most of the world’s food is grown by small and family farms. The paper calls for shifting agricultural subsidies from large-scale industrial farms toward sustainable smallholders, incentivizing good land stewardship among the world’s 608 million farms, and fostering their access to technology, secure land rights, and fair markets
- Land-based taxes or tariffs: To reward sustainable farming and penalize polluters
- Environmental labeling: So consumers can make informed, planet-friendly food choices
- Better data and reporting: To track emissions and land use impacts

2. Reduce food waste by 75 per cent: An estimated 56.5 Mkm² of agricultural land (cropland and rangelands) are used to produce food, and roughly 33 per cent of all food produced is wasted (14 per cent lost post harvest at farms; 19 per cent at the retail, food service and household stages).

Reducing food waste by 75 per cent, therefore, could spare roughly **13.4 Mkm²** of land.

The authors highlight key measures to remedy this, including:

- Policies to prevent overproduction and spoilage
- Ban food industry rules that reject “ugly” produce
- Encourage food donations and discounted sales of near-expiry products
- Education campaigns to reduce household waste
- Support small farmers in developing countries to improve storage and transport

They note new legislation in Spain requiring stores to donate or sell surplus food, restaurants to offer take-home containers, and all actors across the food supply chain to implement formal food waste reduction plans.

3. Integrate land and marine food systems: Red meat produced in unsustainable ways consumes large amounts of land, water, and feed, and emits significant greenhouse gases. Seafood and seaweed are sustainable, nutritious alternatives. Seaweed, for example, needs no freshwater and absorbs atmospheric carbon. Responsible aquaculture—focusing on low-impact species like mussels and seaweed-derived products—can reduce pressure on land. The authors recommend:

- Replacing 70 per cent of unsustainably produced red meat to sustainably sourced seafood, such as wild or farmed fish and mollusks. Doing so would spare **17.1 Mkm²** of land currently used for pasture and livestock feed
- Using sustainably sourced seaweed-derived products as a vegetable substitute—replacing just 10 per cent of global vegetable intake with seaweed-derived products could free up **over 0.4 Mkm² of cropland.**

These changes are especially relevant for wealthier countries with high meat consumption. In some poorer regions, animal products remain crucial for nutrition.

Total land spared by food system-related measures 2 and 3: ~30.9 Mkm², an area roughly equal to Africa.

The combination of land restoration, food waste reduction,, and dietary shifts, therefore, would spare or restore roughly **43.8 Mkm²** in 30 years (2020-2050).

The proposed measures combined would also

- Contribute to emission reduction efforts by mitigating roughly 13 Gt of CO2-equivalent per year through 2050.
- Co-benefit biodiversity by improving habitat quality and ecosystem functioning, and avoiding the conversion of remaining natural ecosystems to cropland, and
- Help the world community achieve its commitments in several international agreements, including the three Rio Conventions (climate, biodiversity and desertification), the Sustainable Development Goals and others

Coordinated action among the Rio Conventions

The authors call for the UN's three Rio conventions– UNCCD, CBD and UNFCCC–to unite around shared land and food system goals and encourage the exchange of state-of-the-art knowledge, track progress and streamline science into more effective policies, all to accelerate action on the ground.

Land and food systems play a key role in advancing towards the goals and targets of the three conventions and the Sustainable Development Goals, they say.

The authors call on Parties to all three Rio conventions to promote multilateral actions on land and food systems in a coordinated and collaborative manner. UNCCD's 197 Parties, at their most recent Conference of Parties (COP16) in Riyadh, Saudi Arabia, have already adopted a decision on avoiding, reducing and reversing land and soil degradation of agricultural lands.

Additional comments

"Land is more than soil and space. It harbors biodiversity, cycles water, stores carbon, and regulates climate. It gives us food, sustains life, and holds deep roots of ancestry and knowledge. Today, over one-third of Earth's land is used to grow food - feeding a global population of more than 8 billion

people. Yet today, modern farming practices, deforestation, and overuse are degrading soil, polluting water, and destroying vital ecosystems. Food production alone drives nearly 20 per cent of global emissions of greenhouse gases. We need to act. To secure a thriving future - and protect land - we must reimagine how we farm, how we live, and how we relate to nature - and to each other. It's time for land stewardship: to care for the land as a living ally, no longer as a resource to exploit."

Co-author Elisabeth Huber-Sannwald, Professor, Instituto Potosino de Investigación Científica y Tecnológiva, San Luis Potosí, Mexico

"Land degradation is a key factor in forced migration and conflict over resources. Regions that rely heavily on agriculture for livelihoods, especially smallholder farmers, who feed much of the world, are particularly vulnerable. These pressures could destabilize entire regions and amplify global risks."

C0-author Dolors Armenteras, Professor of Landscape Ecology – Universidad Nacional de Colombia, Bogotá

"Integrating land and marine food systems is fundamental to achieve food security, enable the restoration of degraded land and maintain healthy populations"

Co-author Carlos M. Duarte, **Professor of Marine Science, KAUST**

******

By the numbers

56 per cent: Projected increase in food production needed by 2050 if we stay on our current path

34 per cent: Portion of Earth's ice-free land already used for food production, headed to **42 per cent** by 2050

21 per cent: Share of global greenhouse gas emissions produced by food systems

80 per cent: Proportion of deforestation driven by food production

70 per cent: Amount of freshwater consumption that goes to agriculture

33 per cent: Fraction of global food that currently goes to waste

US$1 trillion: Estimated annual value of food lost or wasted globally

75 per cent: Ambitious target for global food waste reduction by 2050

50 per cent: Proposed portion of degraded land to be restored by 2050 using sustainable land management

US $278 billion: Annual funding gap to achieve UNCCD land restoration goals

608 million: Number of farms on the planet

90 per cent: Percentage of all farms under 2 hectares

35 per cent: Share of the world's food produced by small farms

6.5 billion tons: Potential biomass yield using 650 million hectares of ocean for seaweed farming

17.5 million km²: Estimated cropland area saved if humanity adopts the proposed Rio+ diet (less unsustainably produced red meat, more sustainably sourced seafood and seaweed-derived food products)

166 million: Number of people who could avoid micronutrient deficiencies with more aquatic foods in their diet

****

Bending the curve of land degradation to achieve global environmental goals,
https://doi.org/10.1038/s41586-025-09365-5

Authors

- **Fernando T. Maestre** – King Abdullah University of Science and Technology, Saudi Arabia (Lead author)
- **Emilio Guirado** – King Abdullah University of Science and Technology, Saudi Arabia
- **Dolors Armenteras** – Universidad Nacional de Colombia, Bogotá, Colombia
- **Hylke E. Beck** – King Abdullah University of Science and Technology, Saudi Arabia
- **Mashael bint Saud AlShalan** – Aeon Collective, Riyadh, Saudi Arabia
- **Noura bint Turki Al-Saud** – Aeon Collective, Riyadh, Saudi Arabia
- **Ralph Chami** – Blue Green Future LLC, Washington D.C., USA
- **Bojie Fu** – Key Laboratory of Regional and Urban Ecology, Chinese Academy of Sciences & University of Chinese Academy of Sciences, Beijing, China
- **Helene Gichenje** – Independent Consultant, Nairobi, Kenya
- **Elisabeth Huber-Sannwald** – Instituto Potosino de Investigación Científica y Tecnológica, San Luis Potosí, Mexico
- **Chinwe Ifejika Speranza** – Institute of Geography, University of Bern, Switzerland
- **Jaime Martínez-Valderrama** – Estación Experimental de Zonas Áridas, CSIC, Almería, Spain
- **Matthew F. McCabe** – King Abdullah University of Science and Technology, Saudi Arabia
- **Barron J. Orr** – United Nations Convention to Combat Desertification, Bonn, Germany
- **Ting Tang** – King Abdullah University of Science and Technology, Saudi Arabia
- **Graciela Metternicht** – Western Sydney University, Australia
- **Michael Miess** – King Abdullah University of Science and Technology, Saudi Arabia
- **James F. Reynolds** – Nicholas School of the Environment and Department of Biology, Duke University, USA
- **Lindsay C. Stringer** – University of York, UK
- **Yoshihide Wada** – King Abdullah University of Science and Technology, Saudi Arabia
- **Carlos M. Duarte** – King Abdullah University of Science and Technology, Saudi Arabia

****

About KAUST

Established in 2009, King Abdullah University of Science and Technology (KAUST) is a graduate research university devoted to finding solutions for some of the most pressing scientific and technological challenges in the world as well as Saudi Arabia in the areas of food and health, water, energy, environment and the digital domain.

KAUST is a curiosity-driven, interdisciplinary university. It brings together the best minds from around the world to advance research. More than 120 different nationalities live, work and study on campus. KAUST is also a catalyst for innovation, economic development and social prosperity, with

research resulting in novel patents and products, enterprising startups, regional and global initiatives, and collaboration with other academic institutions, industries and Saudi agencies.

https://www.kaust.edu.sa/en

About UNCCD

The United Nations Convention to Combat Desertification (UNCCD) is an international agreement on good land stewardship. It helps create wealth, grow economies and secure food, clean water and energy by enabling sustainable land management. The Convention's 197 parties establish partnerships and robust systems to manage drought promptly and effectively. Good land stewardship based on sound policy and science helps integrate and accelerate achievement of the Sustainable Development Goals, builds resilience to climate change and prevents biodiversity loss.

The 16th session of UNCCD's Conference of the Parties (COP16) was held in Riyadh, Saudi Arabia in December 2024. Mongolia will host UNCCD **COP17** in Ulaanbaatar from 17-28 August 2026, a major event coinciding with the UN's International Year of Rangelands and Pastoralists. Delegates from UNCCD Parties, heads of state, ministers, representatives from international organizations, scientific communities, civil society, and the private sector will convene to accelerate action against desertification, land degradation and drought.

https://unccd.int