

Woodwell's Global Assessment of Carbon Health of Grazing Lands



**Woodwell
Climate
Research
Center**

Rangelands at COP 17

Rangelands cover more than half of global land area, support 500 million people, and are essential to food security. While rangelands are degrading and overlooked in policies, attention is growing, and COP 17 aims to take protection and restoration of rangelands to the next level.

This process began at COP 16 in Saudi Arabia, which recognized rangelands as critical for combating land degradation and requested the UNCCD to strengthen public-private partnerships, projects, and programs to support rangeland health.

With Mongolia's territory comprising 90% rangelands, and COP 17 alignment with the UN International Year of Rangelands and Pastoralists, the Conference will be a key platform for elevating rangelands and food systems on the global agenda.

COP 17 will achieve this by:

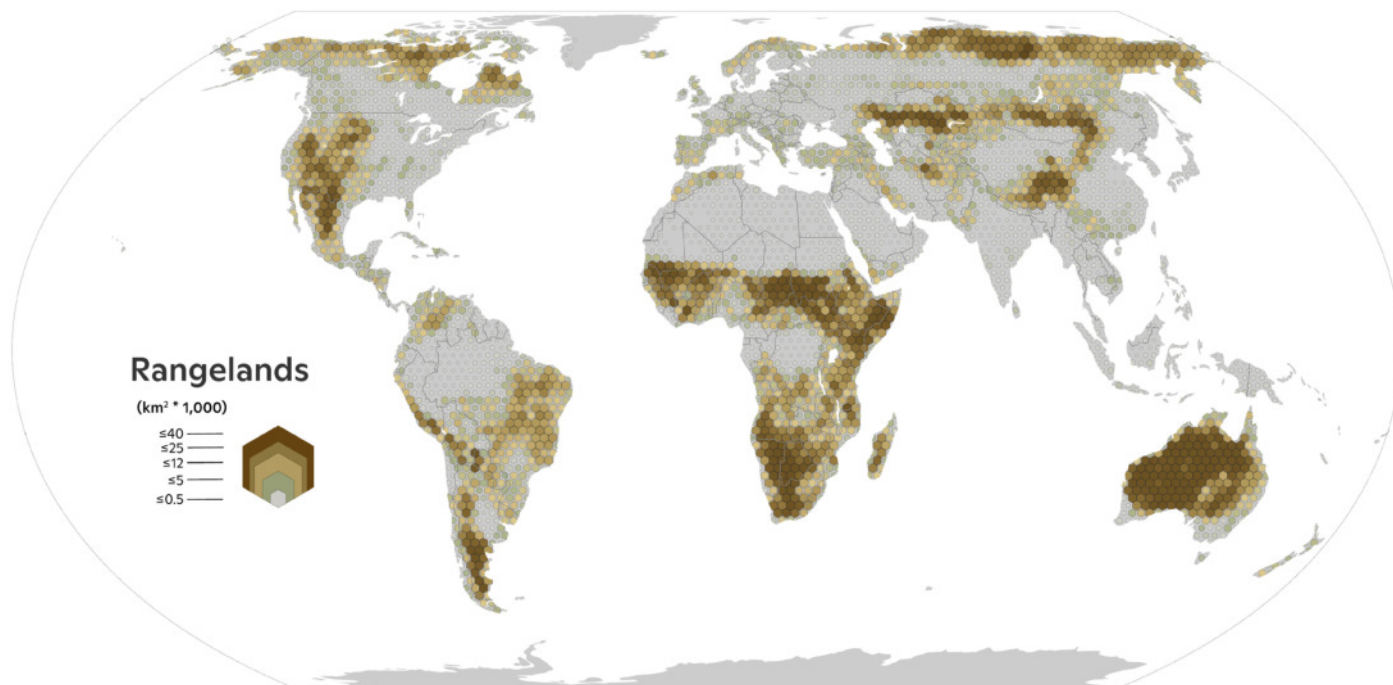
- Enhancing official policy frameworks and collaborations to conserve, manage, and restore rangelands.

- Launching Mongolia's Rangeland Flagship Initiative (RFI), a global collaboration platform to advance knowledge, investments, and institutions for protecting rangelands.
- Hosting a Land and People Day, a session of high-level and technical discussions to put rangeland restoration at the heart of the Conference.
- Advancing the "Silk Road Caravan" framework, which outlines the next steps on the Land and Soil Breakthrough Targets (BTTs) from COP 16.

Success in enhanced action on rangelands in a climate-changed world requires better understanding of the carbon flows across those lands. To this end, Woodwell Climate Research Center will introduce a new global assessment of the carbon health of grazing lands at COP 17.

Assessing the Carbon Health of Global Grazing Lands

Robust and science-based land management decisions that increase land health and carbon uptake require



a deep understanding of the carbon cycle status of rangelands, relevant ecosystem and climate feedbacks, as well as of climate risks. However, current assessments of grazing land health are based mostly on remote-sensing metrics of plant cover vs. soil, leading to a low understanding of those lands in a changing climate. Many ecosystem models applied by governments and organizations are coarse, not applicable to rangelands, outdated, and do not reflect linkages between carbon health and climate risks.

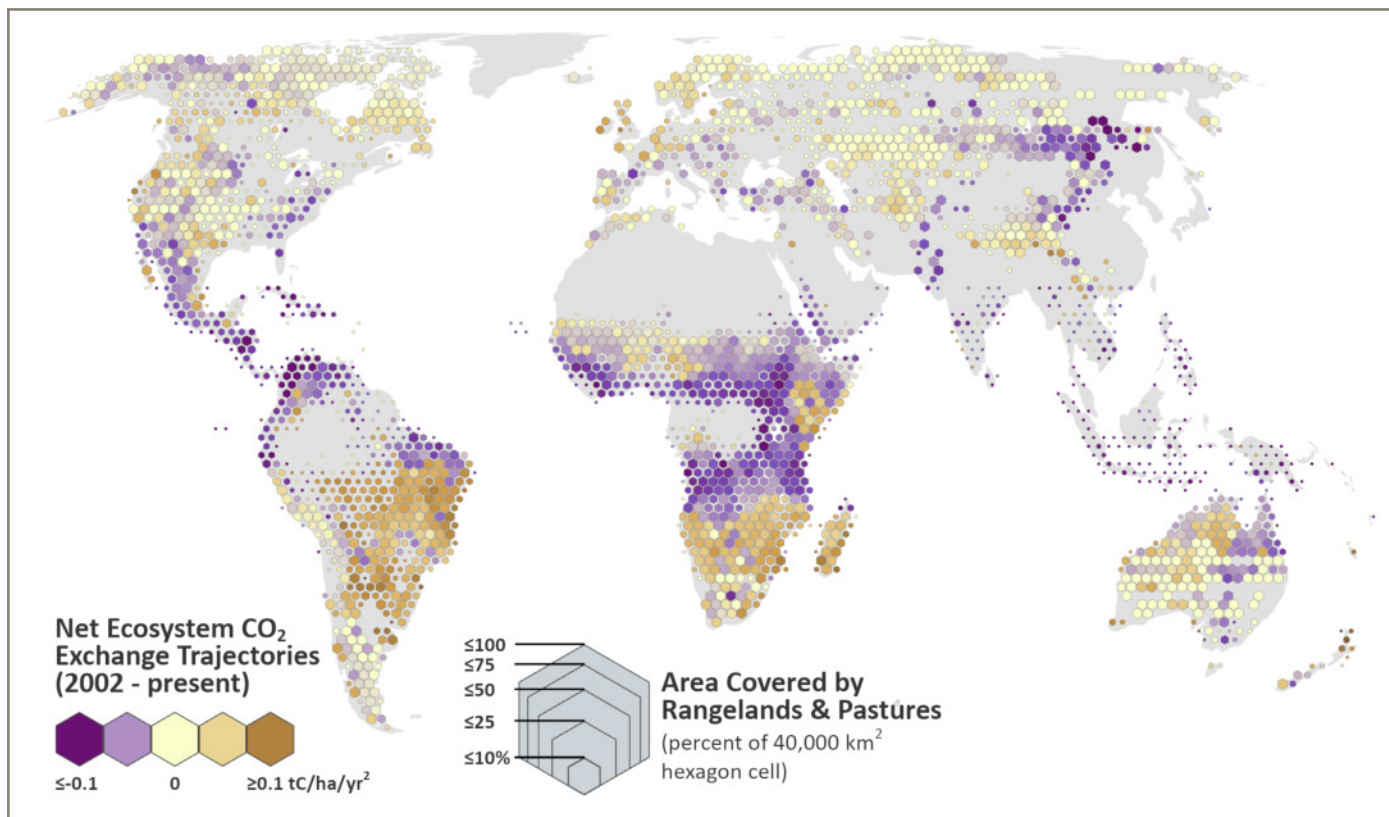
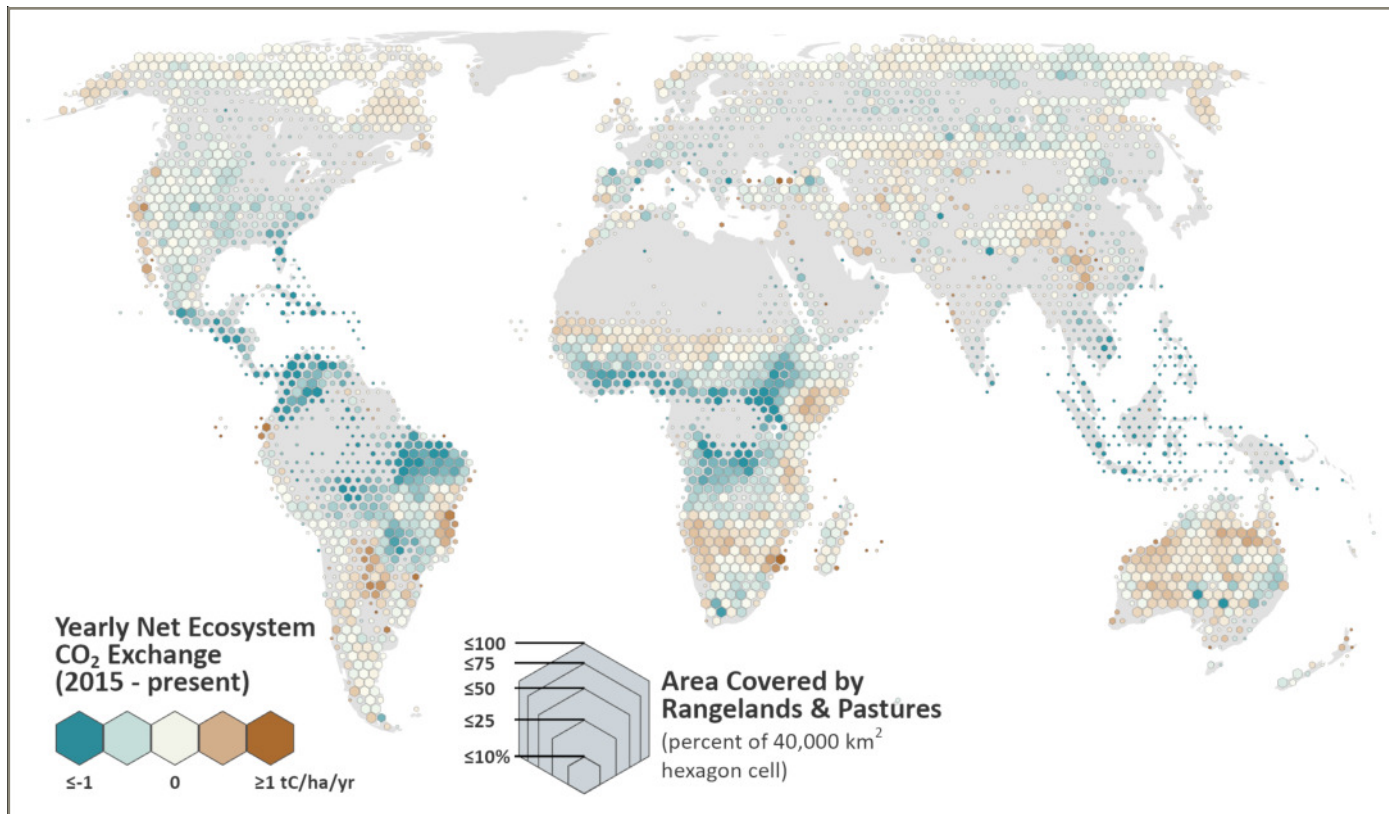
To fill these gaps, Woodwell’s project team is analyzing a NASA satellite dataset for 2003–2025 to assess carbon hotspots of rangelands around the world to calculate how much carbon rangelands absorb or release, how soil carbon stocks change, and where losses or gains are occurring. They have also integrated climate model trends with carbon status trends to identify regions at risk from drought, extreme events, and land degradation. The goal is the most comprehensive, high-resolution global picture of rangeland carbon status to date. A [dynamic webviewer](#) will enable zooming in to specific regions and toggling between data layers of interest.

The assessment will build on NASA’s SMAP Level 4 Carbon satellite database to generate a systematic and high-resolution (9 km) time-series picture (2003–2025) of carbon cycle health across the world’s range- and pasturelands, with the ability to be downscaled and validated locally. The assessment will quantify vegetation CO₂ uptake (gross primary production),

net ecosystem CO₂ exchange (NEE, gross primary production minus CO₂ loss from respiration) and associated changes in soil organic carbon (SOC) across major rangeland biomes.

Key Findings

- The carbon cycle can provide a key indicator for land health: in comparison to low-carbon soils, high-carbon soils tend to be characterized by enhanced soil structure, water retention and infiltration, nutrient cycling and biodiversity.
- Overall, between 2000 and 2025, global rangelands switched from being a net source of CO₂ emissions to a net NEE sink. Currently, in terms of NEE, 15% of grazing lands having a significant 2000–2025 trend are gaining annual NEE carbon, whereas 20% are losing carbon.
- Climate forcings (including temperature, precipitation, vapor pressure and soil moisture) explain parts of the observed trends, while local land-use change also plays a significant role. Future research—including projected climate trends—can clarify how these drivers contribute to land health and inform science-backed land stewardship.
- Higher-resolution and regionally calibrated approaches, along with the integration of other health metrics (e.g. soil water storage, changes in plant type), are needed for local tracking of grazing land health and to support local verification of conservation efforts.



Woodwell's Contributions to COP 17 Rangelands Priorities

- Our assessment fills knowledge gaps on soil carbon and climate risk, enabling design and implementation of efforts to manage and restore rangelands in a climate-synergistic way. Such gaps were recognized in 29/COP.16 (the Rangelands Decision) and its follow-up, which launched work to enhance understanding of functioning of rangelands and to **address knowledge gaps** that impede action. The assessment provides science-based insights to inform national efforts to prioritize sustainable rangelands management, launching work at COP 17 towards a stronger evidence base for efforts to conserve, manage and restore rangeland health (as stipulated in ICCD/COP(17)/10), and and collaboration under the RFI to develop knowledge products.
- As the UNCCD focuses on the **synergies between the Rio Conventions**, our assessment establishes actionable links between rangeland protection and climate action. This is an example of how to create a “scientific basis for joint target achievement”, as stipulated in decision 8/COP.16. Furthermore, the

RFI aims to support integration of rangelands and sustainable grazing into nationally determined contributions (NDCs) under the Paris Agreement, and this assessment provides the knowledge basis for Parties for doing so.

- By quantifying key aspects of land health, our assessment can also help advance several of the aspirations outlined in the draft UNCCD **post-2030 Strategic Framework**. Our analysis makes links between land and climate concrete and operational, provides granular data to enable defining baselines and measuring progress on nature-based solutions at national and subnational levels, as well as towards national LDN targets, and by quantifying global soil carbon status, it can inform the design of carbon cycle-related indicators for the post-2030 Strategic Framework.

Woodwell looks forward to engaging with Parties, organizations, and other stakeholders at COP 17. For more information about Woodwell's upcoming engagement at COP 17, please visit <https://www.woodwellclimate.org/unccd-cop-17> or contact jwatts@woodwellclimate.org.

cover photo: Mongolia grazing lands. / photo by Alexander Popovkin



WOODWELL CLIMATE RESEARCH CENTER works at the intersection of science and decision-making. We partner with communities, businesses, and policymakers to protect life and livelihoods from the devastating impact of climate change. We bring together hands-on experience and over 40 years of policy impact to find societal-scale solutions that can be put into immediate action.