

Grassland Savannah Rangeland Ecosystems

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The Importance of Grasslands, Savannahs and Rangelands in Global Climate Change Strategies

Key Recommendations:

Grasslands, savannahs and rangelands (GSRs) are huge carbon stores, vital global resources for biodiversity, food and freshwater security, and offer many ecosystem services to support climate mitigation and adaptation. High biodiversity GSRs generally have the greatest mitigation and adaptation benefits. Parties to the UNFCCC are therefore urged to:

- Ensure the protection, sustainable management and restoration of natural GSRs in adaptation plans and Nationally Determined Contributions (NDCs)
- Protect natural GSRs from land use changes such as inappropriate afforestation and agricultural intensification, which lead to net losses of carbon stocks, biodiversity and other ecosystem services
- Align UNFCCC actions on GSRs with the CBD and UNCCD, including through National Biodiversity Strategies and Action Plans (NBSAPs) and Land Degradation Neutrality (LDN) targets.

The companion document "Grassland Savannah Rangeland Case Studies of Significance for Carbon and Biodiversity" is also available and provides several examples giving context to the state of GSR carbon studies and projects around the world.

This is a jointly produced briefing from WWF-International and Plantlife International for country delegates at COP27.

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Grasslands, savannahs and rangelands contain huge carbon stores to mitigate climate change and provide ecosystem services that help adapt to a changing climate

GSRs sequester carbon,¹ with the large majority stored below ground in roots and soil organic carbon (SOC).² Their huge extent means their carbon stocks are vast: rangelands alone account for 54% of global land;³ recent figures for grasslands suggest they store between 25-35% of terrestrial carbon,^{4,5,6} 90% of it underground.⁷ Statistics are hampered by lack of agreement about where GSRs merge into forests and wetlands,⁸ and by variations in sequestration and storage between GSR types.^{9,10,11} Whilst GSRs store less carbon per area than forests, their underground stocks are considered safer in areas of high fire or future logging risks.¹²

GSRs are also essential but under-valued¹³ assets in adapting to present and future climate change. Healthy grassland ecosystems reduce soil erosion, dust storms and desertification,¹⁴ and protect against flooding.¹⁵ GSRs aid water security through protection of surface and groundwater sources,¹⁶ support food security and livelihoods through livestock production, pollinators and wild foods,¹⁷ and maintain a wide range of recreational,¹⁸ cultural and aesthetic benefits.^{19,20}

GSR ecosystems can play a key role in government responses to climate change under the UNFCCC, both in Nationally Determined Contributions (NDCs) and in adaptation plans.

Benefits can be achieved both by maintaining or restoring natural, old-growth grasslands,²¹ and by changing agricultural practices and livestock management,²² such as through wider use of silvopastoral systems.²³ However, at present few countries include GSRs in their approaches. Analysis in 2019 found only 10% of NDCs mentioned grasslands, with most of these being in Africa.²⁴

The dense underground root structure of grasslands is how they store and fix most of their carbon below ground



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But these ecosystems are increasingly vulnerable and threatened

GSR carbon stores require effective management to prevent emissions from soil disturbance, land-use change and degradation, including from overgrazing or encroachment of woody biomass or invasive grasses.²⁵ Some non-native, invasive and fire-adapted grasses increase fire risk in ecosystems not adapted to fire, releasing more carbon.²⁶ Yet natural grassland is often undervalued in conservation policies;²⁷ indigenous temperate grasslands are the least protected terrestrial biome,²⁸ 90% of temperate grasslands have already been converted to agriculture and urban areas, and less than 1% of the remnants are currently protected from land development.²⁹ Climate change itself can exacerbate these losses. For instance, increased variation in precipitation in dryland areas is predicted to decrease grassland productivity³⁰ and cause longer, more severe droughts. This can reduce soil carbon sequestration due to decreased plant litter inputs and increase CO₂ emissions from soils. Elevated CO₂ also favours woody species, exacerbating woody encroachment. Increased grassland plant species diversity can help to mitigate many of the effects mentioned above.³¹

Ironically, some climate change mitigation strategies can themselves drive biodiversity and carbon losses from GSRs

Forest conservation actions have at times displaced land use change into biodiverse GSRs, e.g., in Brazil,³² China,³³ and the Congo Basin.³⁴ Degraded grasslands, savannahs, and natural grasslands mistaken for degraded forests have been inappropriately planted with trees.³⁵ Such tree planting destroys underground carbon stocks and grassland community composition which may take centuries to recover.³⁶ Problems could be aggravated by efforts to meet UNFCCC goals,³⁷ if forest “restoration” occurs in natural or semi-natural grasslands³⁸ or savannahs,³⁹ with important flora and fauna.⁴⁰ Forest restoration targets of the Bonn Challenge have encouraged some governments to focus on quantity of trees rather than quality of forests.⁴¹ Identification of suitable reforestation areas, e.g., by the World Resources Institute,⁴² have been criticised as including important grassland areas.⁴³

Increasing native tree cover is essential for carbon sequestration and conservation, but must be guided by the principle of 'right tree, right place' and not achieved at the expense of other carbon and species-rich habitats.



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The temperate grasslands of Russia's far east; the least protected terrestrial biome, 90% of temperate grasslands have been converted to agriculture and settlement.

Climate change and biodiversity loss must be tackled simultaneously in GSRs

Natural GSRs support high levels of biodiversity, including many threatened species. There is also evidence that biodiverse GSRs have greater resilience in the face of environmental change.^{44,45} Restoration of GSR biodiversity accelerates soil carbon sequestration in some conditions.^{46,47} Protection of SOC is therefore most effective if combined with biodiversity conservation,^{48,49} creating synergy between aims of the Convention on Biological Diversity and the UNFCCC. Restoring native wildlife, in particular re-establishing grazing herds, can help to: maintain the light-absorbing albedo effect of GSRs and their potential as carbon sinks; maintain peat soils under permafrost; and restrict above ground woody biomass to reduce carbon released from natural burning.⁵⁰ Research from the Serengeti-Mara found an increase of 100,000 wildebeest translated to approximately 10% less area burned.⁵¹

Climate change mitigation therefore needs to be aligned with other objectives linked to biodiversity.⁵²

A narrow focus on carbon can undermine biodiversity.⁵³ Research in the Brazilian Cerrado found that artificially suppressing fire beyond natural levels increased carbon sequestration by allowing more woody growth, but caused a decline in savannah plant and ant species.⁵⁴ Other research shows that prioritising both biodiversity and soil carbon can achieve up to 90% of each objective, triple conservation gains and halve implementation costs.⁵⁵

Knowledge of co-benefit areas with high biodiversity and high carbon can help in the identification of NDCs.⁵⁶

A combination of protection, sustainable management and restoration can maximise the potential of GSRs in climate change strategies

Due to their existing high underground carbon stocks, protection of the remaining ancient grasslands is a first priority for GSR climate mitigation,^{57,58} especially vulnerable sites with more-or-less irrecoverable carbon.⁵⁹ Restoration actions focusing on building back old-growth characteristics can facilitate further carbon sequestration and storage in GSRs. These may include suppressing invasives and woody encroachment, vegetative propagation, establishing bud banks and below-ground organs,⁶⁰ temporary grazing exclusion,^{61,62} reduced livestock grazing,⁶³ rotational grazing,⁶⁴ changed cropping patterns, enhanced grassland biodiversity and early season burning.⁶⁵ Sustainable management reduces emissions of methane, another greenhouse gas.⁶⁶ GSR management and restoration also reverses biodiversity decline, protects ecosystem services, e.g., reduced soil erosion,⁶⁷ while also preserving the livelihoods and cultural traditions for the 800 million people⁶⁸ living in GSRs. Many conservation strategies can be integrated with traditional practices, such as where floristic quality, richness and diversity are increased by sustainable grazing management.⁶⁹

A specific focus on grasslands, savannahs and rangelands in NDCs and national adaptation plans is therefore now an urgent priority.

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