International Union for Conservation of Nature
TECHNICAL BRIEF
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ECOSYSTEM RESTORATION AND DROUGHT

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KEY MESSAGES

- **Drought is a profound global threat affecting people, wildlife, and landscapes.** Ecosystem integrity and functioning are changed by drought, while biodiversity generally experiences negative effects, resulting in greater pressure on species and habitats. Ecosystem services are in turn affected, compromising food, water, and economic security for people.
- **The socioeconomic and geopolitical costs of drought are rapidly intensifying and accelerating.** Drought is a major source of economic loss and damage, particularly in the agricultural sector. In addition to direct human health impacts, such as increases in heat-related deaths and food and water insecurity, drought can acutely accelerate conflict over natural resources, leading to violence, displacement, migration, and associated rippling effects beyond local communities or specific regions.
- **Ecosystem restoration is an essential Nature-based Solution (NbS) for drought mitigation, adaptation, and resilience.** Restoration actions can mitigate and reverse land degradation and desertification, support the ability of human and ecological communities to adapt to drought conditions, and increase resilience in the face of climate change, including through sustainable livelihood development.
- **Restoration should be performed in conjunction with, not as a replacement for, ecosystem conservation and protection.** Ecosystem restoration is most effective when performed in synergy with other conservation measures, but it should not be treated by decisionmakers as a substitution for maintaining ecosystem integrity where it still exists. Rather, restoration is an essential intervention in landscapes which are already degraded or disturbed.
- **To effectively restore ecosystems at scale, ambition and investment must increase.** Ecosystem restoration is an effective tool with myriad co-benefits which should be employed in drought management strategies, but it must receive sufficient investment at international, national, and subnational levels to be effective. Ultimately, restoration has significant return on investment, and is an intervention which reaps benefits across sectors, contexts, and scales, most optimally when supplemented by enabling policy environments.

What is the issue?

Drought is an increasingly impactful threat to human wellbeing. Droughts are exacerbated by climate change and unsustainable land use practices, and they are occurring globally more frequently and with greater severity than ever before. The OECD's Global Drought Outlook confirms that the most extreme droughts in recorded history have occurred in recent years, and these have been more intense and damaging than they otherwise would be in the absence of climate change. Shifting global drought patterns have profound implications for human health, various economic sectors, wildlife, and geological cycles across multiple scales. Projections affirm that these impacts are likely to worsen in the coming decades as climate change continues to affect average temperatures and precipitation variability while compounding existing ecological and socioeconomic stressors.

At the landscape level, the negative consequences of drought are felt more strongly where land is degraded and desertified or where water resources are already under stress. Drought impairs ecosystem integrity and functioning, endangers biodiversity, and leads to pervasive human health impacts—including

by reducing food security, increasing incidences of drought-related illnesses, and heightening violence and displacement attributable to resource conflict.

Nature-based Solutions (NbS), including ecosystem restoration, are integral to effective drought management strategies, supporting prevention, mitigation, and adaptation. Restoration can be achieved through different approaches and with different end goals in mind, with interventions falling along a spectrum in terms of scope, process, and outcome. Though ecological restoration, ecosystem restoration, forest landscape restoration (FLR), and other restorative actions should be specified and differentiated within management plans, they are ultimately each important and complementary forms of NbS which contribute towards restoring integrity and which can be effectively employed against drought. Investment in restoration, alongside effective conservation measures, is therefore essential to confronting drought and averting worst case climate scenarios.

Why is this important?

The ecological implications of drought

Drought has significant impacts on biodiversity, land and soil health, water availability, and the wellbeing of people. Drought itself is driven by climate change, deforestation, unsustainable agricultural practices, intensive natural resource extraction, and urban expansion. Drought is often concurrently observed alongside land degradation and desertification, and in combination these phenomena are recognised as crises affecting a substantial portion of the world's land and population. Up to 40 percent of the world's land is degraded, affecting 3.2 billion people. Drylands now comprise 40 percent of the Earth's land excluding Antarctica, with over 77 percent of land being more arid as of 2020 compared to the previous century.

Drylands, including deserts, are biologically and culturally significant landscapes, but the rate at which they are becoming drier and expanding into previously non-arid areas poses challenges as people and species race to adapt. Terrestrial vertebrates, for example, show significant negative survival and fecundity responses to drought, particularly in areas where drought is historically anomalous (e.g. in the Southwestern United States, South Africa, and Southeastern Australia). Grasslands, which contain considerable plant biodiversity but which have been historically undervalued, demonstrate that vegetation is also negatively affected by sustained drought conditions, leading to lower productivity and reduced plant vitality. In grasslands and forests alike, the higher temperatures and lower precipitation associated with drought are also worsening wildfires, which is particularly dangerous for biodiversity in ecosystems where species have not evolved alongside a natural fire regime. Moreover, in ecosystems where species are endemic or already threatened, drought provides an additional stressor which can increase extinction risk.

The negative environmental effects of drought go beyond flora and fauna to impact the quality of air, soil, and water directly. Drought alters soil microbiomes and can reduce the abundance and diversity of microorganisms, impairing soil health. Reduction in soil moisture can also affect soil structure, heightening vulnerability to erosion and increasing the concentration of airborne particulate matter. Water systems are also influenced, with reduced water availability from lack of precipitation affecting freshwater access and quality, the latter being a consequence of pollutants and dangerous contaminants concentrating more easily in lower volumes of water.

Drought is therefore a serious ecological threat, and one which is relevant to the aims of the Kunming-Montreal Global Biodiversity Framework (GBF), Land Degradation Neutrality (LDN), and the Paris Agreement. Nationally and subnationally, government agencies, civil society, and local communities should co-produce drought management strategies and plans which incorporate ecological and biodiversity considerations. Conversely, conservation and restoration action plans targeted at specific species, landscapes, or regions should integrate drought considerations and projections under current climate change scenarios, where possible, to mitigate future potential losses and damages. Overall, drought is both an ecologically important consequence and driver of unsustainable natural resource use.

The socioeconomic aspects of drought

Drought is not only an environmental challenge, but an economic and social one as well. The United Nations Convention to Combat Desertification (UNCCD) estimates the cost of drought damages is US$ 307 billion per year due to the cascading, knock-on effects experienced across sectors and the wider global economy. Agricultural lands are the most strongly affected, with US$ 278 billion in documented losses in the global agricultural sector attributed to drought from 1991 to 2023. Over 34 percent of crop and livestock losses in Least Developed Countries (LDCs) and Low- and Middle-Income Countries (LMICs) are linked to drought, costing US$ 37 billion overall. Beyond agriculture, other sectors including energy and transportation are strained in areas where drought reduces the water supply and alters hydrological functioning.

In addition to direct economic losses, damage from drought also manifests in the form of human health impacts, resulting in a real human cost as well as stronger burdens on public health infrastructure. Drought often occurs alongside heatwaves, and vice versa, in the form of self-reinforcing compound events. The World Health Organization recognises heat stress as a leading cause of weather-related deaths, resulting in approximately 489,000 heat-related deaths each year between 2000 to 2019. Drought and heat can also exacerbate wildfires, which are associated with premature mortality, excess deaths, and respiratory and cardiovascular disease. Similarly, wildlife and livestock experience more adverse health consequences in the presence of drought, reinforcing the interconnection between human, animal, and environmental health.

Finally, drought is a contributing factor to conflict over natural resources, which can in turn lead to increased rates of violence, migration, and displacement, or exacerbate existing geopolitical tension and armed conflicts. Severe drought is linked to increased rates of Sexual and Gender-Based Violence (SGBV), particularly against adolescent girls and women, and greater incidences of intercommunity and extremist violence at the local level. Where war leads to displacement and famine, drought can deepen humanitarian crises. Drought can also heighten tensions within and between farmer, herder, and pastoralist communities, where land is inextricably linked to culture, livelihoods, and wellbeing.

What can be done?

Ecosystem restoration as a critical Nature-based Solution (NbS) for drought

IUCN defines Nature-based Solutions (NbS) as actions to protect, sustainably manage, and restore natural or modified ecosystems, that address societal challenges effectively and adaptively, simultaneously providing human well-being and biodiversity benefits. Ecosystem restoration, which is a type of Nature-based Solution, is the process of halting and reversing degradation, resulting in improved ecosystem services and recovered biodiversity. Forest landscape restoration (FLR), meanwhile, is a specific integrated process that aims to regain ecological functionality and enhance human wellbeing in deforested or degraded landscapes.

Restoration yields significant ecological and economic return on investment. Ecosystem restoration is widely recognised as a proven means of regaining ecosystem integrity and functioning, restoring biodiversity, improving soil, air, and water quality, reducing human and wildlife disease incidence, sequestering carbon, and increasing landscapes' resistance and resilience to natural disaster. Moreover, for every US $1 spent on rangeland restoration, up to US $35 in returns can be expected, as restoration creates livelihood opportunities for communities and recovers essential, invaluable ecosystem services. In other words, many of the impacts of drought can be mitigated through evidence-based ecosystem restoration, and drought itself can be combatted through large-scale restoration of degraded and desertified landscapes.

Restoration is most effective when coupled with conservation and protection of high-integrity landscapes. Restoration is not a substitute for conservation, as restoration requires a significant timeframe to meaningfully regain the integrity and functioning seen in intact ecosystems. However, in landscapes which are already disturbed, deforested, or degraded and which have experienced drought, restoration is an essential tool.

Recommendations for drought management with restoration components

Drought management strategies and plans are necessary mitigation measures which should actively incorporate restoration activities and principles into intervention design, paying particular attention to intersections with biodiversity, climate change, land health, and human wellbeing in order to maximise effectiveness, minimise the impacts of ongoing drought events, and proactively avert potential worst case drought scenarios.

1. In contexts where drought has been, or is projected to be experienced, policymakers and decisionmakers should coordinate across international, national, and subnational scales to develop coherent, context-tailored drought management strategies and action plans.
2. Drought management strategies and action plans should linked to and synergised with the appropriate biodiversity, natural resource, and climate change management plans, including national biodiversity strategies and action plans (NBSAPs), national action programmes (NAPs), and national adaptation plans (NAPs).
3. Drought should be treated as an intersectoral challenge, and drought response should aim to reduce silos and ensure coordination between relevant sectoral decisionmakers, such as national government agencies.
4. Civil society, community-based organisations, local communities, and other relevant stakeholders are important actors who should be meaningfully involved drought mitigation and adaptation in measures. Participatory approaches can increase the long-term effectiveness and sustainability of drought interventions, including ecosystem restoration, while ensuring benefits are shared and stakeholders are actively involved in solutions.
5. Ecosystem restoration, forest landscape restoration (FLR), and other Nature-based Solutions (NbS) should be incorporated into drought management strategies and action plans. Broadly, restoration activities should align with evidence-based restoration principles, such as those accepted under the United Nations Decade on Ecosystem Restoration.
6. When designing landscape-level restoration interventions, decisionmakers should select drought-appropriate measures which revive soil health and moisture, conserve water sources, prioritise native drought-resistant plants, and curb local drivers of terrestrial and aquatic habitat degradation.
7. In addition to restoration, the conservation, protection, and preservation of intact and high-integrity ecosystems should be recognised as essential to prevent further land degradation and deforestation, which compound the effects of drought.
8. Investment in dedicated drought mitigation and adaptation activities must be mobilised to ensure intervention measures are sufficiently funded over appropriate spatial and temporal scales.
9. Perverse policies and incentives which drive unsustainable natural resource use and, subsequently, desertification, land degradation, and drought (DLDD), should be identified and addressed by relevant policymaking bodies.
10. Where gaps in understanding exist in relation to drought, its impacts, or the measures needed to mitigate it, dedicated research should be financed and carried out to ensure drought response is rooted in a robust evidence base.

UNCCD COP17 as an opportunity for action

At the 17th session of the Conference of the Parties (COP17) to the United Nations Convention to Combat Desertification (UNCCD), drought is a central item, as it currently affects communities the world over which are dependent on drylands, grasslands, and rangelands for survival, including farmers, pastoralists, and Indigenous Peoples. Per the IUCN Position Paper for UNCCD COP17, a proactive global drought process that integrates nature metrics, technology, and traditional knowledge is needed, as is increased investment in ecosystem restoration and landscape approaches. Nature-based Solutions (NbS) like ecosystem restoration offer a coherent approach for national integration and delivery of Rio Convention commitments, under which drought is a unifying, intersectoral issue for many Parties.

IUCN's role in advancing solutions

With financial support from the Austrian Development Agency (ADA) and International Partnerships Austria, IUCN is advancing effective Nature-based Solutions centered around ecosystem restoration and forest landscape restoration (FLR) for drought management alongside government and civil society partners, including in Burkina Faso, Georgia, and Kenya through the project **Accelerating Action for Resilience and Innovation in Drought Risk Management (ARID)**. More broadly, IUCN is pioneering adaptive drought solutions in Africa, Asia, Europe, and Latin America, supporting local communities, biodiversity, and climate resilience in the process.

Where can I get more information?

Access the official IUCN Position Paper for UNCCD COP17 | https://iucn.org/resources/position-paper/iucn-position-paper-unccd-cop17

Explore IUCN's work on drylands, grasslands, and rangelands | iucn.org/our-work/topic/drylands-grasslands-and-rangelands

Explore IUCN's work on ecosystem restoration and land degradation | iucn.org/our-work/topic/ecosystem-restoration-and-land-degradation

Learn about IUCN's work on drought, funded by the Austrian Development Agency (ADA) |

iucn.org/our-work/topic/drylands-and-land-degradation/restoring-ecosystems-reduce-drought-risk-and-increase

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This resource was made possible through support from:

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