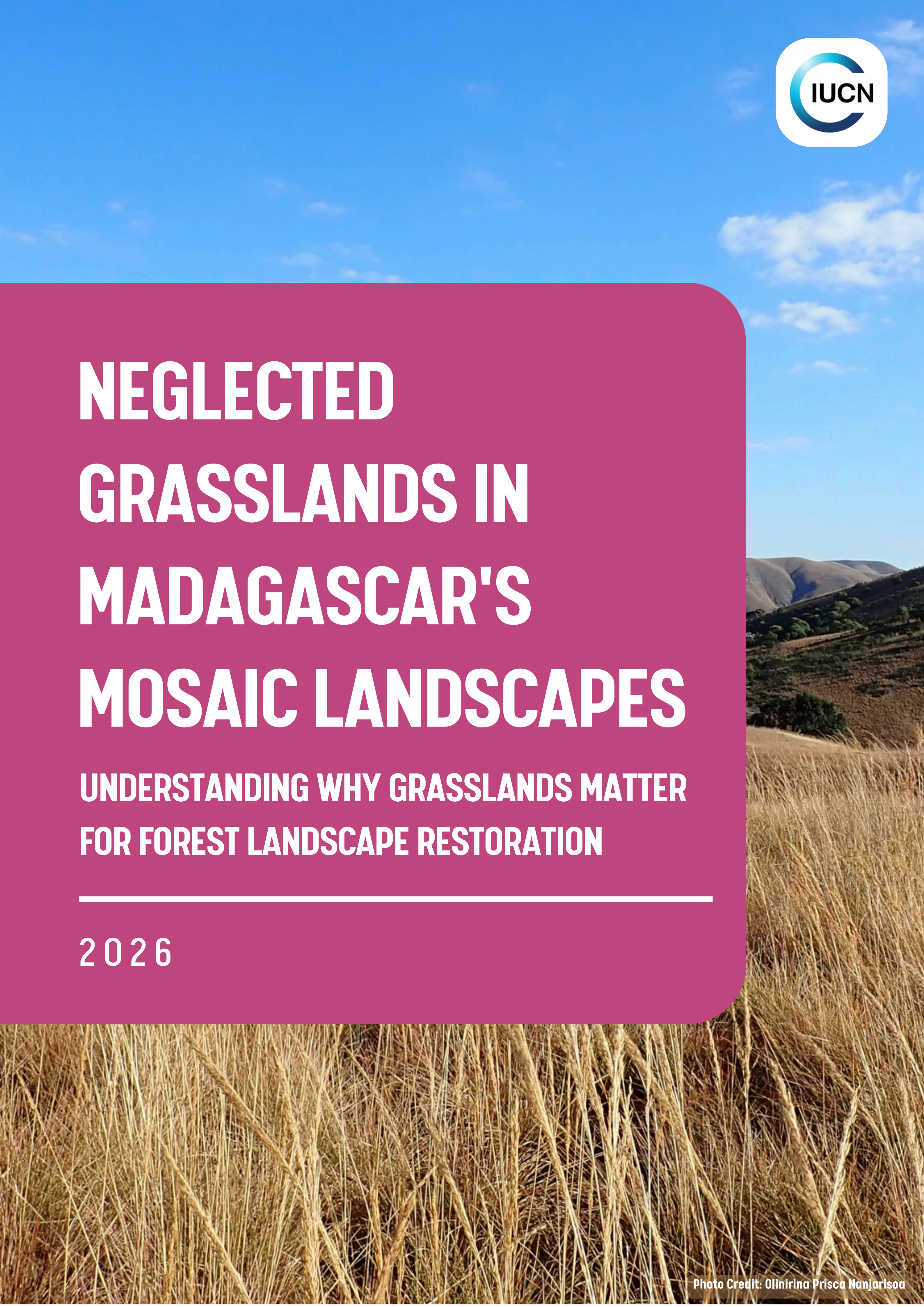
NEGLECTED GRASSLANDS IN MADAGASCAR'S MOSAIC LANDSCAPES

UNDERSTANDING WHY GRASSLANDS MATTER FOR FOREST LANDSCAPE RESTORATION

2026



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This policy brief highlights the overlooked grassy ecosystems of Madagascar and presents a case for the role in Forest Landscape Restoration as a critical component of the landscape mosaic. The brief was developed as part of the project "Safeguarding overlooked Ecosystems: Protect, Manage and Restore Grasslands and Savannahs in Argentina, Colombia and Paraguay" funded by the International Climate Initiative (IKI) on behalf of the German Federal Ministry for the Environment, Climate Action, Nature Conservation and Nuclear Safety (BMUKN). This brief explores thematic cross collaboration with the project "The Forest Landscape Restoration (FLR) Implementation Hub: Delivering the Bonn Challenge" funded by the International Climate Initiative (IKI) on behalf of the German Federal Ministry for the Environment, Climate Action, Nature Conservation and Nuclear Safety (BMUKN) and Swiss Agency for Development and Cooperation (SDC).

Ecology and distribution of Madagascar's grassy ecosystems

Madagascar is a global biodiversity hotspot, characterised by a wide range of vegetation types that come as a result of variable soil properties, topography and climate heterogeneity. Across the island, major vegetation formations include dry forest, humid forest, spiny forest, mangroves, tapia woodlands, subhumid forest, and extensive grassland-woodland mosaics (Antonelli et al., 2022). Conservation attention in Madagascar has historically focused on forest ecosystems, with grasslands and savannas having long been interpreted as degraded remnants of forest. Growing evidence, however, shows that many grassy ecosystems are ecologically persistent systems with distinctive biodiversity and evolutionary histories (Bond et al., 2008; Vorontsova et al., 2016; Salmona et al., 2020; Razafimanantsoa et al., 2024), as well as high levels of plant endemism, including in iconic groups such as orchids (Wieczorkowski et al., 2026). As in tropical grassy biomes elsewhere, recognising these open landscapes as integral components of the island's ecosystems is essential for understanding their origins, ecology, biodiversity, and conservation value.

Figure 1. Extent of Savannas and Grasslands Biome in Madagascar according to IUCN Global Ecosystem Typology indicative map. Note that this distribution overlaps with other biomes not reflected in the figure.

Grassy ecosystems are widely distributed across the island, covering more than 75% of its land area (Bond et al., 2008), and occupying large areas of the Central Highlands as well as extensive lowland regions (Figure 1). These open ecosystems form complex mosaics with agricultural land, ericaceous shrublands (at higher altitudes), dry deciduous forests, and wet gallery forests (along river valleys). Across the island, fine-scale transitions occur between open grasslands, shrublands, and forests (Virah-Sawmy et al., 2009), and the relative extent of these components has varied through time with shifts in climate and fire regimes (Razafimanantsoa et al., 2024). The present structure and distribution of the distinct grassy ecosystems in Madagascar reflect strong rainfall seasonality typical of savanna regions globally (Lehmann et al., 2011), recurrent fire, and pronounced altitudinal gradients. Some examples include the Tapia woodlands, where the Tapia tree (Uapaca bojeri) forms a fire-adapted savanna of cultural, economic and ecological importance (Kull & Birkinshaw, 2022); the high-altitude grasslands, such as in Andringitra, which support diverse and endemic grass and orchid floras (Rabetaliana et al., 1999; Lehmann et al., 2022); or the grassy inselbergs associated with high botanical diversity and endemism (Whitman et al., 2011; Rabarimanarivo et al., 2019).

Biodiversity and ecosystem dynamics shaping Madagascar's grasslands

The origins and natural extent of Madagascar's grassy ecosystems remain debated (Solofondranohatra et al., 2020; Joseph et al., 2021), yet current evidence indicates that these landscapes cannot be reduced to a simple binary of ancient versus anthropogenic. Early interpretations attributed most grasslands to post-settlement burning and zebu (cattle) grazing (Humbert, 1927; Koechlin et al., 1974; Perrier de La Bâthie, 1921), but palaeoecological and phylogenetic studies now demonstrate that fire and grazing-associated fauna shaped open ecosystems long before human arrival, with extinct megafauna such as hippos and giant tortoises occupying grassy habitats (Bond et al., 2008; Samonds et al., 2019; Génin et al., 2022; Razafimanantsoa et al., 2024). These systems also exhibit long-term persistence of C4 grassy biomes linked to disturbance regimes and seasonal climates, with the diversification of Malagasy grasses coinciding with the Miocene expansion of fire-prone open vegetation globally (Cerling et al., 1997; Edwards et al., 2010; Strömberg, 2011; Silander Jr. et al., 2024).

Disturbance remains central to their ecology today: fire is a dominant driver operating across annual to multi-year intervals, with most ignitions now human-set and closely tied to livelihoods (Phelps et al., 2022; Convery-Fisher et al., 2025). Meanwhile, zebu grazing may in some ways replicate lost megaherbivore pressures (Solofondranohatra et al., 2020). The fire regimes maintain ground layers dominated by C4 grasses and select for distinctive plant traits, including forbs with underground storage organs that resist fire (Cribb et al., 2005) and thick-barked, fire-tolerant trees such as Tapia (Kull & Birkinshaw, 2022).

Madagascar's grassy ecosystems support distinctive biodiversity with high levels of plant endemism and unique evolutionary lineages, although overall patterns of species richness remain incompletely understood due to strong spatial biases in botanical sampling, with the most data collected near human settlements (Antonelli et al., 2022). Endemism is most pronounced among plant groups, such as grasses (Vorontsova et al., 2016, 2021), sedges (Rasaminirina et al., 2026), open-habitat forbs such as orchids (Hermans & Rajaovelona, 2022), and succulent floras associated with rocky outcrops, such as Aloe and Pachypodium (Lehmann et al., 2022). This island also supports fire-adapted Tapia woodlands, listed on the IUCN Red List of Ecosystems, which sustain diverse endemic families, including species of Sarcolenaceae and Asteropeiaceae (Keith et al., 2013). Faunal diversity in these open ecosystems is less well documented (Iannella et al., 2019; Silander Jr. et al., 2024), but available studies indicate high richness in several invertebrate groups (Krištín et al., 2019; Camacho et al., 2021), while work on butterflies and birds suggests that many species often regarded as forest-dependent rely on landscape mosaics that include grassy ecosystems (Safford et al., 2022; Wurz et al., 2022; Bond et al., 2023).

Photo Credit:Jakub D. Wieczorkowski

Recognizing grassy ecosystems for conservation, restoration and ecosystem services

Madagascar's savannas and grasslands illustrate the need for conservation frameworks that explicitly recognise open ecosystems as distinct components of the island's landscapes. These systems contribute substantially to the island's biodiversity and provide important ecosystem services, including grazing resources for cattle, hydrological regulation, and deep cultural and livelihood value, yet they remain poorly represented within protected areas (Ralimanana et al., 2022; Silander Jr. et al., 2024). At the same time, they face increasing threats from inappropriate fire management, from complete fire exclusion in fire-dependent systems to overly frequent burning in fire-sensitive components, pervasive invasion by pine, Eucalyptus and Acacia, which has been recently suggested to be the main threat to Tapia woodlands rather than fire or cutting (Kull & Birkinshaw, 2022). Restoration approaches that prioritise tree planting without accounting for the ecological value of open ecosystems will likely replicate the issues that invasive tree species now pose. Distinguishing biodiversity-rich grassy ecosystems from recently deforested sites is therefore critical for avoiding management actions that can transform ecosystems for centuries and for developing conservation strategies that safeguard both ecological integrity and livelihoods.

Photo Credit:Jakub D. Wieczorkowski

Ecological condition of grasslands and the health of forest landscape mosaic: Experiences from the ground

In the Menabe Region of Madagascar, savannas and grassy ecosystems, cover approximately 76% of the region's total land area, representing nearly 37,000 km². These ecosystems are located primarily in the upper catchments of the region's five major watersheds (Tsiribihina in the northern part, Morondava in the central part, Maharivo further south, part of Mangoky basin in the far South bordering the Atsimo Andrefana Region and part of the Manambolo in the far North along the boundary between The Menbe and Melaky Regions) which lie in the eastern part of Menabe and drain westward into the Mozambique Channel.

The ecological condition of these upstream grassland ecosystems is a critical determinant of the health and viability of downstream ecosystems, notably the dry forests and mangrove systems. As is the case throughout much of Madagascar, grassland ecosystems generally lack dedicated management systems comparable to those established for forest and coastal ecosystems.

Inappropriate fire management undermines the integrity of upstream ecosystems and triggering a cascade of impacts throughout the watershed. In the intermediate zones, reduced vegetation cover contributes to the drying up of springs and a decline in freshwater availability, which adversely affects agricultural production. As crop yields decrease, local communities are often compelled to expand cultivation into remaining natural forests, further accelerating deforestation.

At the same time, the loss of vegetative cover in grasslands can increase soil erosion. Sediments transported downstream are a major cause of riverbed alteration, siltation of lakes and other water reservoirs, and disruption of hydrological regimes. These processes also reduce the supply of freshwater essential for the maintenance and regeneration of mangrove ecosystems. This watershed dynamic highlights the need for interventions based on an integrated landscape approach that is spatially oriented rather than sectorial approach which is not sustainable. Such an approach is essential to safeguard the long-term viability of the region's interconnected and interdependent mosaic of ecosystems.


Photo Credit: Theresa Fuhrmann

Accordingly, land-use planning and landscape restoration efforts, including Forest Landscape Restoration (FLR), should systematically consider the ecological linkages between upstream grasslands, intermediate dry forests, and downstream mangroves. This is crucial to ensure that restoration objectives are achieved effectively and that intended conservation and development impacts are realized. Landscape restoration initiatives in Menabe should adopt a comprehensive “ridge-to-mangrove” approach that addresses the entire watershed and its interconnected ecosystems, rather than focusing on only one section of the basin.

Landscape Restoration in Practice: FLR Hub Activities in Madagascar

Across Madagascar, restoration efforts increasingly recognise that healthy landscapes are shaped by a mosaic of ecosystems, including forests, wetlands, mangroves, savannas, and grassy ecosystems. Through the Forest Landscape Restoration (FLR) Hub, IUCN and its partners WWF Germany and WRI are supporting restoration initiatives in both the Diana and Menabe regions that aim to strengthen ecosystem resilience while improving local livelihoods and governance.

In the Diana region in northern Madagascar, activities focus on the Mahavavy watershed landscape, where upstream degradation contributes to erosion, flooding, and damage to downstream infrastructure and coastal ecosystems. The FLR Hub is supporting participatory land-use planning, restoration coordination mechanisms, and the identification of priority restoration areas at watershed and community levels. Discussions with stakeholders have highlighted the importance of landscape approaches that account for the diversity of local ecosystems, including forests, agricultural mosaics, and open grassy areas, while balancing restoration, food security, and community needs. Planned interventions include assisted natural regeneration, sustainable land management, community-based restoration planning, and strengthening local restoration platforms to improve long-term coordination and monitoring.


Photo Credit: Theresa Fuhrmann

In the Menabe region in western Madagascar, FLR Hub activities supported by SDC focus on restoring dry forest landscapes and associated ecosystems while addressing key drivers of degradation such as uncontrolled fires, land-use change, and livelihood pressures. The project works closely with regional authorities, local communities, and partner organisations to promote community-based restoration approaches that combine ecological restoration with sustainable livelihood opportunities and gender inclusion. Planned interventions include restoration planning at landscape scale, support for sustainable value chains, strengthening local governance structures, and developing livelihood alternatives that reduce pressure on natural ecosystems. Field consultations have underscored the importance of recognising the interconnectedness of forests, mangroves, agricultural lands, and grassy ecosystems within the wider Menabe landscape.

Together, these initiatives reflect a broader shift towards integrated landscape restoration approaches in Madagascar that move beyond tree planting alone and recognise the ecological and social importance of diverse ecosystem types, including grassy biomes, within resilient and productive landscapes.

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