Species Conservation Action Plan for *Aloe ankoberensis* Gilbert & Sebsebe

Project Title: Restoration and conservation of an endangered medicinal plant species, *Aloe ankoberensis* Gilbert & Sebsebe in Ethiopia

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Target species: *Aloe ankoberensis Gilbert & Sebsebe*

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Executive Summary

Aloe ankoberensis is an endemic succulent plant of Ethiopia, restricted to the central highlands around Ankober. It thrives in rocky outcrops and high-altitude grasslands and forest edges, where its ecological role is significant. The species provides nectar for honey bees, supports bird biodiversity, prevents soil degradation, and is widely used in traditional medicine for treating infectious diseases, eye inflammation, malaria, and as a lactation suppressant. Its socio-economic and ecological importance underscores the need for urgent conservation action.

Despite its value, *A. ankoberensis* faces severe threats. Habitat loss from land-use change, overharvesting, livestock grazing, and climate change has led to fragmentation and decline of populations. Climate models predict further contraction of suitable habitats, increasing extinction risk. The species is currently classified as Endangered under the IUCN Red List and is listed under CITES, reflecting its vulnerability to exploitation and habitat degradation.

This action plan sets out a framework to secure the long-term survival of *A. ankoberensis*. It emphasizes systematic population monitoring to track size, density, and viability, alongside habitat assessments to identify and protect critical areas. Conservation measures include habitat restoration, legal protection, and *ex-situ* strategies such as seed banking and propagation programs. Community engagement is central, with awareness campaigns designed to promote local stewardship and highlight the species' ecological and economic value. Research into its ecology and genetics will inform adaptive management, while collaboration among government institutions, NGOs, and local communities will strengthen implementation.

The plan will be implemented from 2026 to 2030, led by the Ethiopian Biodiversity Institute in partnership with universities, local authorities, and conservation organizations. Progress will be monitored annually, with a mid-term review in 2028 and independent evaluation at the end of the period.

By stabilizing populations, improving habitats, and engaging local communities, this plan aims to safeguard *A. ankoberensis* for future generations. Successful implementation will conserve this unique endemic species while enhancing ecosystem resilience and biodiversity in Ethiopia's central highlands.

1. Introduction

Ethiopia is one of Africa's most biodiverse nations, characterized by varied ecosystems and exceptional plant endemism (Friis *et al*., 2010). Out of recorded 6027 higher plant species, 10% are known to be endemic to the country (Demissew *et al.*, 2021)

Among these is *Aloe ankoberensis*, a succulent perennial uniquely adapted to high altitudes. It thrives in mountainous terrain, particularly within high-altitude grasslands and rocky outcrops in Ankober and its environs in the central highlands of Ethiopia. The species occupies microhabitats such as rocky crevices and well-drained slopes, which provide refuge from excessive moisture and intense sunlight, enabling survival in this challenging environment.

Despite its ecological and socio-economic importance, *A. ankoberensis* faces severe threats. The species has most recently been assessed for the IUCN Red List of Threatened Species and it is listed as Endangered under criteria B1ab(iii,v)+2ab(iii,v). Habitat loss and degradation driven by land-use change, overharvesting, and climate change have placed the entire *Aloe* genus at risk in the Ethiopian highlands (Bachman *et al.*, 2020).

Endemic species have long been targets for conservation efforts because they are not found anywhere else in the world, and if lost from their native habitat, they will be lost forever. Therefore, immediate and coordinated conservation interventions are required to ensure its long-term survival.

The purpose of this five-year conservation action plan is therefore, to guide the long-term conservation, restoration, and management of this valuable species in Ethiopia. The plan also serves as a strategic framework for coordinating conservation actions among government institutions, local communities, researchers, and development partners over the next five years. It outlines strategies for population and habitat assessment, conservation interventions, awareness raising, and stakeholder collaboration, ultimately serving as a guiding framework for the species' conservation and management.

The action plan aims to:

- Guide conservation and habitat restoration activities;
- Reduce threats affecting the species;
- Strengthen *in-situ* and *ex-situ* conservation measures;
- Support research, monitoring, awareness raising, and institutional collaboration;
- Ensure the long-term survival and ecological resilience of the species.

The plan will be implemented from 2026 to 2030, led by the Ethiopian Biodiversity Institute in partnership with universities, local authorities, and conservation organizations

2. Description, Status and Trends of *Aloe ankoberensis*

2.1. Taxonomy, species description and reproduction

Aloe ankoberensis belongs to the family **Asphodelaceae** and the genus *Aloe*, which includes many succulent plant species adapted to arid and semi-arid environments. The plant is Pendent shrub, mostly unbranched, stem to 6 m long, hanging down cliffs. Leaves numerous, dense, dull grey- to blue-green; marginal spines 7-19 per 10 cm, 2-3 mm long, pale with minute dark red-brown tips (sometimes absent) (Demissew and Gilbert, 1997).

Aloe ankoberensis reproduces primarily through sexual reproduction by seeds, although vegetative propagation may also occur under favorable conditions. Like many species in the genus *Aloe*, the plant produces conspicuous tubular flowers arranged in inflorescences that attract pollinators such as sunbirds and insects. Pollination plays a crucial role in fertilization and subsequent seed formation. The bright flower coloration and nectar production are considered important adaptations for attracting pollinating agents in its natural habitat.

Following successful pollination, *A. ankoberensis* develops dry capsule fruits containing numerous small seeds. These seeds are mainly dispersed by wind due to their lightweight and winged structure, enabling the species to colonize nearby suitable habitats. Seed germination is strongly influenced by environmental conditions, particularly soil moisture, temperature, and

seasonal rainfall patterns. Successful establishment generally occurs during periods of adequate moisture availability.

In addition to sexual reproduction, limited vegetative reproduction may occur through offshoots or clonal growth, where new shoots develop from the base of the parent plant. However, compared with some other *Aloe* species, vegetative propagation in *A. ankoberensis* appears to be less common and less extensively documented. Consequently, natural population regeneration largely depends on successful flowering, pollination, seed production, dispersal, and seedling establishment.

The reproductive success of the species is closely linked to the condition of its habitat. Habitat degradation, overgrazing, recurrent fires, climate change, and human disturbances can negatively affect flowering frequency, pollinator availability, seed viability, and seedling survival. Therefore, conservation of both the species and its reproductive ecology is essential for maintaining viable natural populations.

2.2. Socio economic and ecological value

A. ankoberensis is one of the endemic *Aloe* species in Ethiopia and is scientifically recognized for its ecological, economic and conservation importance within the country's highland ecosystems. Locally, *A. ankoberensis* is highly valued for its medicinal properties, including treatment of infectious diseases, eye inflammation, malaria, and as a lactation suppressant. Its antimicrobial effects are attributed to its ability to inhibit the growth of pathogens such as yeast, fungi, and bacteria (Demissew & Nordal, 2010). Beyond its medicinal uses, it serves as a nectar source for honey bees, helps prevent soil degradation, and provides shelter and moisture for birds, thereby supporting biodiversity.

2.3. Distribution, population status and trends

Aloe ankoberensis has a very restricted range with only two subpopulations (Weber & Demissew, 2013). As it grows on very steep cliffs in forested areas where the forests are threatened by anthropogenic factors, soil erosion and changes to the watershed area are likely to occur in its

habitat. Population is severely fragmented with continuing decline of mature individuals and continuing decline in area, extent and/or quality of habitat. Currently, suitable habitats for *A. ankoberensis* are concentrated in few areas of North Shewa zone (i.e.Ankober, Tarmaber, Debresina and Asagirt areas) (Haile Abebe *et al.,* 2024). This shows a decreasing and narrowing patterns of habitat ranges compared to historical distribution records (Demissew and Nordal, 2010). Furthermore, habitat suitability prediction models showed that *A. ankoberensis* will change its distribution in response to future climatic changes leading to reduction and a gradual loss in its suitable habitats. The conditions or habitat status of the sub-Afroalpine and Afroalpine ecosystems where the species prevails in North Shoa zone needs to be assessed for its responses to evitable changes due to climate change and anthropogenic factors. A recent study on the species in the Ankober area by Haile Abebe *et al.* (2024) documented a habitat suitability modeling with declining suitable habitats, but this needs to be complemented with studies of the current land use and land cover dynamics to quantify habitat fragmentation threatening the species to help guide its conservation and mitigate its vulnerability to loss. Habitat fragmentation is considered to be among the most important causes of plant species declines and extinctions leading to small and isolated populations.

Driven by anthropogenic activities, fragmentation and isolation of ecosystems disrupt biological processes, contributing to the decline of plant populations. They result in changes to the physical and functional interactions within an ecosystem such as plant–pollinator mutualisms that can be deleterious, especially for invertebrates, and also be so for birds. Pollination limitation has also been strongly linked to habitat fragmentation the effects of which become further exacerbated by the compounding spatial and temporal nature of fragmentation. Apart from the effects of fragmentation on *A. ankoberensis,* it is also important to understand how the species responds to such changes as habitat fragmentation.

2.4. Conservation status

Aloe ankoberensis has most recently been assessed for the IUCN Red List of Threatened Species and the species is listed as Endangered under criteria B1ab(iii,v)+2ab(iii,v) (Weber & Demissew, 2013). Due to its limited distribution and continuing habitat decline, the species is considered at

risk and requires strengthened conservation actions. Moreover, the species is listed under CITES, highlighting its susceptibility to exploitation (CITES, 2024). Climate change models further predict significant loss of suitable habitats, increasing its extinction risk (Haile Abebe *et al.*, 2024).

2.5. Threats, drivers of threats and constraints

Several interrelated factors have been identified as major drivers of population decline and habitat degradation for *A. ankoberensis* (Weber & Demissew, 2013; Haile Abebe *et al.*, 2024). Among the direct threats, land-use change remains one of the most significant, as natural habitats are increasingly converted into agricultural land, grazing areas, and settlements. This transformation reduces the extent and quality of suitable habitat available for the species. Deforestation further accelerates habitat fragmentation and ecological degradation by removing vegetation cover that is essential for maintaining ecosystem stability and microclimatic conditions.

Frequent fire incidents, whether natural or human-induced, also contribute to habitat destruction by altering vegetation structure, reducing food availability, and limiting regeneration of native plant species. In addition, overharvesting of natural resources places considerable pressure on the ecosystem, particularly where local communities depend heavily on forest products and grazing resources for their livelihoods. Expanding human settlements and infrastructure development, including roads and other construction activities, have intensified habitat encroachment and fragmentation, thereby isolating populations and increasing their vulnerability.

Climate change poses an additional and growing threat through rising temperatures, shifting rainfall patterns, and increased frequency of extreme weather events, all of which can negatively affect habitat suitability and species survival. These direct pressures are largely driven by broader underlying factors such as rapid population growth, increasing demand for land and natural resources, and recurring local conflicts that undermine sustainable resource management practices.

Furthermore, weak implementation and enforcement of conservation-related policies, guidelines, and legal proclamations remain major constraints to effective biodiversity conservation. Limited institutional capacity, inadequate monitoring, and insufficient community engagement have reduced the effectiveness of existing conservation measures. As a result, the combined impacts of ecological, socio-economic, and governance-related challenges continue to threaten the long-term survival of *A. ankoberensis* and its habitat.

2.5.1. Landuse change

Landuse change occurs when human activities alter the purpose or management of a physical landscape, transforming natural ecosystems into human-dominated environments. This most commonly involves converting native grasslands, wetlands, or forests into agricultural crop fields, monoculture plantations, or pasture zones to keep up with local food demands. In the North Shewa Zone of Ethiopia's Amhara Region, this structural transformation shifts the local biological baseline, making it one of the largest direct drivers of native habitat loss, and soil erosion.

Beyond the physical loss of space, modifying land use alters critical ecological processes. It disrupts local water infiltration rates, speeds up the loss of soil nutrients, and fundamentally reduces both above-ground and below-ground biodiversity. When complex, multi-layered natural sub-Afroalpine vegetation is replaced by uniform cereal crops or bare soil, specialized endemic species like *Aloe ankoberensis* lose their highly specific rock-ledge habitats. As the agricultural frontier creeps up the mountain slopes, these unique, slow-growing succulents are forced into smaller, fragmented cliff spaces where long-term survival becomes difficult.

2.5.2. Deforestation

Deforestation is the permanent clearing and removal of forest and scrub cover to repurpose the land for non-forest uses, such as commercial agriculture, cattle ranching, or urban sprawl. When whole stands of indigenous vegetation are cleared, the complex canopy layers and root systems that shield the mountain slopes vanish overnight. This direct destruction strips away the primary

nesting, shelter, and foraging microhabitats for countless organisms, leading to immediate localized species displacement and extinction risks.

The loss of these high-altitude vegetation systems also triggers severe environmental feedback loops. Highland flora acts as a vital carbon sink; clearing it releases massive amounts of stored carbon back into the atmosphere while simultaneously eliminating the planet's capacity to absorb future emissions. Additionally, without deep root systems to anchor the earth, topsoil washes away during heavy rains. For *Aloe ankoberensis*, which clings directly to vertical rock faces and steep slopes, the deforestation of surrounding mountain crests disrupts water infiltration. This causes severe landslide events, strips away the thin soil pockets needed for seed germination, and dramatically alters the local microclimate.

2.5.3. Fire

While naturally occurring wildfires can be a normal part of some ecosystem cycles, anthropogenic or altered fire regimes present a severe threat to fragile environments. Human-ignited fires—often started intentionally by local communities to clear brush for agriculture, manage highland pastures, or harvest wild honey—frequently escape control and burn through dry, high-altitude ecosystems. These intense, unmanaged blazes rapidly consume vast swathes of slow-growing vegetation, destroying crucial ground cover.

Uncontrolled fires have devastating consequences for non-mobile wildlife and unique flora, directly killing individuals and destroying active reproductive sites. Because *Aloe ankoberensis* is restricted to specialized cliff edges and steep mountain faces, its populations are highly vulnerable to localized fire events. Unlike fire-adapted woodland aloes, intense heat from agricultural fires escaping up cliff corridors can scorch the dense, fleshy rosettes of *A. ankoberensis*, sterilize the upper rock-crevice soils, and incinerate its native seed banks. This prevents natural recovery and allows aggressive, invasive weed species to colonize the charred rock faces, permanently reducing the ecosystem's resilience.

2.5.4. Overharvesting

Overharvesting—or overexploitation—occurs when humans extract biological resources from the wild at rates faster than the target populations can naturally reproduce. In vulnerable ecological zones, this frequently manifests as the unsustainable gathering of high-altitude shrubs, woody plants, succulents, and grasses for use as domestic cooking fuel, animal fodder, medicine, or house-building thatch. When local communities strip away these resources without allowing fallow periods for regeneration, the targeted plant communities face severe population crashes.

This driver is a major threat to *Aloe ankoberensis*, an endangered endemic aloe prized both for traditional local medicine and by domestic and international succulent collectors. Its vibrant orange-red flowers and striking striated leaves make it highly sought after. Unregulated uprooting of mature individuals from their wild cliff habitats prevents natural seed dispersal, while the concurrent overharvesting of nearby mountain rocks for house-building materials physically dismantles the plant's essential growth substrates, triggering a downward domino effect that compromises the biological integrity of its remaining populations.

2.5.5. Human settlement and infrastructure development

The expansion of villages, towns, roads, and utilities directly converts wild habitats into permanent, impervious human surfaces. Building mountain roads, erecting power grids, and expanding clifftop or valley settlements physically carves up vast, continuous natural landscapes into small, isolated habitat patches. This fragmentation forms impassable barriers for many wildlife species, cutting off their traditional migration, foraging, and dispersal corridors.

Isolating wildlife and plant populations into fragmented pockets restricts genetic exchange, leaving species highly vulnerable to inbreeding and extirpation (localized extinction). For *Aloe ankoberensis*, which has a highly localized distribution restricted to the historic cliffs of Ankober, infrastructural growth is particularly threatening. Road construction along mountain ridges can physically blast away the exact vertical rock faces the species depends on, completely obliterating micro-populations and exposing pristine interior cliff ecosystems to increased human foot traffic and illegal harvesting.

2.5.6. Climate change

Climate change acts as a powerful threat multiplier, shifting long-term rainfall patterns, elevating baseline temperatures, and increasing the frequency of extreme weather events like severe droughts and flash floods. These altered environmental conditions happen too fast for many specialized species to evolutionarily adapt. Shifting rainfall patterns disrupt the delicate seasonal timing of plant flowering, directly threatening the reproductive success of flora that relies on predictable moisture windows for germination.

Recent species distribution modeling confirms that *Aloe ankoberensis* faces a severe risk of losing its remaining highly suitable areas under future climate change scenarios. Rising global temperatures force entire ecological zones to migrate upward toward higher elevations. For this unique sub-Afroalpine succulent, which is already restricted to an elevation range of 3,000 to 3,500 meters above sea level, this upward shift creates a dead-end ecological bottleneck. As warmer zones expand up the mountains, its cool, high-altitude cliff habitats shrink, leaving the species trapped on dwindling, isolated mountaintop islands with nowhere higher to go.

3. Vision and Goal

Vision

Championing the restoration and natural resilience of *Aloe ankoberensis* within its native ecosystem.

Goal

To ensure long-term survival of *A. ankoberensis* through habitat management, species support, research and public awareness raising through integrated conservation strategies.

4. Threat analysis

Analyzing threats forms an important component of the planning phase of species conservation and sustainable utilization action plan. It involves sorting out the threats, drivers and constraints (underlying causes) behind population decline and long-term vulnerability of the species. For *Aloe ankoberensis*, threats are identified during the species status review as indicated under section 2.5 above. Drivers (underlying processes) for these threats are identified and comprise

agricultural expansion, fuelwood extraction, uncontrolled grazing pressure, unsustainable harvesting of the species, anthropogenic fires, habitat fragmentation, land degradation and increasing climate stress. Constrains (root causes) driving the direct drivers of threat include: human population growth, poverty and livelihood dependence, weak law enforcement, limited conservation awareness, weak implementation of land-use planning, insufficient alternative livelihoods, unsustainable grazing systems and limited climate adaptation capacities. The threat analysis depicting the hierarchical relationships between threats, drivers and constraints can best be described using a problem tree (Fig. 1).

The problem-tree framework was developed through a qualitative synthesis of information obtained from literature review, field observations, expert consultations, and contextual understanding of the ecological and socio-economic conditions affecting *A. ankoberensis* in Ethiopia. Identified factors contributing to species decline were organized hierarchically into constraints, drivers, and direct threats following the conceptual approach commonly applied in species conservation planning and IUCN threat analysis frameworks. Constraints were defined as broader underlying socio-economic, institutional, or environmental conditions that indirectly promote biodiversity loss, whereas drivers represented intermediate processes leading to direct threats affecting the species and its habitat. Cause-and-effect relationships among these components were then conceptualized and linked using directional pathways to illustrate how interacting pressures collectively contribute to population decline and habitat degradation of *A. ankoberensis*.

The problem-tree framework summarizes the causal relationships among constraints, drivers, and direct threats affecting *A. ankoberensis* in Ethiopia. It illustrates how broader socio-economic and institutional constraints such as population pressure, poverty, weak land-use planning, and limited conservation capacity contribute to ecological drivers including agricultural expansion, overgrazing, habitat fragmentation, and unsustainable resource use. These drivers ultimately generate direct threats such as habitat loss, deforestation, fire, overharvesting, and climate-related degradation that negatively affect the survival and regeneration of the species. The framework also highlights the interconnected nature of threats, where individual drivers may simultaneously contribute to multiple forms of habitat degradation. Thus, the diagram provides a

conceptual basis for designing integrated conservation strategies that address both immediate threats and their underlying causes.

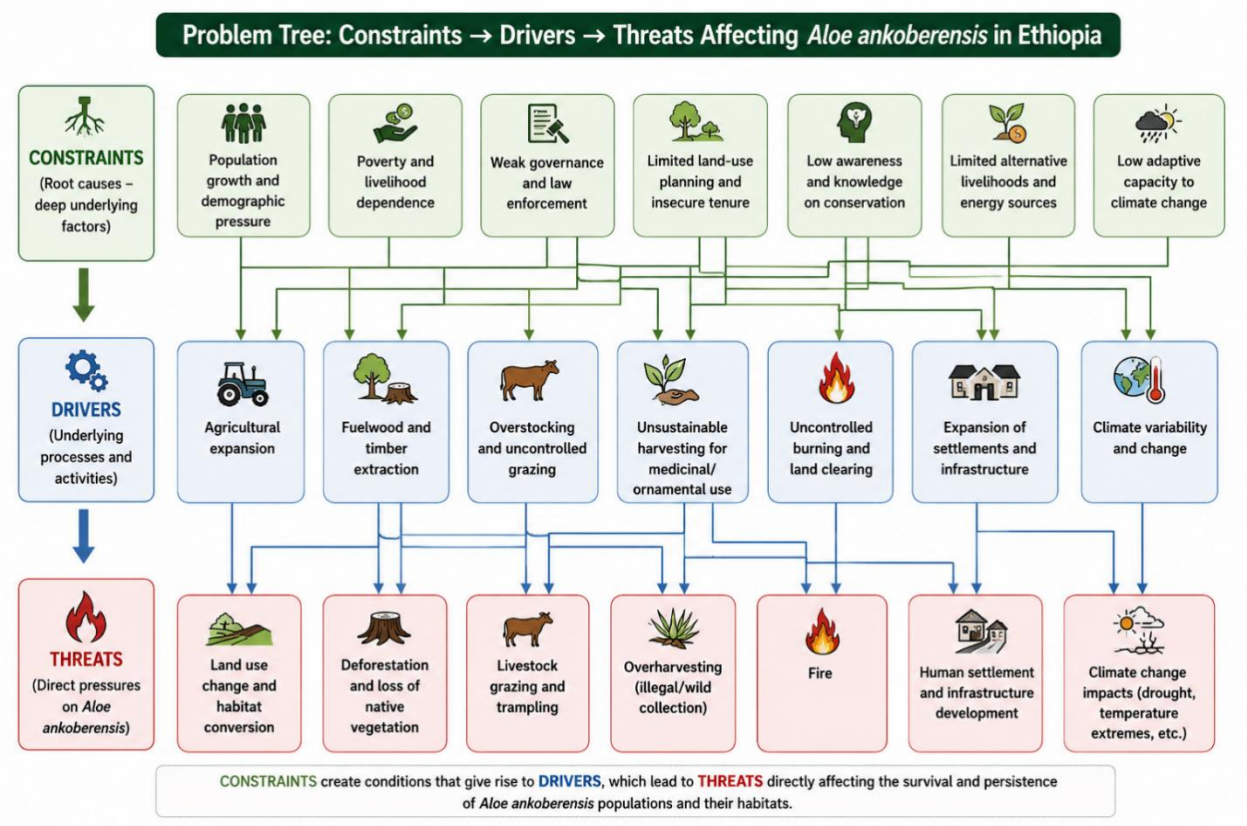

Figure 1. Problem tree showing the relationships among constraints, drivers and threats affecting *A. ankoberensis* in Ethiopia

On the bases of threat ranking, threats affecting *A. ankoberensis* were prioritized based on their cumulative scores for scope, severity, and irreversibility of threats following a semi-quantitative threat-ranking approach. Each threat was scored on a five-point scale, and the average score across the three criteria was used to determine relative threat priority (Table 1). The ranking indicates that land-use change and overharvesting constitute the most critical threats affecting *A. ankoberensis*, suggesting that conservation interventions should prioritize habitat protection, regulation of resource extraction, and sustainable land management. Deforestation and climate change also represent important pressures requiring long-term mitigation measures, whereas fire, livestock grazing, and settlement expansion currently exert relatively moderate impacts. The

prioritization framework therefore provides an evidence-based basis for allocating conservation resources and designing targeted management actions.

Table 1. Priority of major threats affecting *A. ankoberensis* in Ethiopia based on combined scores of threat scope, severity, and irreversibility. Red indicates critical threats, orange indicates high-priority threats, and yellow indicates moderate threats requiring monitoring and management.

VERY HIGH PRIORITY THREATS	HIGH PRIORITY THREATs	MODERATE PRIORITY THREATS
✓ Land-use change (4.67) ✓ Overharvesting (4.33)	✓ Deforestation (3.33) ✓ Climate change (3.00)	✓ Fire (2.33) ✓ Livestock grazing (2.00) ✓ Settlement and infrastructure development (2.00)

5. Conservation and Management Action Plan

According to the International Union for Conservation of Nature (IUCN) Red List assessment, *Aloe ankoberensis* exhibits a critically decreasing population trend. Faced with intensifying anthropogenic and environmental driving forces that threaten to accelerate the loss of this endemic species, immediate and decisive mitigation measures are essential. Halting this decline requires a holistic conservation framework that blends sustainable land management with targeted interventions designed to shield remaining wild populations from further degradation.

To ensure long-term genetic resilience, the strategy implements a balanced approach combining *in-situ* and *ex-situ* conservation methodologies. *In-situ* conservation efforts focus primarily on protecting and restoring the microhabitats where wild populations still persist, safeguarding the natural evolutionary processes of the species. Complementing these field measures, *ex-situ* strategies, including the establishment of germplasm seed banks and dedicated botanical nursery propagation, will be deployed to create a vital biological safety net against catastrophic extinction in the wild.

Recognizing that habitat degradation is deeply linked to local economic activities, the mitigation plan prioritizes community-led sustainable grazing management. Conservation field teams will actively engage local communities and livestock herders to co-develop and enforce regulated grazing frameworks, such as structured rotational grazing, cut-and-carry system or zero-grazing and strict area boundaries. By transitioning away from open, unmanaged grazing, this participatory approach mitigates the primary pressure on the species while fostering long-term community stewardship over local ecological resources.

Ecological restoration of degraded areas will be achieved through a suite of proven, low-impact habitat rehabilitation techniques. Active interventions will include constructing physical soil erosion control structures, enforcing temporary area exclosures to allow natural recovery, removing competing invasive vegetation, and implementing assisted natural regeneration (ANR). These targeted actions collectively stabilize the local ecosystem, optimize soil moisture, and create the ideal microclimate necessary for *A. ankoberensis* populations to naturally rebound, as detailed in the comprehensive activity matrix below (Table 2).

Table 2. Species action plan with detailed activities and budget for conservation and management of *A. ankoberensis.*

Goal	Objectives	Outputs	Activities	Budget (USD)
1. Awareness raising and Capacity Building	1.1. To increase by at least 75% the awareness and participation of local community and stakeholders in *Aloe ankoberensis* conservation within 3 years in and around two known localities.	1.1.1 Improved community and stakeholder awareness of the species importance, uniqueness and threats as well as enhanced participation in conservation activities.	1.1.1.1 Conduct structured community awareness campaigns in both locality engaging elders, religious leaders and local administrations in conservation dialogues.	5,000.00
			1.1.1.2 Develop and distributed IEC materials (posters, brochures, in local language).	1,500.00
			1.1.1.3 Organize school based biodiversity education programs.	3,000.00
	1.2. To build technical and institutional capacity of at least 10 local stakeholders and conservation practitioners within two years	1.2.1 Trained local conservation groups and government staffs (local development agents).	1.2.1.1 Trained local development agents, conservation agents and community members on species identification and protection.	3,500.00
			1.2.1.2 Provide technical training for Woredas' and zonal, biodiversity conservation, environmental protection and natural resource management officers.	2,500.000
		1.2.2 Strengthened local conservation governance structures.	1.2.2.1 Establish community-based conservation teams/committees and integrate *Aloe ankoberensis* conservation into annual	1,500.00

Goal	Objectives	Outputs	Activities	Budget (USD)
			local natural resource conservation plan.	
2. *Ex-Situ* Conservation	2.1 To develop effective propagation and nursery protocols within three years to support restoration and reintroduction	2.1.1 Stabilized and/ or enhanced wild populations of *Aloe ankoberensis.*	2.1.1.1 Assess germination and propagation methods	2,500.00
			2.1.1.2 Identify optimal environmental conditions requirement of the species	
		2.1.2 Availability of planting material for restoration.	2.1.2.1 Integrate *Aloe ankoberensis* seedling production into local annual seedling production plans of selected target nurseries.	5,000.00
	2.2 To secure viable ex situ populations and germplasm of *Aloe ankoberensis* from all known populations with 3 years	2.2.1 Safely conserved germplasm in cold room/seed bank	2.2.1.1 Collect seed from two known populations and conserve in national biodiversity seed/ gene bank.	2,000.00
		2.2.2 Collections established in field genebank and conservation structures.	2.2.2.1 Collect appropriate propagules and establish living collection in botanical garden/research institutions.	5,000.000
		2.2.3 Seedling of *Aloe* ankoberensis planting integrated with local natural resource conservation structures.	2.2.3.1 Plant appropriate *Aloe ankoberensis* propagules integrating with annual local natural resource conservation and green-legacy activities.	7,500.00

Goal	Objectives	Outputs	Activities	Budget (USD)
3. *In-Situ* Conservation	3.1 To stabilize and improve population trends in all known locality within five years through habitat protection and restoration.	3.1.1 Stabilized or increased natural population of *Aloe ankoberensis*	3.1.1.1 Establish *in-situ* conservation site of *Aloe ankoberensis* in known sites.	12,000.00
			3.1.1.2 Restore degraded habitats of *Aloe ankoberensis* (including where it has totally been removed during the last one to two decades) using native vegetation planting including *Aloe ankoberensis* itself.	5,000.00
			3.1.1.3 Promote alternative livelihood options to reduce over exploitation.	17,000.00
		3.1.2 Reduced habitat degradation.	3.1.2.1 Construct fire breaks and implement fire management strategy.	5,000.00
			3.1.2.2 Integrate conservation of the species into watershed and land-use planning frameworks.	3,000.00
			3.1.2.3 Enforce land-use regulation.	2,500.00
			3.1.2.4 Establish exclusion zones.	7,500.00
4. Research and Exploration	4.1 To establish baseline ecological, demographic, and distributional data for all known population	4.1.1 Comprehensive ecological baseline established.	4.1.1.1 Collect ecological data (including soil and micro-habitat preference), quantify treat and habitat condition	12,000.00
			4.1.1.2 Assess ecological threshold and	3,000.00

Goal	Objectives	Outputs	Activities	Budget (USD)
	within two years.		limiting factors	
			4.1.1.3 Map distribution and using GIS an remote sensing tools	2,500.00
		4.1.2 Improved understanding of population dynamics.	4.1.2.1 Assess population structure, regeneration and reproductive biology including seed dispersal.	4,500.00
	4.2 To identify additional potential suitable habitats and assess for the occurrence of *Aloe ankoberensis*	4.2.1 Potential new habitats prioritized and verifyied.	4.2.1.1 Conduct habitat suitability modeling.	3,500.00
			4.2.1.2 Survey three top priority areas across the region.	4,500.00
			4.2.1.3 Characterize habitat and population structure of newly identified populations.	5,500.00

6. Monitoring and Evaluation

The execution and long-term efficacy of this species conservation action plan will be systematically assessed through a structured Monitoring and Evaluation (M&E) framework. This formalized scheme establishes routine oversight mechanisms to track the deployment of field interventions and verify that all conservation efforts align with international best practices. By maintaining continuous technical oversight, project administrators can guarantee transparency, institutional accountability, and rigorous scientific standards throughout the lifecycle of the initiative.

Progress and institutional success will be primarily measured by the capacity of designated lead organizations and local stakeholders to execute the strategic mandates outlined in this document. Evaluating stakeholder performance against defined operational milestones will highlight the strengths and limitations of the institutional framework. This focus ensures that participating entities remain actively engaged, legally compliant, and properly equipped to meet their specific conservation commitments.

The adopted M&E framework functions as an adaptive management tool, systematically documenting project milestones, operational bottlenecks, and implementation shortcomings. By capturing real-time data on field successes and failures, the framework generates a continuous feedback loop for responssible institutions. This information will be used to refine operational tactics, reallocate financial resources dynamically, and iteratively optimize the overarching conservation strategy as field conditions evolve.

All tracking and impact assessments will rely on concrete, scientifically validated Key Performance Indicators (KPIs) to quantify progress and measure ecological outcomes. These metrics will explicitly evaluate how effectively the implementation mitigates threats and restores critical habitats. Ultimately, this data-driven approach ensures that all operational activities directly and measurably advance the primary objective: securing the long-term survival of *A. ankoberensis* in the wild. The detailed action plan monitoring framework is shown in table 3 below.

Table 3. Quarter-based five year implementation monitoring and evaluation framework for the conservation of *Aloe ankoberensis*

Goals and objectives	Actions	Implementers	Year 1				Year 2				Year 3				Year 4				Year 5			
			Q1	Q2	Q3	Q4	Q1	Q2	Q3	Q4	Q1	Q2	Q3	Q4	Q1	Q2	Q3	Q4	Q1	Q2	Q3	Q4
Goal 1		EBI, DBU and EWCA																				
Objective 1.1	1.1.1.1																					
	1.1.1.2																					
	1.1.1.3																					
Objective 1.2	1.2.1.1																					
	1.2.1.2																					
	1.2.2.1																					
Goal 2		EBI, DBU, EPA and North Shoa zone Natural Resource Office																				
Objective 2.1	2.1.1.1																					
	2.1.1.2																					
	2.1.2.1																					
Objective 2.2	2.2.1.1																					
	2.2.2.1																					
	2.2.3.1																					
Goal 3		EBI, DBU and North Shoa zone Natural Resource Office																				
Objective 3.1	3.1.1.1																					
	3.1.1.2																					
	3.1.1.3																					
	3.1.2.1																					
	3.1.2.2																					
	3.1.2.3																					
	3.1.2.4																					
Goal 4		EBI, DBU,																				
Objective	4.1.1.1																					

Goals and objectives	Actions	Implementers	Year 1				Year 2				Year 3				Year 4				Year 5			
			Q1	Q2	Q3	Q4	Q1	Q2	Q3	Q4	Q1	Q2	Q3	Q4	Q1	Q2	Q3	Q4	Q1	Q2	Q3	Q4
4.1	4.1.1.2	EWCA, EPA and North Shoa zone Natural Resource Office																				
	4.1.1.3																					
	4.1.2.1																					
Objective 4.2	4.2.1.1																					
	4.2.1.2																					
	4.2.1.3																					

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Species Conservation Action Plan Working Group Photo (Curtesey: Abiyot Berhanu, Dr.)

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