In-situ Conservation of African Violets

Coastal Kenya

Project Title:
Habitat-based approach to sustainably conserve African violets and other threatened plants housed in three irreplaceable karst habitats in coatsal Kenya

Technical Report
February 2025

Submitted by:
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Report Submitted to:

The Rufford Foundation
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NatureKenya
THE EAST AFRICA NATURAL HISTORY SOCIETY

Contents

Acknowledgement

The conservation of African violets in the wild has gained recognition from various stakeholders in the grassroots, thanks to the continuous support by the Rufford Foundation. On behalf of the entire project team, I highly appreciate the Rufford grants' committee for seeing it fit to fund our conservation project activities. In a special appreciation, I take pleasure to recognize the commitment of Rufford Foundation's Director for his good will to environmental conservation matters and ensuring grassroots efforts are supported. Indeed, this funding has expanded our efforts towards rescuing the African violets from extinction risk in coastal Kenya and as a result, the species is an icon used to conserve habitats where it inhabits. It is my sincere hope that we continue partnering together and build a solid conservation foundation for this species. Through this project, we were able to achieve the following; 1) boosted *in-situ* recovery of African violets (propagated around 1700 African violet seedlings and established two new *in-situ* populations of African violets where 1500 seedlings were transplanted), 2) improved the habitats (propagated over 10,000 indigenous tree seedlings in three community nurseries, and transplanted over 6000 seedlings in the wild), 3) strengthen local community capacity for conservation (trained 12 local para-taxonomists, established one community apiary, and evaluated the conservation status of the three sites). Through this booster grant, we have cemented a conservation journey that saves not only the African violets but other threatened plant species in the coastal forests of Kenya. It is through the sites' immense conservation value that has drawn the attention of conservationists (a win for the long-term preservation of the sites). We would be glad to extent our partnership with the Rufford Foundation and eventually exhibit sustainable results worth the work. We also appreciate Nature Kenya, our local hosts for administratively facilitating our project and ensuring our activities are smoothly implemented. Not forgetting the local communities for their support and dedication to conserve forest fragments in their neighborhoods. Finally, we wish to appreciate the entire project team members for being dedicated towards the project's activities, the local community members/guides for sacrificing their time, and the government authorities for facilitating our access to different areas.

Executive Summary

Conservation of native plants through wholly conserving native habitats using selected flagship species is proven worldwide. Thus, its application in the fragile coastal forests of Kenya (which remain critical in conserving endangered/ endemic flora, but face elimination by mining and expanded agriculture) could be of unimaginable benefits. One notable plant is the African violet, an iconic species leading the conservation of other critical plants/ habitats in the coastal Kenya. Through previous support phases of the Rufford Foundation, we have established a baseline for the conservation of African violets; understanding the species ecology, raising community awareness/ training, and rolled out an *in-situ* recovery program. However, there still exist critical gaps hindering a holistic conservation success. In a push for sustainable conservation, this 1st booster grant focused on; conservation translocation (to add *in-situ* populations in secure habitats), habitat restoration efforts (tree-planting to boost *in-situ* populations of other threatened plants), and local capacity building for conservation (establish community-based conservation plans through providing incentives and technical training of local experts). Notably, we managed to propagate approx. 1700 African violet seedlings (1500 of which were taken back to the wild), established two new *in-situ* populations, propagated around 10,000 indigenous tree seedlings (half of which were transplanted to the three habitats), and build local community capacity (12 local para-taxonomists/experts trained, and a community apiary established). Further, we managed to establish ground work (gathered socio-ecological data) towards developing a conservation plan for the three habitats. However, our restoration efforts were challenged by scanty rains making us not transplant the target number of seedlings. In conclusion, our efforts to secure the future of the African violets in the wild have advanced, the local communities are now actively engaged in nature-friendly livelihood activities (thanks to exposure from our intense training), and the development of a comprehensive conservation/management plan for the three irreplaceable habitats is underway. We plan to expand this work towards; developing a stakeholder-based management plan, to reverse the IUCN status for the African violets (through establishing more *in-situ* recovery sites), expand restoration efforts (based on identified critical indigenous species) and establish an apiculture value chain (technical training on apiculture and establishment of other apiaries).

1. Introduction

1.1 Background Information

Kenya's coastal forests occur as fragments (part of the Coastal forests of Eastern Africa biodiversity hotspot) that are home to almost half of the country's flora (39.55%) (Ngumbau *et al.,* 2020) and millions of people, thus a priority for conservation efforts. Except the larger fragments (Arabuko-Sokoke = 370Km^2, Shimba hills = 63Km^2) that enjoy government protection, the approx. 70 smaller fragments (averaging 6.7Km^2) are either unprotected or under the local communities as sacred sites (Burgess *et al.* 2000).

Among the unprotected fragments, are three extremely fragmented limestone outcrops Cha Simba, Mwarakaya, and Pangani (Fig. 1) forests that offer refuge to rare, endemic and threatened plant diversity (Burgess & Clarke, 2000). The three fragments are rapidly degrading (from agricultural expansion, and limestone mining), yet house a chunk of threatened plant species; Cha Simba (6); Mwarakaya (3); Pangani (6) (Fig 2). Despite hosting endangered plant species and facing detrimental threats, the three fragments witness limited habitat-based conservation efforts.

Volis (2017) fronted conservation reintroduction (*in-situ* boosting) as a critical tool in preventing extirpation of species and natural habitats. Previously, while targeting *Streptocarpus ionanthus* subsp. *rupicola* (African violets), we observed the urgency for restoration and *in-situ* boosting of threatened plant species' populations. Basing our efforts on numerous species of conservation concern will halt destructive activities (e.g., our efforts to conserve African violets in Cha Simba in 2021 stopped a proposed mining project). Thus, extending such efforts in similarly-threatened habitats could avert biodiversity loss (lack of conservation efforts caused loss of an African violets population in Mwache forest). For instance, China has protected 85% of native plants by wholly conserving native habitats through flagship species (Xu & Zang, 2023). Thus, the best approach to conserve threatened plants is through restoring their habitats while boosting their *in-situ* populations. The African violets is a critical flagship species to lead the conservation of the coastal forests of Kenya due to its habitat-specificity (restricted to karst habitats) and economic potential (it's the wild mother of the horticulture industry in the Europe and America (Afkhami-Sarvestani *et al*., 2012).

Despite the species speciality, habitat intrusion and fragmentation in most parts of its range (Hughes *et al.*, 2004) has degraded forest cover, leading to desiccation and this has tremendously reduced the range of most species (reduced number of populations). Due to the habitat-specificity nature of the African violets (prefer constant shade, and wet conditions in karst habitats) (Kolehmainen & Korpelainen, 2008), vegetation disturbance may lead to extinction. For example, limestone mining activities in Mwache forest have indirectly led to the eventual loss of a resident *S. ionanthus* subsp. *rupicola* population (through habitat destruction, exposing the species to direct sunlight and dry conditions). Unfortunately, a similar trend seems to follow Cha Simba population where a mining company was cleared to conduct limestone mining within Cha Simba. Thus, habitat-based interventions are urgently required.

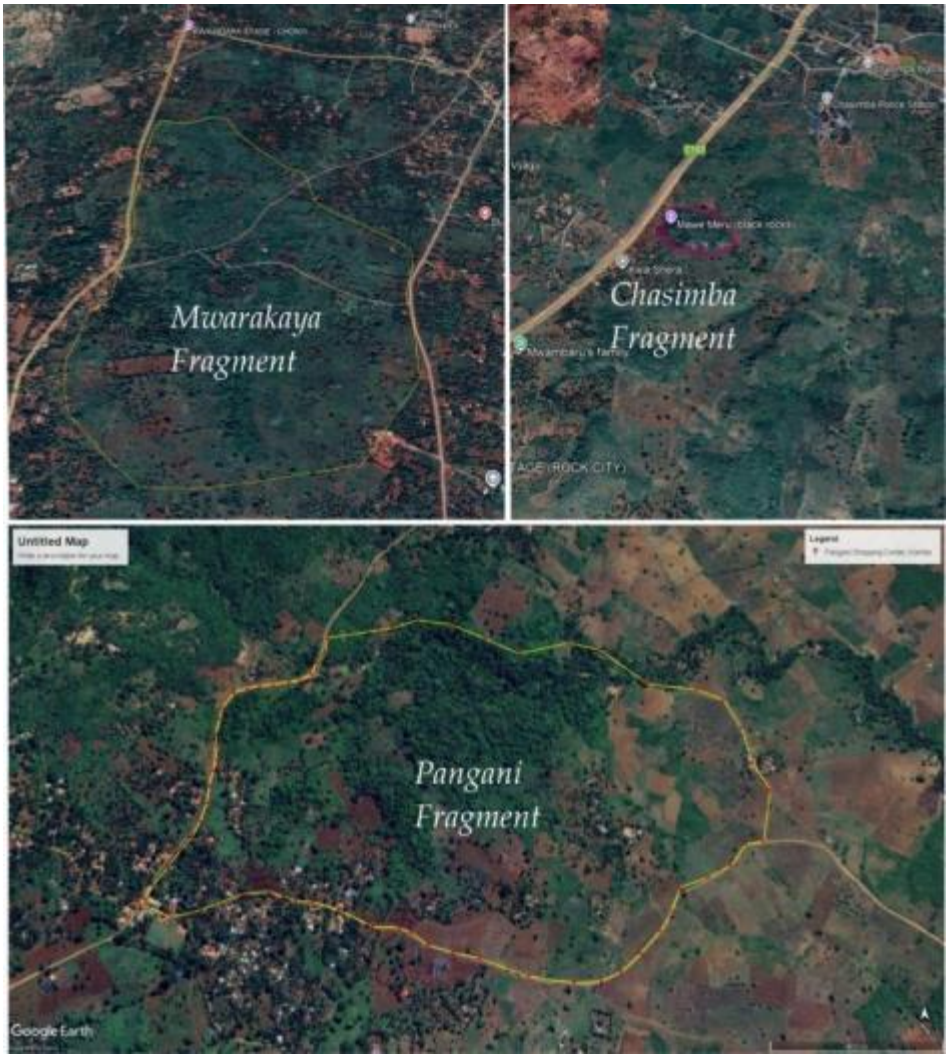

Fig. 1: *Map of the three target fragments.*

Fig. 2: *A selection of some threatened plant species in Coastal forests of Kenya. Photos by Veronicah Ngumbau.*

1.2 Biodiversity potential of the target habitats/Locality description

Our activities targeted three community-owned karst fragments (lies on approx. 15 Km transect) in Kilifi County, coastal Kenya;

Cha Simba - a cave-dominated outcrop along Kaloleni - Kilifi road (Lat: 03”44’18.82S Long: 039”41’44.90E). Despite its small size (approx. 0.04Km^2), it harbors over 200 plant species, with over eight being threatened; *S. ionanthus* subsp. *rupicola* - CR, *Euphorbia wakefieldii* - EN, *Combretum chionanthoides* - NT, *Cola octoloboides* - EN, *Kalanchoe ballyi* - EN, *Premna discolor* var. *discolor* - CR. However, the fragment is threatened by mining interests (a limestone mining project was proposed last year), expanded maize/coconut farming, charcoal trade, and tourism activities. Thus, urgent conservation efforts, especially discussions pushing for official protection, are required.

Mwarakaya - a tiny limestone outcrop (approx. 0.01Km^2) that geographically occurs at Lat: 03”47’27.32S Long: 039”41’46.15E, and has been relatively ‘neglected’ in conservation efforts despite having the sole records of the critically endangered *Karomia gigas* in Kenya (the last individual seem to have been cut down around

1970s). Our field expeditions recorded *S. ionanthus* subsp. *rupicola* and the Endangered *E. wakefieldii,* cementing its conservation importance. However, the fragment is highly degraded (by human settlements, over-grazing, maize farming, and charcoal burning), and is on the verge of disappearance (degraded from $0.03Km^2$ to $0.01Km^2$ in the last few years) unless urgent efforts are incorporated. Our efforts will bring the fragment to recognition for its biodiversity potential.

Pangani rocks - occurs at Lat: 03”27’26.49S Long: 039”45’11.25E, and is mixed of riverine vegetation, dry shrub lands and wet groves. Botanically, Pangani rocks ($0.19Km^2$) hosts the sole population of *Cola porphyrantha* - CR, *C. chionanthoides* - NT, *Uvaria faulknerae* - EN, *E. wakefieldii* - EN, *Encephalartos hildebrandtii* - NT, and *Cynometra webberi* - NT. However, the fragment is threatened by expanded agriculture, limestone mining, and invasive species.

1.3 Project Justification

The coastal forests of East Africa are part of the world’s biologically-rich areas, supporting many endangered flora and fauna diversity, thus a priority for conservation efforts. However, more than 30 million people also inhabit this region, increasing pressure on the natural resources. Here, we tackled an urgent need to conserve three critical forest fragments (hosting over 15 irreplaceable plant species, yet highly degraded). The African violet, being an habitat-specific species (with a narrow distribution and sensitive to ecological disturbance), was selected as the iconic species to lead this conservation.

Well aware that species extinction, preceded by habitat degradation, is irreversible and should be curbed, we approached the situation by applying both habitat-based and species-based conservation approaches (key plant species to lead the conservation interventions). Among the selected approaches include: ecological restoration (action-based approach to curb degradation), vegetation mapping (identify degraded areas to guide restoration), species distribution modeling (detect habitat suitability for rare species), conservation reintroduction (useful tool in conserving threatened species), and community capacity building (custodians of our forests).

Ecological restoration can combat species loss by repairing/ enhancing the structure and function of ecosystems (Hammann *et al.,* 2021). For example, due to degradation, African violets’ sole bee pollinator has declined (lack of foraging plants), affecting

the plant's reproduction. Thus, we expect habitat restoration to improve species interactions within the forests.

The Global Biodiversity Standards ensures restoration activities are performed right (planting right species - native; involving the right people; following nature (considering adapted species); and handling the root causes of degradation (hence, our plan to raise community awareness, train local experts, and introduce nature-based livelihoods)). In restoration projects, stakeholders can expand the mobilization of resources, and should be engaged. Plant conservation entails three major techniques; *in-situ* conservation, *ex-situ* conservation, and reintroduction. In China, *in-situ* conservation has protected 85% of native plants (Xu & Zang, 2023). Further, according to Volis (2017), official protection only cannot halt species loss, but also wide-scale reintroduction. In our case, there is need for species-based recovery plans (Heywood, 2014) such as conservation translocation (create new populations). Thus, the methods selected are ideal for the conservation of both plant species and habitats, and will thus, contribute highly to reversing degradation in the target fragments.

1.4 Project Objectives

In realization of the urgency to save the three fragile karst fragments and the constituent threatened species, we aimed to enhance their conservation through;

a) Habitat restoration - through native seedlings propagation, transplanting and mitigation of human-driven threats.

b) *In-situ* recovery of the African violets - through massive propagation and establishment of *in-situ* populations/recovery sites.

c) Build local communities capacity for conservation - through training local para-taxonomists, establishing forest management committees, developing a conservation/management plan, and promoting alternative livelihoods (apiculture and sale of seedlings).

2. Conservation Approaches & Impacts

2.1 Project Inception

To ensure a smooth implementation of our project, we first met members of the local communities, briefly introduced our project focus, and made a working timeline with the project team (since the team was trained in the previous rounds of funding). However, this round, our briefing touched on the biodiversity potential of the area (highlight on the endemic and threatened species, species of conservation concern, rare species, etc), emerging threats facing the habitats (including human-induced threats, majorly expanded maize farms and limestone mining), and introduced the need for Community Forest Associations (CFAs) (for future implementation of conservation activities).

Fig. 3: *Community training and awareness sessions in the target fragments.*

2.2 In-situ recovery of African violets

2.2.1 Mass Propagation of African violets

Since we already have a propagation station (from the previous funding), we directly began mass propagation of African violets using leaves and seeds from the wild. To initiate propagation, we conducted population visits to collect/harvest leaves and a few seeds (based on availability) (Fig. 4). The leaves were prepared and set up for propagation in water and soil media. In total, we set up over 2800 individual leaves of which 1700 successfully re-sprouted into seedlings.

Fig. 4: *Harvesting of African violet leaves from the wild and propagating them for translocation purposes.*

2.2.2 In-situ translocation of African violet seedlings

To initiate *in-situ* recovery and boosting, we established two new populations of African violets (outside extant populations). The recovery sites were selected based on evaluation of experienced/potential threats, local community agreement, ease of access (for nurturing, e.g., watering), and availability of volunteer management. Thus, based on these factors, one recovery site was set up in Pangani karst fragment, and

another one in Cha Simba rocks. In Mwarakaya, we resorted to conduct *in-situ* boosting of the extant population and proper protection through the locals. A total of 1500 individuals were taken back to the wild in all sites and propagation still continues (Fig. 5).

Fig. 5: *Trans-locating the African violet seedlings from the propagation center to the wild for in-situ recovery*.

2.3 Habitat Restoration

2.3.1 Mapping fragment degradation

To prioritize the correct areas for restoration, we first mapped the three target fragments through extensive surveys/field visits and recorded degradation occurrence. We set our reference points to be the areas where the main forests commence towards the human inhabited areas. We plan to begin restoration from the forest areas extending towards community farms. According to our surveys, the areas are highly degraded and consistent restoration activities are required. For instance, in Pangani, four degraded blocks were established and area calculated (Fig. 6). In Mwarakaya, three degraded blocks were mapped (comprising only the major rock outcrops) (Fig. 7). In Chasimba, three degraded blocks were mapped and assessed (Fig. 8).

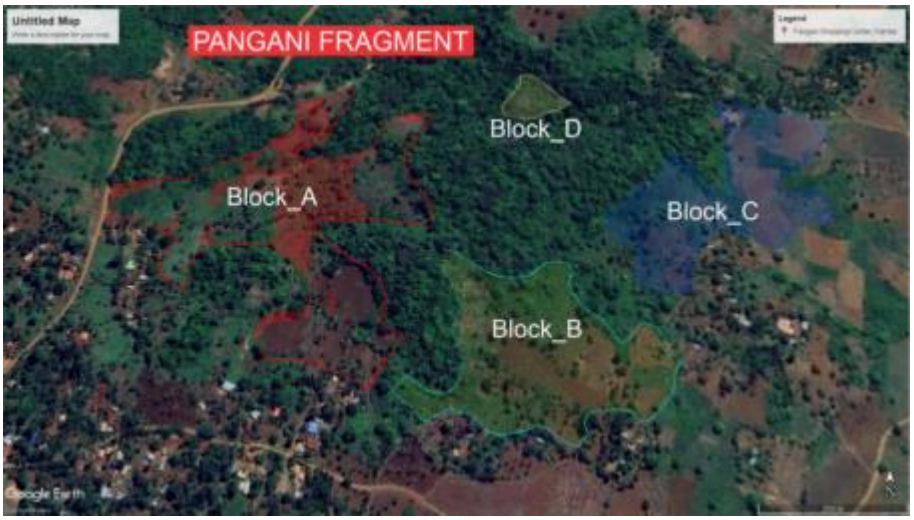

Fig. 6: *Mapping degradation in Pangani. Block_A (26.3 Acres), Block_B (15.3 Acres), Block_C (15 Acres), and Block_D (1.6 Acres).*

Fig. 7: *Mapping degradation in Mwarakaya. Block_A (15.6 Acres), Block_B (6.9 Acres), and Block_C (10.7 Acres).*

Fig. 8: *Mapping degradation in Chasimba. Block_A (12.1 Acres), Block_B (8.5 Acres), and Block_C (13.8 Acres).*

2.3.2 Seed Collection & Indigenous Seedlings propagation

The success of habitat restoration rely on genetic diversity within seedlings. We mobilized local communities within the target fragments and conducted seed collection exercises (Fig. 9).

Fig. 9: *Seed collection, preparation/processing, and propagation. The seeds were collected, extracted (if need be), and dried using direct sunlight.*

In conjunction, we supported local volunteers to collect more seeds for propagation. In total we were able to collect approx. 29kg of assorted seeds which were propagated in the nurseries.

2.3.2 Propagation and tree planting

The germinated seedlings were re-potted into potting tubes with manure and mixed with existing seedlings in the nurseries. Fig. 10 shows some of the seedlings we have propagated so far (we managed to propagate an approx. of 10,123 indigenous seedlings from three community nurseries). During this time, we also purchased assorted indigenous seedlings from local nurseries (from Kaya Chonyi and Kaya Kauma) which were used to transplant in December (Fig. 11). This was done to capitalize on the rains as we await our seedlings to attain transplanting size. Approx. 6,234 seedlings were transplanted in the wild. So far, our monitoring session in January 2025 (Fig. 12) exhibit approx. 75% success of seedlings in the wild.

Fig. 10: *Seedlings propagation in the nurseries.*

Fig. 11: *Tree planting activity conducted to establish a green wall in Pangani.*

Fig. 12: *Restoration monitoring in January 2025. Individual seedlings still surviving well in the wild.*

2.4 Build local community capacity for conservation

2.4.1 Establish forest conservation/management committees

The local communities are the backbone of species conservation (can either protect or destroy forests), thus, need to be enabled towards conservation. Previously, we have raised awareness, trained the locals on destructive livelihoods and promoted nature-based livelihoods as incentives (e.g., modern beekeeping, commercial forestry, etc). However, the organization/formal part of how the locals can participate in conservation remains to be implemented. Community Forest Associations (CFAs) are integral forest protection units in Kenya Forest Service's management (allows local community to manage their own forests). Thus, our target is to establish a joint CFA for the three fragments (due to their size). However, at this time we could not establish the CFA since the groundwork needs a reorganization. There is urgent need to first ensure the custodians of each fragment are participating, collect baseline data for each fragment, and develop targets for each fragment. Here, we established two forest conservation committees, in Cha simba and Pangani fragments. Together with

the committees, we surveyed the fragments, assessed the current conservation status, and proposed next courses of action. We trained the members on the necessary roles and efforts to ensure a protected fragment. Using the baseline information, we plan to develop a comprehensive management plan for the three fragments in future opportunities.

2.4.2 Train local para-taxonomists

Since Eco-tourism is a potential economic venture within the target fragments, we trained 12 para-taxonomists (Fig. 13) on classification of plants, biodiversity in relation to man, data collection tools (specimen collection, ecological data recording), assessing degradation, ethno-botanical knowledge/useful plants/plants that need urgent attention, and basic nature guiding skills/forest navigation. We developed educative poster guides of useful/ threatened plant species in the coastal forests for demonstration.

Fig. 13: *Para-taxonomy training activity in Pangani. Inside are some threatened plant species in coastal Kenya for demonstration.*

2.4.3 Promote alternative livelihoods

To curb environmentally-destructive activities, we established a community apiary to help the locals earn income and mitigate destructive income sources e.g., charcoal trade. We also promoted commercial forestry by facilitating the local communities to propagate mass seedlings for sale. Unfortunately, the colonisation of the hives has been poor (only 4 hives were colonised of 10, and in one the bees absconded). However, we have plans to mitigate this by relocating the hives to a friendly area away from cold (from expert advise). The communities have also managed to sell 2100 indigenous seedlings to conservation partners doing restoration activities. The funds are used to support the community volunteers and daily running of the nurseries.

Fig. 14: *Apiary set up in Pangani forest fragment.*

3. Challenges

a) ***Drought*** - due to dry conditions, the established recovery sites demanded extra care. This is because the transplanted seedlings had not gained adaptive ability when the rain season ended. To tackle this challenge, we purchased medium-sized drums to store water and supported local volunteers to regularly water the seedlings in the wild.

b) ***Recurring mining threat*** - after we successfully halted a limestone mining project in 2022, other proponents also came up with a different project targeting the same localities. This demonstrates the undying quest for the karst outcrops limestone deposits endanger the highly-valued biodiversity. To tackle this, we wrote to the National Environmental Management Authority (NEMA), demonstrating how such project could be detrimental to biodiversity and disregard the years of conservation milestone. The case is pending in court as we prepare testimonials to prove in court.

c) ***Opposition from a section of local custodians in Pangani*** - after we established a tree nursery in Pangani forest fragment, there emerged a minor division from a section of the custodians of the fragment (arguing some members have more benefits than others). Since this is linked with family wrangles, we involved the local Chief who invited both parties for negotiation. We are glad we managed to harmonize the situation and gain the goodwill of all parties.

4. Conclusion & Prospects

4.1 Conclusion

Here (1st Booster grant), we managed to boost the *in-situ* distribution of the African violets (by population enrichment and establishing additional populations - transplanted 1500 seedlings), strengthened habitat restoration in the target fragments (mapped/identified degraded areas, propagated over 10,000 indigenous seedlings, and transplanted over 6,000 seedlings into the wild), and build local community capacity for conservation (trained 12 local para-taxonomists, collected baseline data for site-conservation planning, established two conservation committees, and established an apiary as a conservation incentive). In conclusion, this project has managed to achieve substantial milestones including; securing a future for the African violets (be creating safer localities), enhancing site recovery through restoration activities, winning the free will of the locals to lead site-conservation, and creating environmental stewardship in the areas. Therefore, the foundation laid during this project has exposed other gaps worth the attention and we plan to expand this work in partnership with the Rufford Foundation.

4.2 Prospects

Currently, the long-term sustainability of the target fragments depends on how the locals actively participate (out of their free will) to conservation efforts. Thus, the efforts now need to shift towards enabling the locals to protect their fragments. In line with the gaps exposed during this 1st Booster grant, there is an evident need to continue with this work focusing on the following areas;

a) Although we managed to collect baseline data about the conservation status of the target fragments and established forest management committees, **a comprehensive management plan for the sites is urgent** (we plan to conduct wide consultations, invite partners/stakeholders for open

discussions, and gather expert opinions). We expect this management plan to have regulation on resource utilization.

b) The African violets and other threatened plants are not yet out of danger - although we have achieved much on ensuring a future for the African violets and other threatened plants, they are yet to enjoy protection until **we boost their presence in multiple localities**. We plan to establish other recovery sites (for the African violets), and target direct propagation for other critical species (*Cola porphyrantha*, *Euphorbia wakefieldii, Uvaria faulknerae*) for *in-situ* boosting.

c) It is clear that the sustainable conservation of the community forests relies heavily on the economic status of the local communities. Thus, **we plan to expand our incentives** (establish apiaries in the three fragments, regularly support them with nursery supplies, and value-addition of apiculture).

d) Ecotourism is an unexplored conservation incentive - the target fragments all enjoy a rich cultural/natural heritage (attraction for rock climbers, cave enthusiasts, photographers, plant lovers, bird watchers, and spiritualists). However, this tourism potential lies unexplored. We plan to fully **survey the sites and develop a map of nature trails, posters clearly pointing out unique features** e.g., threatened plants. We expect this to give sense to conservation by making the locals guard highly the natural heritage. In conjunction, the trained para-taxonomists will be offered further training on ecotourism and other topics to serve as guides.

e) Citizen science education is lacking - although the locals are aware of their localities' conservation potential, they lack the technical knowledge of how to understand nature. **We plan to introduce the use of digital tools of conservation** e.g., iNaturalist among the young generation to boost connection with nature. This tool will be used to enhance a rapid inventory of the biodiversity/plants within the sites.

f) There is need to **develop a plant inventory of the three sites** (for enhanced community knowledge), listing all plants, their photos, and ethno-botanical use.

g) **Habitat restoration** need more efforts - after establishing green walls around fragments, the locals now welcome more tree planting. Although our restoration efforts are yielding fruits (we are closing the degraded gaps already), we are yet to attain a good threshold on restoring the sites. Hence, **we now have set a target of 30,000 indigenous seedlings in the next two years.**

References

Afkhami-Sarvestani R, Serek M, Winkelmann T 2012. Interspecific crosses within the *Streptocarpus* subgenus *Streptocarpella* and intergeneric crosses between *Streptocarpella* and *Saintpaulia ionantha* genotypes. *Scientia Horticulturae* [J], 148: 215-222.

Burgess, N.D., & Clarke, G.P. (2000). Coastal forests of eastern Africa.

Hammann, L., Silliman, B., & Blasius, B. (2021). Optimal planting distance in a simple model of habitat restoration with an allee effect. *Frontiers in Marine Science*, *7*, 610412.

Ngumbau, V. M., Musili, P. M., & Hu, G. W. (2021). Premna mwadimei (Lamiaceae), a new species from Cha Simba, a remnant of coastal forests of Kenya, East Africa. *Phytotaxa*, *510*(2), 155-162.

Ngumbau, V. M., Nyange, M., Wei, N., Malombe, I., Hu, G. W., & Wang, Q. F. (2020). Zehneria monocarpa (Cucurbitaceae), a new species from the relicts of Kenya's coastal forests. *Phytotaxa*, *443*(3), 258-264.

Volis, S. (2017). Plant conservation in the anthropocene: Definitely not win-win but maybe not lose-lose?. In *Encyclopedia of the Anthropocene* (pp. 389-397). Elsevier.

Xu, Y., & Zang, R. (2023). Conservation of rare and endangered plant species in China. *Iscience*.

Hughes M, Möller M, Bellstedt D U, *et al*. 2004. EST and random genomic nuclear microsatellite markers for *Streptocarpus*. *Molecular Ecology Notes* [J], 4: 36-38.

Kolehmainen J, Korpelainen H, Mutikainen P 2009. Inbreeding and inbreeding depression in a threatened endemic plant, the African violet (*Saintpaulia ionantha* ssp. *grotei*), of the East Usambara Mountains, Tanzania. *African Journal of Ecology* [J], 48: 576–587.

Appendices

Appendix 1. Selected project photos

Photo: A langstroth bee hive used as catcher for bees in Pangani. *Photo by Cornelius M. Kyalo*

Photo: Newly transplanted African violets in Chasimba recovery site. *Photo by Cornelius M. Kyalo*

Photo: Indigenous plant propagation in Pangani community nursery. *Photo by Cornelius M. Kyalo*

Photo: Forest destruction through fires to create land for maize farming. *Photo by Cornelius M. Kyalo*

Photo: Community training session in Mwarakaya. *Photo by Cornelius M. Kyalo*

Para-taxonomy as a powerful boost to biodiversity conservation: *training para-taxonomists in the coastal forests of Kenya*

Dr. Cornelius M. Kyalo - Trainer

Introduction

Para-taxonomy - identification of plants, mammals, birds, insects, by members of the local population.
Para- taxonomists - local assistants trained by professional biologists (Basset *et al.*, 2004)
Origin of para-taxonomy: the idea was coined in 1986 when the Costa Rica conservation program national biodiversity institute hired local adults living near Guanacast Conservation Area (GCA) to help scientists identify species and provide ethno-botanical information.

Problem: In developed countries, **citizen science** has become a major boost for **biodiversity research and conservation**. However, in developing countries, which have **dire need for environmental data**, such programs are slow to emerge, despite the large and untapped human resources in close proximity to areas of high biodiversity and **poorly known** flora and fauna (Schmiedel *et al.*, 2016).

Many research institutions are run by research scientists who have little connection to the ground. Although the connection happens once in a while the scientists visit the field, there is need for all stakeholders to have a common language. Thus, training some locals to act as 'scientists' is necessary.

Why train para-taxonomists in the coastal forests of Kenya?

- Kenya's coastal forests harbor **uniqe, threatened, and endemic biodiversity**
- Kenya's coastal forests have of late received **biodiversity research /conservation attention**
- There is need for locals to gain knowledge in biodiversity - to work with scientists
- **Ecotourism hub** - there is need to train local experts to boost tourism

Role of para-taxonomists

Para-taxonomists' duties include; making biodiversity (plant, animal) inventories, collect biological specimen, collect **ecological data**, assess **degradation**, advice on rehabilitation, provide **environmental education** in schools and local public, provide biological and technical literacy to land owners on land -use and management, and **manage ecotourism** programmes.

Training Curricullum

: Classification/Nomenclature/Basics of plant identification
: Biodiversity in relation to man
: Data collection (specimen, ecological information, recording)
: Mapping (Degradation, species monitoring, etc)
: Forest navigation/ eco-tourism trails

Project Sponsor

References

1. Basset, Y., Novotny, V., Miller, S. E., Weiblen, G. D., Missa, O., & Stewart, A. J. (2004). **Conservation and biological monitoring of tropical forests: the role of parataxonomists.** *Journal of Applied Ecology*, 163-174.
2. Schmiedel, U., Araya, Y., Bortolotto, M. I., Boeckenhoff, L., Hallwachs, W., Janzen, D., ... & Toko, P. (2016). **Contributions of paraecologists and parataxonomists to research, conservation, and social development**. *Conservation Biology*, 30(3), 506-519.

Photo: Para-taxonomists training poster.