

Final Evaluation Report

Your Details	
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Project Title	Assessing the Socio-Ecological Implications of Vernonathura polyanthes Invasions within Chimanimani Transfrontier Conservation Area
Application ID	33684-1
Date of this Report	16/12/22

1. Indicate the level of achievement of the project's original objectives and include any relevant comments on factors affecting this.

Objective	Not achieved	Partially achieved	Fully achieved	Comments
To assess distribution patterns of <i>Vernonanthura polyanthes</i>				Project activities managed to generate data on the distribution patterns of <i>V. polyanthes</i> in Chimanimani region. Key findings point out that changing climatic conditions and increasing invasions. It is strongly believed that <i>V. polyanthes</i> was introduced into the Chimanimani Transfrontier Conservation Area between 2000-2005 from Sussundenga Farms (where it was originally introduced) by a series of tropical storms that hit the region – including Cyclone Eline. Changing climatic conditions further strengthened <i>V. polyanthes</i> spread across the region – drought episodes resulted into massive outbreaks of wildfires that promoted <i>V. polyanthes</i> spread. Changes in land use patterns in Zimbabwe that include conversion of commercial farms into small scale farms and illegal gold mining exposed various ecological landscapes to <i>V. polyanthes</i> infestation. <i>V. polyanthes</i> distribution and infestation is more visible in human and naturally disturbed landscapes.
To assess socio-ecological impacts associated with <i>Vernonanthura polyanthes</i>				We ascertained that <i>V. polyanthes</i> bears both positive and negative impacts on human livelihoods and the environment. Diverse socioeconomic groups in Chimanimani reflected <i>V. polyanthes</i> as a nuisance which is severally disturbing livelihood activities by invading crops, grazing, agro-forests and tourism sites. On the other hand, some reflected that <i>V. polyanthes</i> is, however, promoting local livelihoods for example apiculture projects since it is utilised as a bee fodder. <i>V.</i>

			<p><i>polyanthes</i> is adopted in ethnomedicine. Additionally, relating to the environment we find out that <i>V. polyanthes</i> is affecting Key Biodiversity Areas (KBAs). It is altering fire regimes, therefore exposing indigenous forests to sporadic wildfires, outcompeting endemic floral species, human encroachment)</p>
<p>To capacitate local communities with skills and knowledge to identify, assess taxa of invasive alien plants</p>			<p>This project was community-centred, and diverse socioeconomic groups (youths, women, traditional leaders, migrants, farmers, pastoralists, beekeepers, NGO representatives, government representatives, park rangers, tour guides, artisanal miners, foresters, private company representatives) participated in various project activities including identifying <i>V. polyanthes</i> distribution, mapping landscapes infested by <i>V. polyanthes</i>. This project was the first project to engage locals for a better understanding of <i>V. polyanthes</i> spread and infestation along the Zimbabwe – Mozambique border.</p>

2. Describe the three most important outcomes of your project.

a). Out of this project, we managed to increase local understanding on human interaction and the environment. Through 20 participatory community mapping exercises we managed to deepen knowledge on how daily activities (in)directly shape environmental outcomes they are experiencing in the region. Vulnerable social groups and less powerful social groups (especially youths, migrants and women) managed to learn how region's environment is exposing their key livelihoods activities such as farming to invasive alien species. These participatory community mapping exercises generated some *V. polyanthes* distribution maps at village, ward and district level. Through 25 participatory GIS mapping and 15 species modelling activities, we managed to expose locals to current ecological impacts associated with increasing infestation of *V. polyanthes* into their communities. For instance, we managed to visit multiple forests and watershed areas which many participants have last visited some years ago, this allowed participants to understand how changing climatic conditions in combination with invasive alien plants is transforming nature. During these participatory activities we observed with locals that native flora and fauna species are slowly disappearing following increasing plant invasions of indigenous forests.

b). Through the work on this project, we increased local expert knowledge on the drivers leading to the spread of *V. polyanthes* into the region as well as trends of the

distribution patterns of *V. polyanthes* in key biodiversity areas. Through participatory methodologies, we managed to increase local environmentalist knowledge on how the *V. polyanthes* is invading key biodiversity areas (protected areas, community forests and watershed areas). During species distribution modelling activities, park rangers and wardens in both countries managed to observe and understand how fire outbreaks are facilitating the spread of *V. polyanthes* into protected areas. Likewise, during community mapping activities, community environmental experts, traditional leaders and tour guides in communities engaged managed to witness the role played by illegal settlers, intensification of agricultural activities (crop farming and livestock rearing) in spreading *V. polyanthes* into community forests and watershed areas.

c). The work capacitated local leadership and environmentalists with knowledge on invasive alien species characteristics, impacts and potential management frameworks. Through this project we managed to equip local leadership with knowledge on the characteristics of invasive alien plant species, impacts and potential management strategies. Before the project was conducted, very few local leaders (including those in government position at district level) were knowledgeable of invasive alien plants i.e., meaning, characteristics, origins, ways of spread and potential management frameworks. Taking *V. polyanthes* as case study we managed to share with local decision makers various dynamics of invasive alien species, and potential measures to manage their spread. At the end of the project, local leadership were empowered with knowledge to identify other invasive alien plant species (lantana camara, milk thistle, pine, gum trees) invading landscapes critical for livelihoods and ecological values as well as possible management strategies.

The project managed to capacitate local participants with knowledge on the complexities associated with invasive alien plants species and how they can be cognisant of their roles in the spread and management of the invasive plants in the region. Through various participatory engagement exercises, we managed to empower locals with knowledge and skills to identify invasive alien plant species invading various landscapes in the region. Critical to this achievement we managed to involve local participants of different socio-economic and ethnic backgrounds (women, youths elders, migrants and those of minority ethnic groups), including those who were rarely involved in community development programmes or decision-making activities Participatory tools empowered locals with capacity to share their experiences, observations and aspirations in regard to invasive alien plant species. While this project initially targeted Chimanimani TFCA, other protected areas were later included in the project (Chirinda Forest, Nyanga National Park and Vumba Botanical Gardens) and this generated an overview picture of how invasive alien plant species are spreading as well as invading key biodiversity areas along the Zimbabwe- Mozambique border.

3. Explain any unforeseen difficulties that arose during the project and how these were tackled.

This project was conducted during the COVID-19 pandemic; therefore, some activities were rescheduled in order to comply with lockdown restrictions in both

Zimbabwe and Mozambique as well as to promote healthy environments during research. When the project was first implemented in June 2021, Zimbabwe was under level two restriction, during this time indoor gatherings were not allowed. This directly affected plans to hold all-stakeholder meetings with key informants. In this regard, I resorted to individual key informant interview methods with targeted key informants in the region. In addition, from July – September 2021 the Governments of Zimbabwe and Mozambique instigated a shutdown of all non-essential activities including cross-border movements. During this period Mozambique instigated policies to restrict the movement of foreigners except for truck drivers and those on important missions or travelling by air. As a result, I was forced to stop project activities and resumed in December 2021. To travel outside the country a government letter was required from the Department of Immigration, which took weeks to process. When the letter was processed, Mozambique was in level three of COVID-19 lockdown, restricting all in door meetings. This affected conducting stakeholder engagement meetings with key experts as initially proposed. In this regard, I resorted to outdoor discussions with community experts (traditional leaders, led farmers, tour guides, traditional healers) and foresters for private timber companies. As a measure of observing COVID-19, social distance was maintained during discussions, however this reduced social cohesion and flow of the discussion most of the times. I have therefore, to make some follow ups to each individual participant for a more comprehensive in-depth discussion.

Furthermore, massive price fluctuations and high inflation in Zimbabwe changed initial project plans. Quoted prices for fieldwork gadgets (recorders and GPS) and radio shows were increased with more than 50%. However, I managed to purchase, small GPS and recorders of lower quality than as expected. Likewise, I realised that prices for radio bookings were increased to £1,500 for a special show per week. However, I decided to convert the budget line to visit other protected areas (Yumba Botanical Gardens, Nyanga National Park and Chirinda Forest) in the Zimbabwean side as recommended by key informants and project advisors during fieldwork activities.

4. Describe the involvement of local communities and how they have benefited from the project.

Various local groups (at district, community and village level) were involved in the project activities. Local conservationists at district level (government representatives, tour guides, park rangers, local NGOs representatives) were engaged as local research advisors in both Zimbabwe and Mozambique. Local conservationists (government representatives i.e., environmental management authority in Zimbabwe and Administrator for Rural Development Conservation of National Reserves for Mozambique, Sussundenga District) participated in identifying key biodiversity areas infested by *V. polyanthes* in the study areas. On several occasions in both Zimbabwe and Mozambique, I also engaged tour guides to support me during species distribution modelling and transect walk exercises in selected forests. Through this engagement, local conservationists managed to discuss possibilities of including invasive alien plants species in District Environmental Management Plans (DEMPs), closely related to this, an Environment Management Authority Officer for Chimanimani District adopted some of the project insights to develop an invasive

alien plants concept note which he is looking forward submitting to the Environment Management Authority National Office. Additionally, this project encouraged local stakeholders (tour guides and MICAIA representatives) in Chimanimani-Mozambique to support Chimanimani National Park's calls for *V. polyanthes* to be declared an invasive alien species in Mozambique, as well for a need for bilateral collaborations with environmental stakeholders in the Zimbabwean side.

At community level, traditional leaders and community forest managers were actively engaged in key informant interview discussions. For instance, community foresters or managers were involved in multiple discussions that led to the identification of community forests and watershed areas that are under *V. polyanthes* infestation. These discussions were followed by visits to identified community forests infested by *V. polyanthes*. Given that some of the forests are rarely monitored or visited (most of them are visited once in two years when locals were conducting ritual ceremonies), such visits enabled local forest managers to understand other dynamics (impacts of fires and floods to forest status and possible management techniques that can be used to maintain these forests). In addition, I managed to recruit project assistants from a group of knowledgeable youths affiliated with community-based organisations (CBOs) in the two regions.

At village level, different social groups were involved in several data collection engagements that include community mapping and participatory GIS mapping exercises. At this stage local participants included women, youths, farmers, migrants and elders who played a part as information providers. Through these engagements we managed to improve local level understanding of invasive alien species (distribution, characteristics, taxa, and trends of distribution). Locals also managed to learn skills to communicate their views and ways of knowledge sharing. For instance, use of GPS during participatory GIS mapping exercises, exposed women and youths to technologies in environmental research activities.

5. Are there any plans to continue this work?

The study established multiple gaps that need to be revisited and addressed if invasive alien plants are to be well managed in buffer zone areas associated with protected areas.

As part of future activities, the researcher is currently leading a small project on "Use of Forest Resources During the COVID-19 Pandemic in Chimanimani: exploring the impacts of successive shocks for forest dependent communities" funded by the University of Edinburgh to Dr Samuel Spiegel. Part of the project's objectives is to understand utilisation of non-timber forest products (NTFPs) particularly honey, wild fruits, insects and vegetables) in times of shocks in Chimanimani region. By focusing on this objective, we questioned if diverse social groups have different perspectives over *V. polyanthes* on access to NTFPs. In this project forest users are finding *V. polyanthes* as a significant inhibitor that is invading community forests where locals harvest wild fruits such as Mazhanje (wild loquat) and Tsvubvu (*Vitez payos*) that are critical for the provision of food security and household income. On the other hand, some social groups like *V. polyanthes* for boosting honey production, especially following loss of beehives to Cyclone Idai. However, these mixed feelings towards *V.*

polyanthes are fostering social conflicts in the region, with some groups wanting it to be totally exterminated with others wanting it to stay to promote apiculture projects. In combination with the Rufford project, plans are underway to foster a sustainable *V. polyanthes* framework that will not only harmonise social groups but promote fair access to NTFPs in the region.

Additionally, this study established that transboundary fires are among the factors promoting the distribution and spread of *V. polyanthes* in the region. This case emerged in all four protected areas (Chimanimani National Park, Nyanga National Park, Vumba Botanical Gardens and Chirinda Forest) along the Zimbabwe-Mozambique border. Cross-border fires between Zimbabwe and Mozambique were discussed to be of high impact on borderland native vegetation since they can go for days unnoticed by locals and relevant institutions (park authorities and timber companies). In both countries, community maps reflect a strong association between the distribution of *V. polyanthes* and fire outbreaks, landscapes that are vulnerable to fires are highly infested by *V. polyanthes*. For instance, as captured in both articles prepared by the work funded by The Rufford Foundation, timber compartments and indigenous forests (Makurupini) that are vulnerable to wildfires are witnessing loss of endemic tree species and massive spread of *V. polyanthes*. Tracing how wildfires are starting is a great challenge to both formal and informal institutions in both Zimbabwe and Mozambique. Conservation agencies in the region are associating locals who are invading the margins of the protected areas for causing fires during land preparation. On the other hand, local traditional leadership is pointing to reckless artisanal mining and local hunters for causing fires during their activities out of hand, therefore spreading to various areas. Wildfires are not only rendering conservation landscapes vulnerable to *V. polyanthes* but leading to a massive loss of endemic biodiversity species that include birds, amphibians and reptiles. Some conservationists in the region are sceptical of the future of vulnerable and near endemic plant species such as *Olinia chimanimani* (Penaeaceae) and *Encephalartos chimanimaniensis* is at risk given increasing fire outbreaks in some parts of the protected area.

In this regard, both communities in Zimbabwe and Mozambique need to be sensitised on the impacts of fire on the environment including how they are rendering forests vulnerable to *V. polyanthes* infestations. This future will include developing a transboundary fire management framework that will guide local institutions on ways to protect biodiversity from fires and existing customary laws that inhibit the regular use of fires in community forests. As recommended during in-depth interviews with key informants in both Zimbabwe and Mozambique main this future work will also train locals on sustainable land preparation methods and honey harvesting technologies that are less reliant on the use of fire.

Besides fire outbreaks, the region is strongly associated with changing climatic conditions, especially floods that are causing soil erosion and gullies, therefore allowing *V. polyanthes* to invade disturbed landscapes. Closely related to this, several key informants proposed rewilding landscapes degraded by cyclone as one of the methods that can be adopted to reduce *V. polyanthes* distribution and infestation. For instance, as captured in our two articles *V. polyanthes* is invading gullies created by Cyclone Idai - especially in in community forests like Makurupini,

Nyamariwe, and Masagoni. Therefore, I envision for my future work to extend this focus on rewilding cyclone-degraded native forests in the Chimanimani region in order to reduce *V. polyanthes* spread in bare landscapes. Along this plan, I have already identified that locals in Chimanimani- Zimbabwe can source indigenous trees' seedlings from Vhumba Botanical Gardens and Chirinda Forest that share same endemic species and climatic conditions with Chimanimani.

6. How do you plan to share the results of your work with others?

Project results will be made available to multiple audiences in different ways. Currently, two articles were completed, the first article titled "Invasive plants in a Trans Frontier Conservation Area: A participatory analysis of the impact of climate change and socio-ecological drivers" co-authored with Dr Samuel Jason Spiegel was submitted to Human Ecology Journal in September 2022 for peer review. The article explores different knowledges and worldviews being used to explain the spread and distribution of *V. polyanthes* in Chimanimani region. A central contribution of the paper is on the role of climate change in facilitating the distribution of *V. polyanthes* from established areas to new landscapes. With agreed support from University Edinburgh, the institution will meet publishing costs for this article to be open access. The second paper co-authored with Dr. Ross Shackelton titled "Invasive alien plants, conservation and livelihoods: the case of *Vernonathura polyanthes* in the Chimanimani Uplands" was submitted to Ecology and Society in December 2022 for peer review. The article addresses observed impacts of *V. polyanthes* on livelihoods and ecological landscapes. This article advances new knowledge on how *V. polyanthes* is rendering livelihood landscapes unproductive to sustain human wellbeing in the region, it further discusses how the region is losing endemic (flora and fauna species) due to *V. polyanthes* infestation in ecological landscapes. Locals observed that *V. polyanthes* outcompeting native plants species that are invaluable for the provision of non-timber forests products (medicinal values, wild fruits, and wild insects), environment (habitat for bird and small animal species and water retention) and cultural sites (for rituals especially invasion of watershed areas and scared forest sites). Like the first article an arrangement is already made with Dr Shackelton (Swiss Federal Research Institute (WSL)) to make this article an open access, and costs will be paid by WSL. The third policy paper is in progress and is entitled "An Invasive Alien Plant Management Framework in a Multi-land use zone: The Case of *Vernonathura polyanthes* in Southeast Africa" reflects on potential ways *V. polyanthes* can be managed in a multi-landscape such as Chimanimani region. Efforts will be made for this article to have an open-access status to allow access to various audiences. A simple version of the article will be made available for locals, and it will be shared with led farmers, NGOs, Rural District Councils, Agritex Officers, Environmental Management Agencies and CBOs in Chimanimani, Vumba, Chipinge and Vumba where the plant is causing severe impacts.

While I proposed to hold a radio show to reach out locals in the region, the idea was later changed due to the increased high costs that were associated with a radio show (thus over £1000 for a 30-minute talk) and it was not guaranteed that targeted locals will be listening during that given time. Therefore, based on the increasing infestation of *V. polyanthes* in protected areas along the Zimbabwe – Mozambique border, I used the budgeted amount to deepen understanding on how *V.*

polyanthes is being perceived in other protected areas with similar key biodiversity status with Chimanimani TFCA. As a result, the researcher explored *V. polyanthes* dynamics in Nyanga National Park, Vhumba Botanical Garden and Chirinda Forest. Findings from these sites will inform a fourth paper which will be titled "Distribution of invasive alien plants in protected areas along the Zimbabwe-Mozambique Border Region" it will specifically focus on the spread and distributions of *V. polyanthes* and other identified invasive alien plants in protected areas along the border. I envision submitting the article to the Biological Invasions, with an aim to advance a comparative reflection of invasive alien plants' dynamics in protected areas in southeast Africa. Efforts will be made to make the article to be published in an international high impact journal and for it to be open access. In addition, we will provide distribution maps to all park managers.

Additionally, with the support from Dr Shackleton, I conducted senior member for CABI to have a short video reflecting on *V. polyanthes* (introduction, distribution patterns and impacts) made in collaboration with youths in Chikukwa to be publicized to an international audience. Efforts will be made for articles to be shared with locals when published. The articles will be posted on social media platforms accessible to different social groups in the regions where the research was conducted. For instance, I will post the articles at websites and social media handles (Facebook and Twitter) for community-based organisations operating in Chimanimani, Environmental Management Agency, Chimanimani Rural District and social groups on Facebook).

Likewise, the video will be uploaded on YouTube and social medial platforms for Chimanimani District (i.e., Facebook Homepage), MICAIA Foundation and TSURO dzeChimanimani for accessibility to local communities. Local assistant will be also encouraged to share the video with other local members across their communities. To reach national audience, the video will be posted on Twitter tagging environmental agencies in Zimbabwe and Mozambique.

In addition, with the support of funding from Edinburgh University (Moray Foundation) I will print short pamphlets addressing distribution, emerging and management of *V. polyanthes* and other invasive alien plants in the region. Key aspects on the pamphlets will be a *V. polyanthes* distribution map, which will make locals aware of areas where *V. polyanthes* is invading. The pamphlets will be shared with local stakeholders (CBOs, local government institutions, Chimanimani Rural District Council, Chimanimani National Parks (Zimbabwe and Mozambique), Micaia Foundation and traditional leaders.

7. Looking ahead, what do you feel are the important next steps?

Key among the findings is that there is little knowledge on how invasive plants species are being prevented from spreading and or managed. This, therefore, entails that there is a significant gap in the capacity building of institutions and communities within the study areas. I am envisioning my future projects aiming at empowering conservationists (in central Mozambique and eastern Zimbabwe) and communities (local forest users, farmers and apiculturists) with knowledge and skills to curb and manage the spread of invasive alien plants including *V. polyanthes*. These

projects will promote transboundary fire management along the Zimbabwe-Mozambique border, reforestation of Cyclone Idai (naturally degraded landscapes) and managing *V. polyanthes* infestation in cultural forests and other key biodiversity hotspots.

8. Did you use The Rufford Foundation logo in any materials produced in relation to this project? Did the Foundation receive any publicity during the course of your work?

During fieldwork activities, the Rufford Foundation logo was inserted on all paperwork (i.e., invitation letters, participants lists and questionnaires) used. Fieldwork outputs specifically a short video developed also have the Rufford Foundation logo. In addition, academic papers submitted for peer review will also immensely appreciate the financial contribution made by The Rufford Foundation when published. Future outputs from this work, which include community pamphlets and compendiums reflecting the management *V. polyanthes* will also bear the Rufford Foundation and University of Edinburgh logos.

9. Provide a full list of all the members of your team and their role in the project.

Samuel Spiegel (PhD), University of Edinburgh, is a human geographer and international development expert with more than 15 years of research experience in Zimbabwe and six years in Chimanimani. As an international development expert, Dr Spiegel played a critical role on providing guidance on how to include local leadership in every stage of the project. He also assisted me with making suitable decisions, especially during uncertainties (i.e., Covid-19 lockdowns). On several occasions, he also advised the researcher on research tools to engage during the research process. Additionally, he also supervised the first article which we submitted to the Human Ecology Journal.

Ross Shackleton (PhD), WSL, is a biological scientist with extensive experience on biological invasions in southern Africa. During fieldwork activities, he was often consulted for advice whenever the researcher wants an expert's view on some of the methods and findings that were being produced. We have recently submitted a paper on the topic together to Ecology and Society. Additionally, his institution has already accepted to meet publishing costs that are charged by the journal.

Jonathan Timberlake is a renowned botanist with extensive experience of floral species in both sides of the region (Chimanimani, Zimbabwe and Chimanimani Mozambique). He has given his experience on the floral species in the Eastern Highlands of Zimbabwe, Jonathan's advised me on potential sites that can reflect the distribution of *V. polyanthes* differently, for instance he advised the researcher to explore the distribution patterns of *V. polyanthes* in other protected areas in the region such as Vumba Botanical Gardens, Chirinda Forest, Nyanga National Park sharing similar socio-ecological dynamics with Chimanimani.

Billy Mukamuri (Prof), University of Zimbabwe, is an expert in participatory research methodologies and conservation. He reviewed some tools that were used for data collection purposes, particularly questions for community mapping and participatory

GIS mapping. As a local research expert, he also advised the researcher on logistical issues and support with travelling letters that were critical for fieldwork purposes.

Julian Perinani, Birdlife Zimbabwe, is a national ornithologist with knowledge on conservation dynamics in Chimanimani. Her organisation was responsible for administering the funds on behalf of the Rufford Foundation. Closely related to this she advised the researcher on best practices on accountability and other ethical considerations (informed consent, protection of vulnerable participants) during research activities. On several occasions she advised the researcher to assess the linkages of *V. polyanthes* distribution and artisanal gold panning that is unfolding in some parts of Chimanimani.

Solomon Mwacheza, Towards Sustainable Use of Resource Organisation (TSURO dzeChimanimani), helped me to in coordinating locals involved in apiculture projects for discussion.

Charles Murata, Chikukwa Community, is a member of Chikukwa Culture Centre, with an Honours Degree in Development Studies. As a local member, Charles worked closely with the researcher in the Zimbabwean side. He was responsible of assisting the researcher on planning fieldwork activities, making appointments with local participants, traditional leaders and assisted in organising participatory activities that were conducted with villagers. He also assisted the researcher to facilitate participatory workshops with villagers.

Collin Sibanda, Chimanimani Tourist Association, is a local ornithologist and senior tour guide in Chimanimani, Zimbabwe. Collin was very helpful during species modelling activities, participatory GIS mapping and transect walks. Collin has vast knowledge of the areas in the region. He also led us to other key biodiversity areas inside Chimanimani National Park and Community Forests (Vhimba, Makuripini, Nyamarirwe, Chibasani and Python Pool Forest).

Mr Rwidzanai is a local forester who takes care of community forests in Chikukwa and Hangani. Based on his deep understanding of indigenous culture and forests, he escorted us to Masangoni Forests (one of the remaining traditional forests in Chikukwa Community), for us to observe the differences on distribution patterns of *V. polyanthes* in a pristine forest like Masangoni and other landscapes and or forests that are prone to deforestation and veld fires.

Tito Chironda is a local conservationist in Sussundenga District, Mozambique he was responsible of organising local transport (motorbikes) for the research for fieldwork activities. He assisted the researcher to facilitate community workshops with villagers in Chimanimani, Mozambique.

Jose Mandinga is a community park ranger in Mozambique, who have vast knowledge in Mpunga community, Moribane, Zomba, Dombe Forests as well as other core conservation areas in Chimanimani National Park, Mozambique. Jose was also actively responsible of supporting the researcher during species distribution modelling in forests in the region as well as for recording GPS points of areas (forests) cited by villagers during participatory community and GIS mapping exercises.

Piniel Mugwanda, Data Scientist and Geo-Analyst, who was engaged by the researcher to refine community maps into presentable maps. This included coding GPS points presented to produce a more final map.

Mr Bandura is a botanist and forest guard based at Vumba Botanical Gardens. He was responsible of assisting the researcher to understand various commercial and native forests across the region, and their association with invasive alien species and *V. polyanthes* in particular. During the fieldwork, Mr Bandura also guide the researcher to community forests that are heavily infested by *V. polyanthes* in Vumba. He also developed a distribution map reflecting trends and patterns of invasive alien plant species inside and around critical forests in Vumba.

John Magweni is a forester at Chirinda Forest in Chipinge. He was engaged to accompany the researcher for a transect walk aimed at assessing the distribution of invasive alien plants in Chirinda Forests and surrounding forests. He was also responsible of assisting the researcher to identify local key experts (traditional leaders and tour guides) for in-depth interviews. He was further engaged to develop a map for Chirinda Forest, reflecting distribution of invasive alien plants across the forest.

Mr Rufuse, affiliated as a park ranger at Nyanga National Park. He was engaged to develop a distribution map to reflect areas infested by invasive alien plant species in Nyanga National Park.

10. Any other comments?

When I realised that some of pre-planned activities (i.e.) radio shows were unexpectedly expensive and beyond the budgeted funds, with the advice from supervisors and in consultation with Birdlife Zimbabwe, we find it worth to use the budgeted amounts to examine the spread of *V. polyanthes* in other Key Biodiversity Areas (KBAs) which are also protected areas in the eastern highlands of Zimbabwe that share boundaries with Mozambique. The main objective was to trace the interlinkages of borderland dynamics (cross-border movement of people, goods and livestock), shared climatic conditions and spread of invasive alien plants in the region, particularly the idea was to trace the origins of invasive alien plants (including *V. polyanthes*) that were invading protected areas in the region. In this regard I visited three other protected areas that include Vumba Botanical Gardens, Chirinda Forest and Nyanga National Park.

Vumba Botanical Gardens, which is 159 ha of a forest landscape that comprises of perennial streams. It consists of both native (Bunga Forest) and commercial forests (that include pine trees). The reserve is adjacent to communal areas which include Chigodora communities under Chief Zimunya. I, therefore, managed to conduct two transect walks in Vumba Botanical Gardens and Bunga Forest to assess the spread of *V. polyanthes* plant and in-depth interviews with nine key experts from Chigodora and Chitakatira Villages and Burma Valley Estates. Transect walks were coordinated by three forest guards, who have been working at the garden for over 10 years and a botanist who was from Harare Botanical Gardens. We observed that *V. polyanthes* was heavily encroaching around the boundaries of the Botanical

Gardens where human encroachment is unfolding. Likewise, while *V. polyanthes* population was so little inside Bunga Forest it was increasing around the Bunga Forest. During the discussions with forest guards, we learnt that *V. polyanthes* was invading disturbed areas (especially those once affected by fires). From the discussions, we established that forest guards have little knowledge regards the background of *V. polyanthes* in the region, though they shared that it was originally from Mozambique. Unlike in Chimanimani where *V. polyanthes* was associated with climate change, key experts in Vumba associated the origins and spread of *V. polyanthes* with fire outbreaks. *V. polyanthes* was first observed following a transboundary fire, that emerged from communities in Mozambique. Beside fires, cross border movement of livestock between Zimbabwe and Mozambique is believed to be another major pathway that is promoting the spread of *V. polyanthes* from Mozambique into Zimbabwe.

However, key experts affiliated with private sectors associated the spread of *V. polyanthes* with poor land management especially in commercial plantations following land reform programme in the 2000s. However, little have been done to address the spread of *V. polyanthes* in the region, including inside the botanical garden. However, while local farmers and private companies (banana plantations) often utilise mechanical (stumping, weeding and cutting) to reduce the spread of the species in cultivated landscapes, the effectiveness of the chemicals is in doubt. For instance, some of the traditional leaders who also led farmers highlighted that they have tried several herbicides including mixing them before applying to crop fields infested by *V. polyanthes* but without success. Apart from *V. polyanthes* we established that Vumba Botanical Gardens is quickly infested by other invasive alien plants. Most common plants we witnessed inside the garden are *Lantana camara*, Tabour Boer, Milkthistle and wattle that are invading areas with commercial forest. However, little is known on how to control these new plants. Mechanical measures (slashing) have been applied to control milk thistle and *Lantana Camara*, but the plants have increased instead.

Nyanga National Park is among the oldest protected first established in Zimbabwe, it was declared a national park in 1969. The park lies at attitudes between 1,800-2,593 m and consists of the highest point in Zimbabwe (Mount Nyangani). Like elsewhere in the eastern highlands of Zimbabwe vegetation of Nyanga is montane forest-grassland mosaic, within the montane grasslands and shrublands ecoregion. The idea of visiting Nyanga National Park emerged during discussions with Chimanimani National Park rangers who were previously affiliated at Nyanga National Park. At least five park rangers figured out that Nyanga National Park is severely infested by invasive alien plants, therefore I decided to seek more details on how park authorities are handling the spread of invasive alien plants, as well if *V. polyanthes* was among the invasive plants infesting the park and how the spread is associated with proximity of the park to Mozambique. I conducted some focus group discussions with park rangers in Nyanga National Park and key informant interviews with ecologists (aquatic and terrestrial) and a senior park ranger. Through these engagements, I learnt that the population of *V. polyanthes* is very low inside the park it is increasing in park boundaries adjacent to communities in the eastern side of the park close to the Mozambique border.

In addition, while park rangers acknowledged that they have observed *V. polyanthes* in other areas including indigenous forests in Nyanga, they have little knowledge on how the plant is spreading from one point to another. Existing observations were that the species is common in areas that are often associated with fire outbreaks. Key experts reflected that *V. polyanthes* originated from some parts of Mozambique but was spreading into Zimbabwe through human movement. However, while there are no *V. polyanthes* inside the park, Nyanga National Park is highly infested by commercial timber plantations (*Pinus patula*, wattle and *Eucalyptus grandis*) believed to have been planted by early colonialists they first occupied the area. These three species are invading habitat landscapes of small wildlife (duckier) and birds like the blue swallow. The wattle is observed as the most dangerous of the three since its spread is facilitated by fires. Currently, strategies employed to manage these trees is proving to be less effective, for instance the park management has employed massive harvesting of the species for timber purposes, however, this is not addressing regrowth. Besides mechanical methods, around 2010 some chemicals were once used to control wattle seedlings, though this was effective the chemical was not applied in many areas since park authorities were hesitant that the herbicides will cause damage to untargeted species like butterflies and birds.

Chirinda Forest Reserve was established in 1951. It covers approximately 950 ha of evergreen forest on the slopes of Mount Selinda in the southeast of Zimbabwe in Chipinge District, it is situated at the border with Mozambique. The forest reserve is manned by Forest Commission. The forest reserve is situated between 900 - 1,200 m in attitude, and receives some 1,370mm – 1,466 mm annual rainfall. In early 1980s Forest Commission extended the forest to reduce direct human encroachment on the key forest areas. During key informant interviews with local conservationists and key experts in Chimanimani, thus when it emerged that *V. polyanthes* is also causing havoc in Chipinge District. So, when I discussed these findings with supervisors, they encouraged me to consider Chirinda Forest Reserve, particularly to find out if *V. polyanthes* is spreading into forest area. I conducted six in-depth interviews with forest guards, tour guides and traditional leaders (for Masheedze, Barauta and Mandaa communities surrounding the reserve areas) and two mapping activities with forest guards. In Chipinge *V. polyanthes* is believed to have originated from Mozambique. Among the key findings, we figured out that *V. polyanthes* spread is associated with changing climatic events, particularly cyclones (like in Chimanimani), droughts, overgrazing, veldfires and deforestation. Maps presented by forests guards reflected that *V. polyanthes* is increasingly spreading into the extended forest zone where deforestation is rampant. Local communities, rely on the forest edges for firewood, housing and fencing poles, grazing areas and other non-timber forest resources. While local experts are aware of the benefits of *V. polyanthes* i.e., augmenting bee fodder, source of firewood and manure, they are unaware of its ecological impacts especially if it invades forest reserve. In this regard, forest management reflected that the increasing density of *V. polyanthes* is likely to shape fire regimes by facilitating fire outbreaks and or promote flow of fire inside the forest reserve.

Besides, the above reflection of other study areas that were further involved during the research process, the researcher has two comments that may promote the future of Rufford Foundation projects in Zimbabwe and internationally:

1) Given the challenges associated with publishing in high impact scientific journals especially for early career scholars (researchers) in the global south, I suggest that Rufford Foundation can establish an open access journal were funded researchers will be given priority to publish their work (for instance something which is similar to the British Ecology Society which have journals for various ecological disciplines see also: <https://www.britishecologicalsociety.org/publications/journals/>). In this regard, readers will have a full access to detailed findings and how the research was conducted. This will also promote interaction of upcoming scholars with senior researchers during the article reviewing process.

2) I also suggest for a conference in Zimbabwe, so that all Rufford Foundation winners can share insights on how our research findings can be useful towards conservation policy framing and implementation. Given that Birdlife Zimbabwe previously hosted another Rufford Foundation project before this one, I found it quite eligible to host a national conference. Additionally, it is a nationally recognised organisation with capacity to seek audience from various environmental institutions including government agencies. A conference will be a good platform for our findings to move from a local level to national level. It will be a good platform for researchers to have an interface with policymakers (particularly parliamentary portfolio committee for Environment, Tourism and Hospitality Industry, Lands, Agriculture, Water, Climate and Rural Settlement). Besides meeting policymakers, it will be an opportunity to meet other important government agencies with critical roles in implementing environmental laws (Environmental Management Agency and Zimbabwe Parks and Wildlife Authority). This will be a vital platform for all Zimbabwe Rufford Foundation project recommendations to be given a chance to shape environment policy.

Specifically, for my research, I will find it as an opportunity to reach out to government stakeholders to urgently declare *V. polyanthes* as an invasive alien species and discuss potential management frameworks of the species and other invasive alien plants across the country. Beyond this, conference outcomes will include publishing a book which will be a significant platform for all Rufford Foundation recipients to share their experiences, study findings and project recommendations to a wide community of environmentalists across the country.

Above all, I am thankful to The Rufford Foundation for extending funding to research one of the areas I am passionate about. I am confident that continuous engagement with locals and experts in the field of biological invasions will enable this work to immensely contribute to policy formulation for invasive species in Trans-frontier Conservation Parks in southern Africa.