

## Final Evaluation Report

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Your Details	
<b>Full Name</b>	Mercy Ndalila
<b>Project Title</b>	Aspects of fire regimes in a major Kenyan ecosystem in the face of increased global vulnerability to wildfires
<b>Application ID</b>	35623-1
<b>Date of this Report</b>	30 May 2023

**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 map the patterns of fire severity from the 2019 wildfire				<p>I conducted fieldwork in March 2022 to assess ecosystem recovery after the February 2019 fire. From the survey, Chogoria route, the area of the first fire ignition, was most affected relative to other routes. Although the moorland vegetation is recovering well, the fire scar is still present in <i>Hagenia</i> and <i>Lobelia</i> sp. The fire scar was missing in the giant heather which is very flammable yet quick to recover from a fire event.</p> <p>A fire severity map was then created. The map showed two distinct fires: in Chogoria (17,312 ha) and Marania (3,764 ha), with the heathland and alpine areas more affected. The Marania fire (to the north of Mt Kenya) occurred near farmlands and was as a result of escape from agricultural burning.</p> <p>About 54% of Chogoria and 30% of Marania fire perimeter burnt as high-very high severity and occurred mostly in the southwestern and northern parts of the two fires, respectively. Fire severity information is important in guiding forest restoration activities, especially in the severely damaged areas.</p>
To assess the influence of landscape variables on fire severity to determine critical habitats at risk of wildfires.				<p>Weather indices were unexpectedly lower and were therefore not significant predictors of fire severity. In fact, the indices had an opposite influence on fire severity. Typically, fire severity increases with elevated fire weather. However, in this case, fire severity was higher when weather was not elevated. This could be due to the course resolution of the datasets, so determination of finer scale weather pattern was not possible.</p> <p>Terrain, especially north, had a bigger impact on fire severity than weather. The</p>

			<p>more north the slope was, the lesser the fire severity. So, fire severity was higher in southern slopes. Severity was also higher for steeper slopes and on ridges than on valleys.</p> <p>Vegetation type was also influential. Severity was higher in the heathland areas. The fire was mostly restricted in the upper elevation zone, although a few upper afro-montane areas were affected as well.</p>
<p>To determine historical fire weather and project future weather for the region.</p>			<p>I determined historical weather (1990-2020) for the region using ERA5 climate data. As aforementioned, weather indices were low, especially at the ground level. Weather in the lower atmosphere was high. The lower values were likely due to a coarse spatial resolution of the gridded weather data (28 km) which could not adequately resolve the finer scale weather variability.</p> <p>The next step is to use a global climate model (CMIP6) to model future weather. I've already acquired the needed data, and analysis is just starting.</p>
<p>To determine and improve the level of preparedness of nearby communities for uncontrollable fires.</p>			<p>The surveys were conducted in the form of semi-structured questionnaires and key informant interviews around December 2022. We sampled 11 villages (representing 11 community forest associations; CFAs) that included, in the order of sampling, Ragati, Hombe, Naro Moru, Gathiuru, Nanyuki, Ontulili, Marania, Meru (Kathoki), Chogoria, Chuka, and Njukiri. The villages were located within Nyeri, Laikipia, Meru, Tharaka Nithi and Embu counties.</p> <p>We interviewed 55 respondents and reached about 100 locals around the forest stations through fire awareness. The most common training need by the locals was firefighting. We therefore conducted firefighting training on 26<sup>th</sup> April 2023 to about 18 locals from Ontulili forest station. The trainees comprised six women and 12 men. The two-part training was provided by Mt Kenya Trust and involved theoretical background on fire management, and a practical training on firefighting using basic tools.</p> <p>We focused on the Ontulili community because of limited finances to train over 10</p>

				groups at a go and because they are the most fire-affected among all CFAs in Mt Kenya. The forest is also a major fire hotspot in Kenya.
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**2. Describe the three most important outcomes of your project.**

- a) Improved scientific knowledge on wildfires in Mt Kenya forest, which will hopefully and eventually result in reduced wildfire threat to ecosystems and communities.
- b) The capacity of 18 Ontulili community members in fire management improved so that they can prevent wildfire ignitions and combat unexpected fires. Additionally, through the surveys, around 100 community members from nearby villages were made aware of wildfires and their impacts, and their attitudes towards wildfires hopefully changed.
- c) I built networks with fire agencies, among them the Africa Fire Mission, based in Ohio, USA, whom I approached to provide training to other Mt Kenya CFAs that have not received training on firefighting. They agreed to provide the training in November 2023.

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

The first challenge was obtaining research permits, which delayed ecological fieldwork. The delay was due to the requirement to fulfil Nagoya protocol on bioprospecting because of the 'traditional knowledge' clause. I therefore appealed the decision because traditional knowledge formed a minor component of my research. The Nagoya compliance would have further delayed the work. My appeal was accepted, and the permit approved.

Getting spatial data from various agencies was challenging. The long bureaucratic process of requesting for data, as well as high prohibitive data acquisition costs meant that progress was delayed. That's why one objective has been partially completed. Nonetheless, I have been able to use verified alternative sources, where possible.

The next major challenge was a wildfire on the first day of reconnaissance while at the first camp up on the mountain. The fire seemed distant when we arrived at the camp, only for the winds to suddenly change direction and move faster in our direction. We had to escape from the fire at night with the fear of wild animals only becoming secondary. We were rescued shortly after and taken back to a hotel managed by the camp. I learnt the importance of proper coordination during evacuations; this could be improved. The irony of it was that fire was the subject of my research, but I became the subject of the fire. Talk about baptism by fire.

Another challenge was some routes did not have enough rangers, so I had to enlist a local person to provide additional security while inside the park. Luckily, many

animals were in the low-elevation forested areas or appeared in the night while we were mostly in the upper-elevation areas, and we also avoided working at night.

Some high elevation areas in the park could not be reached by vehicles because of the narrow foot paths, rugged terrain, and muddy roads from heavy rainfall half way through fieldwork. This is the rainfall that eventually extinguished the aforementioned fire. We therefore had to walk several kilometres up the mountain under intense sun and steep terrain looking for field points, which tested the limits of my endurance. I couldn't reach some points that I pre-selected on a map because they were inaccessible (either on very steep hills or beyond cliffs). I therefore had to select other points on the go to cover for the limitation.

All in all, fieldwork was fun, and I had a great time traversing the beautiful natural landscapes of Mt Kenya, and going round the mountain, covering a circumference of over 300 km.

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

The forest-adjacent community members were the main target group and the direct beneficiaries of this research. They benefitted from training in firefighting and awareness raising on fire preparedness. I surveyed 55 local respondents, raised awareness on wildfires to about 100 of them in/near the forest stations, and through Mt Kenya Trust, 18 members of the Ontulili CFA were trained. The knowledge gained will help advance the goal of forest conservation on the mountain and reduced threats from wildfires.

The local guides, porters and "security" that I enlisted were all drawn from the community and were useful in data collection and providing the needed local knowledge about the people, places and wildlife. The work of my main guide was impressive, especially with identification of different plants. I therefore gave him a handheld GPS unit so that he could improve on navigation during his frequent visits. I had already trained him on marking coordinates and navigation, but he could improve a lot with a personal GPS unit.

#### **5. Are there any plans to continue this work?**

Yes, I plan to organise a restoration of fire-degraded areas that are near farmlands to the north. I also plan to do a scientific comparison of the 2019 fire and the recent 2022 fire to determine differences in fire behaviour and other dynamics.

I plan to engage more organisations as trainers to increase community wildfire knowledge in areas that have previously not received wildfire training. I also plan to scale up this work to other ecosystems (beyond Mt Kenya) and compare fire regimes between forest and savanna ecosystems.

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

The results in the form of technical reports will be or have been shared to the following institutions as part of fulfilling park access and research permit requirements: Kenya Wildlife Service; Wildlife Research & Training Institute; and National Commission for Science, Technology & Innovation (NACOSTI).

I have presented my findings virtually in two conferences in Kenya and USA, and currently finalising a manuscript for onward submission to a relevant journal. I also plan to (in future) organise a stakeholders' workshop, where I will share the findings with relevant agencies for translation to action. Improvements to the fire management plan for Mt Kenya (which has not been publicly shared) will be a good outcome of the workshop.

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

As aforementioned, the two important steps are: (1) firefighting training to Mt Kenya CFAs that have not received related training; and (2) A stakeholders' workshop which will be a great opportunity to initiate discussions on formulation and enactment of a national fire management policy.

**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?**

Yes, I used the Rufford Foundation logo during the virtual oral presentations at an international conference in Machakos university (in June 2023), and another international emergency management (TIEMS) conference in Atlanta, USA (in October 2022). The Foundation has also been acknowledged in technical reports and journal manuscript.

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

I was the lead researcher, conducting overall research ranging from fieldwork (both ecological and social) to desktop spatial analysis. I also organised community training on firefighting.

**Dr Grant Williamson** of University of Tasmania, Australia, assisted (and is still assisting) in climate and programming aspects of the research given his extensive experience in GIS, statistics and climate modelling.

**Dr Obed Ogega** has been helpful in the meteorological components of this study. He is an adjunct professor in climatology at Mount Saint Vincent University, Canada, and has conducted extensive climate science research in East Africa, including Kenya.

**Prof Stanley Makindi** of Machakos University, Kenya, is my postdoctoral supervisor. He provided overall guidance to the project, and on issues related to ecology and

natural resource management. He also provided administrative support, including disbursement of funding through the university.

#### **10. Any other comments?**

I very much appreciate The Rufford Foundation for funding the project which enabled me to conduct research and improve the local capacity in fire management in Mt Kenya forest. The forest has experienced increased wildfire events in recent times, so this study was timely. The project was a success because most of the project activities were achieved. Importantly, the project went beyond investigating one forest station in Mt Kenya, and instead extended the research to the entire Mt Kenya ecosystem. This therefore enhances scientific knowledge on wildfires for the entire ecosystem.



Photo 1: Mercy during the ecological survey (in March 2022) along Chogoria route of Mt Kenya ecosystem. © Mercy Ndalila.



Photo 2: Mercy talking about wildfires to Chuka community members (south-east of Mt Kenya) in December 2022. © Mercy Ndalila.





Photo 3: Ontulili community forest association members receiving practical training on firefighting. The training was provided in April 2023 by Mt Kenya Trust, a major NGO in the region. © Mercy Ndalila.