

Final Evaluation Report

| Your Details | |
|----------------------------|---|
| Full Name | Jambay Dorji |
| Project Title | Prediction Modelling of Forest Fire Prone Areas of Bhutan under Current and Future Climate Scenario |
| Application ID | 35064-1 |
| Date of this Report | 06/08/2022 |

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 |
|---|--------------|--------------------|----------------|--|
| The main objective of this project was to build the prediction modelling of Forest Fire Prone Areas under Current and Future climate scenarios (2050, 2070) in Bhutan | | | | Prediction modelling of forest fire prone areas was built for current and future climate scenarios (2050, 2070) in Bhutan with a laptop with a high capacity which was purchased with the help of funds. Mostly forest fire incidence occurred in the western and eastern parts of the country which were covered by blue pine and chir pine forest. |
| To identify the key drivers associated with the occurrence of forest fire in Bhutan | | | | The result of the project shows that anthropogenic activities are the main cause of forest fires in Bhutan. |
| Creating Forest Fire awareness among Local Residents | | | | We successfully covered forest fire prone areas and undertook awareness campaigns among the people living near the forest fire occurrences. The use of methodology and the results were also presented at the Department of Forest and Park Services. |
| Introduction of the concept of MaxEnt Modelling for Forest Management for a wider audience | | | | Due to this project, others have also planned on doing similar projects using the similar methods |

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

The most significant achievement of this project was ultimately mapping, identifying and predicting forest fire prone areas for early action and preparedness to prevent and put early measures to control forest fires. The result is communicated to the forest department, relevant stakeholders, and policymakers at national levels for effective planning to prevent and manage forest fires.

a). Successfully modelled and identified the forest fire prone areas in Bhutan for early action and preparedness. Factors associated with forest fire are important scientific knowledge to prevent and put early measures to control the fire. Thereby, intervening in the mitigation of forest fire and forest fire-related disasters with the right method, at the right time, and right place.

b). Creating awareness through presentation and audio-visual means. People were briefed on the effect of forest fires on the environment, society and economy. Furthermore, signboards and posters on forest fire prevention measures and the importance of biodiversity conservation have been installed along the national highways, and in public places like school sub-district and park offices, and shops.

c). Data on the actual record of forest fires from around the country. These data can be used in various ways by the Forest Department and the other research in preparedness and early action to control forest fires in the country.

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

The project was an ambitious attempt to predict forest fire prone areas in Bhutan under current and future climate scenarios. There were a few challenges during the project, though they did not mean changing the plans that were previously made. During the collection of data, we had to travel the whole country which was quite challenging as we had to deal with different people every other day. As Bhutan is a mountainous country, the places were hard to access, which made data collection all that difficult. Apart from that, we didn't face any major setbacks. The travelling and accommodation expenditures were higher than expected even for the planned part of the survey. We slightly adjusted the budget from other items to help cover the shortfall.

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

The local communities were involved in several ways, for instance as field assistants, local guides and camp attendants to navigate the fire location as they knew the location better. They also benefitted economically by hiring their horses, mules and donkeys. In addition, the local people benefited from learning and sharing skills to participate in scientific data collection to be employed for future research projects that will be undertaken in the area. The local people involved in this project will be advocates of forest fires and their effect on the environment, society and economy. The community leaders were also involved in this project through discussion about the importance of the project and controlling the forest fires in particular areas. As far as possible we tried to involve young people in the project to instil in them an interest in research from a young age.

5. Are there any plans to continue this work?

There are plans to continue the work in the future. Forest fire is one of the most prominent threats to forest degradation and a serious hindrance to the national conservation efforts of Bhutan. Every year, a large area of forest is lost to a forest fire and studies are still lacking. Currently, we have tried to predict the model of forest fire prone areas, but these data can still be refined and made better in future. Further, there are future plans to work on the identified forest fire prone areas to take early action and make preparedness to control or prevent the forest fire.

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

The results, if not shared, are worthless. One of the most effective methods of sharing the results is through publications in peer-reviewed journals. Hence the paper is being written for publication and there are plans to attend conferences whenever the opportunity comes. The full written reports of my project have been shared with the Department of Forest and Park Services of Bhutan and Sherubtse College under the Royal University of Bhutan. The results of the project will also be disseminated through websites to reach the public at large. In addition, I will give presentations at local and national workshops and conferences about the results of the project.

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

The current research project was successful in achieving the goals as planned. The next important steps for this project are to manuscript preparation for publication in well regarded journals and submit the reports to the decision makers to initiate the implementation of recommendations from this project to control and prevent the forest fire, especially in identified forest fire prone areas. We have identified forest fire prone areas mostly in the western and eastern part of the country which is covered by blue pine and chir pine forest, so our next plan is to make early action and make preparedness to control or prevent the forest fire occurrence in identified forest fire prone areas. Further research with even more vigorous field data collection can be also done.

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?

The project was carried out with funding support only from Rufford Foundation. Hence the logo was used in presentation slides and acknowledged in the main report. If the paper is published in future, The Rufford Foundation would be kindly acknowledged for its generosity. The Rufford Foundation and its aim were also brought up while making conversation with people.

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

The members who helped me in the project are as follows:

Mr Chimi Tshewang – Field Assistant. Help me in the collection of Data.

Mrs Karma Chekey - Field Assistant. Help me in the collection of Data.

Mr Sonam Wangdi - Providing the Spatial Data and Forest Fire Data that the Department of Forest and Park Service have that will assist my Project.

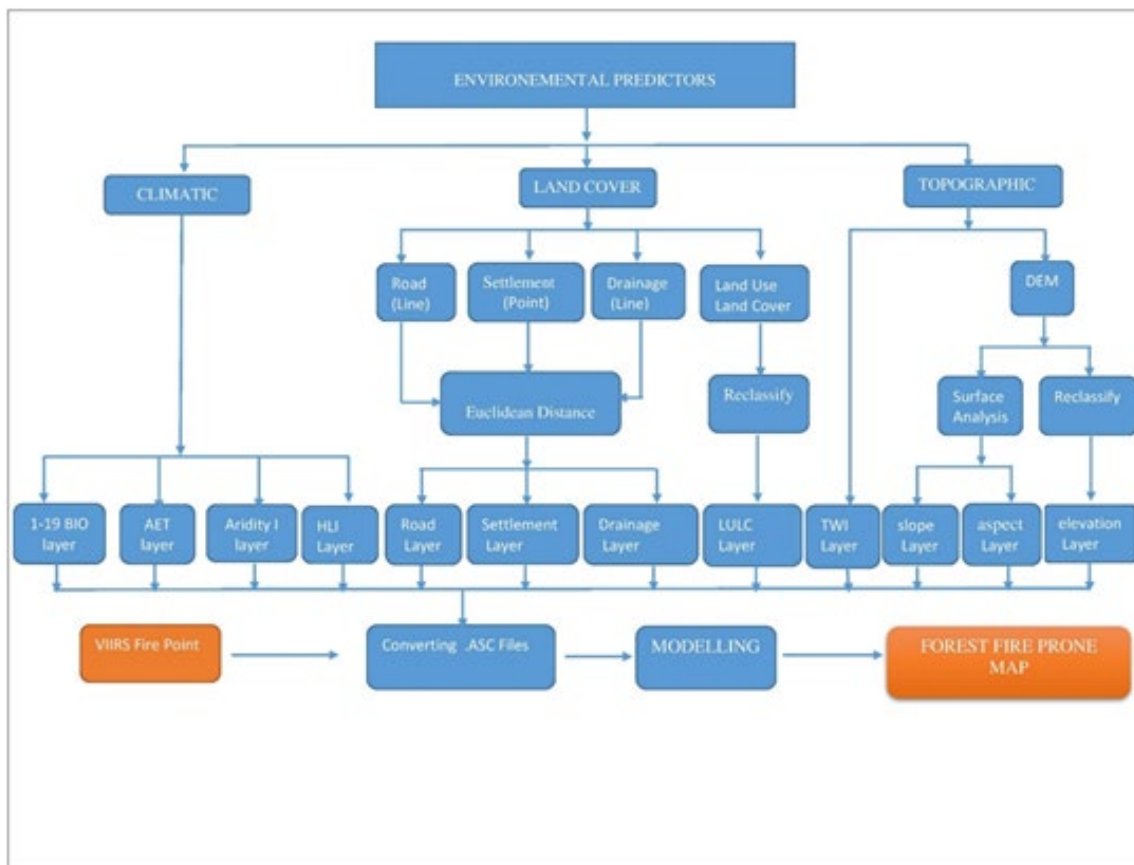
Mr Rinchen Dorji – Forest Officer at Lhuentse Range Forest Office. Help me with accommodation and guidance for my project.

Dr Amit Kumar Verma - has been supervising this research project starting from proposal development to finalizing the data collection. In addition, his help and support in organizing and analysing the data and manuscript preparation for publication in well-regarded journals.

Taxi Driver – all the drivers who assist us to carry to the destination during the project.

10. Any other comments?

I would like to express my warm appreciation and thank The Rufford Foundation for funding my research project that otherwise wouldn't have been conducted. This financial support enables me to direct my activities only toward achieving the planned goals. I hope the Rufford Foundation will continue to provide such support to our growing conservational researchers for their work.



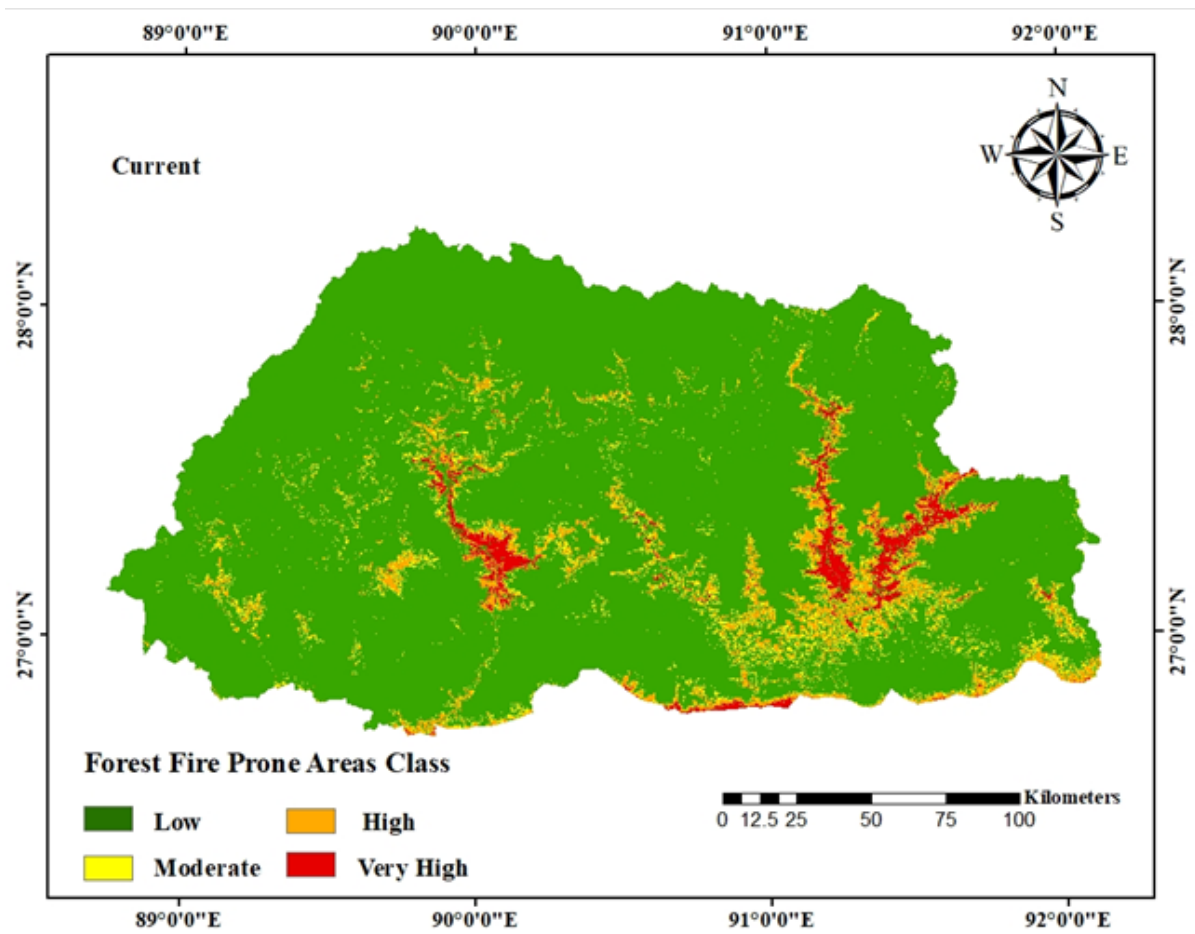


Figure 1: Current Fire Prone Area Map.

Table 1: Areas under different Fire Prone Area Class

| Prone Area Class | Area sq. km) | Percentage |
|------------------|--------------|------------|
| Low | 33731.6 | 87.8 |
| Moderate | 1502.6 | 3.9 |
| High | 2290.8 | 6 |
| Very High | 869 | 2.3 |

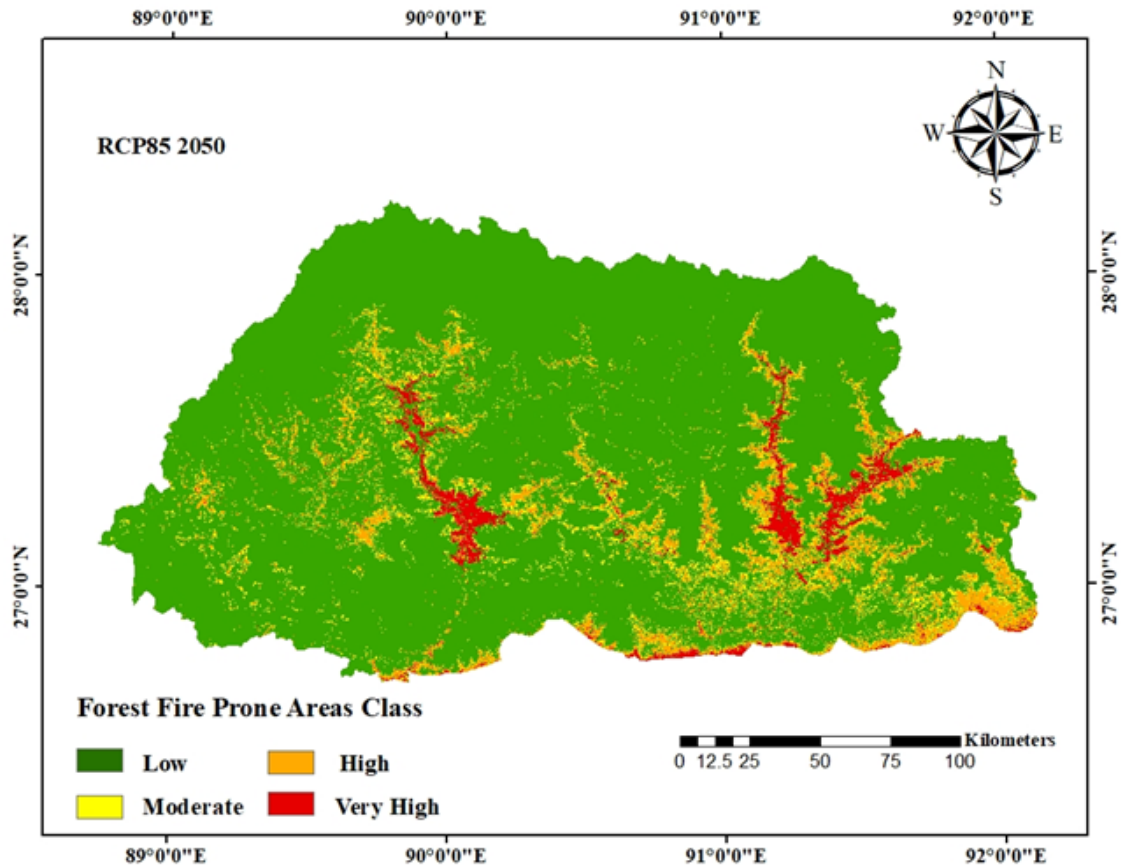


Figure 2: Forest Fire Prone Area Map RCP 85 (2050).

Table 2. Area and Percentage of different class of Fire Prone Area RCP 85 (2050)

| Prone Area Class | Area (sq. km) | Percentages |
|------------------|---------------|-------------|
| Low | 33123.5 | 86.6 |
| Moderate | 1176.5 | 3 |
| High | 2998.3 | 7.8 |
| Very High | 1095.7 | 2.6 |

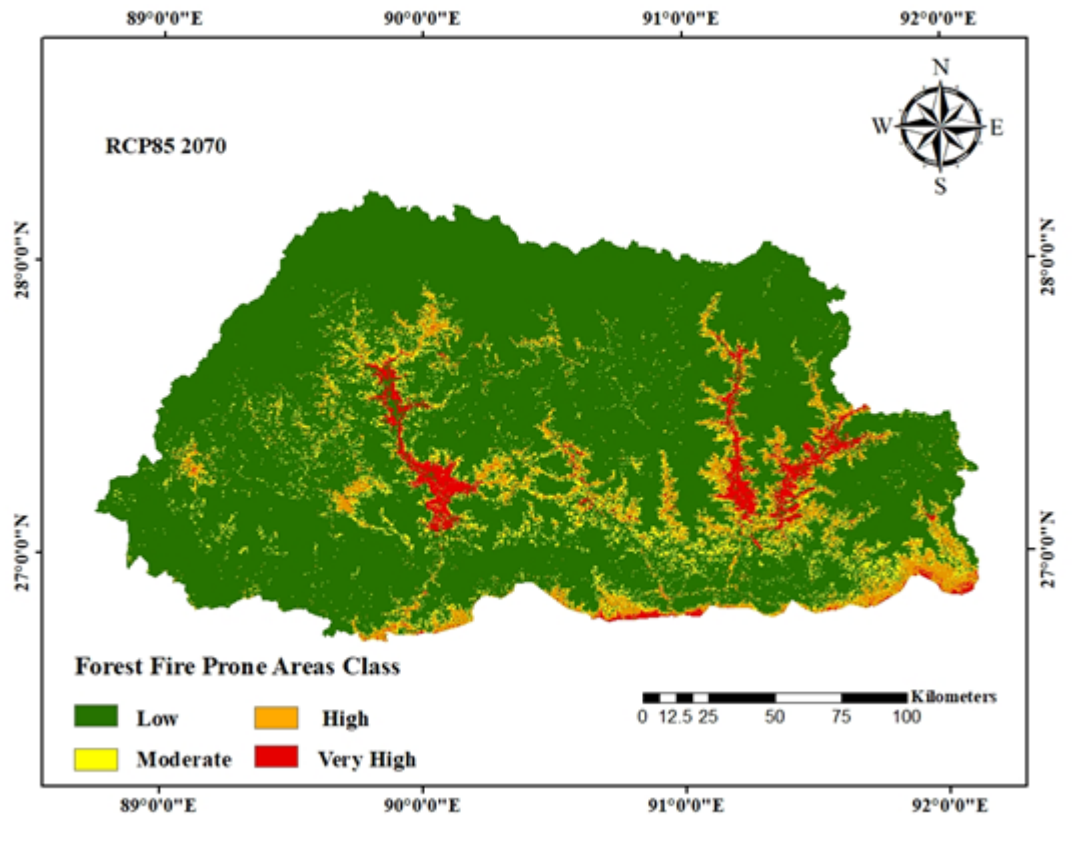


Figure 3: Forest Fire Prone Area Map RCP 85 (2070).

Table 3. Area and Percentage of different class of Fire Prone Area RCP 85 (2070)

| Prone Area Class | Area (sq. km) | Percentages |
|------------------|---------------|-------------|
| Low | 33434.7 | 83.7 |
| Moderate | 1080.3 | 6.2 |
| High | 2785.5 | 7.3 |
| Very High | 1093.5 | 2.8 |