The Rufford Foundation
Final Report

Congratulations on the completion of your project that was supported by The Rufford Foundation.

We ask all grant recipients to complete a Final Report Form that helps us to gauge the success of our grant giving. The Final Report must be sent in **word format** and not PDF format or any other format. We understand that projects often do not follow the predicted course but knowledge of your experiences is valuable to us and others who may be undertaking similar work. Please be as honest as you can in answering the questions – remember that negative experiences are just as valuable as positive ones if they help others to learn from them.

Please complete the form in English and be as clear and concise as you can. Please note that the information may be edited for clarity. We will ask for further information if required. If you have any other materials produced by the project, particularly a few relevant photographs, please send these to us separately.

Please submit your final report to jane@rufford.org.

Thank you for your help.

Josh Cole, Grants Director

Grant Recipient Details	
Your name	Jiban Chandra Deb
Project title	Mapping rare and endangered species distribution of a protected area in Bangladesh under future climate scenario: Implications for Conservation Planning
RSG reference	15263-1
Reporting period	July 2015
Amount of grant	£4850
Your email address	j.deb@uq.edu.au
Date of this report	30.07.2015

1. Please 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
Analysing tree diversity of the study area in order to find out the rare and endangered tree species distribution			√	We identified 28 rare and endangered tree species belonging to 18 families in the study site.
Modelling the distribution of target species under future climate scenarios for conservation planning			√	The spatial distribution of three rare medicinal tree species namely *Terminalia chebula, Terminalia bellirica,* and *Phyllanthus emblica* were modelled under future climate scenarios.

2. Please explain any unforeseen difficulties that arose during the project and how these were tackled (if relevant).

Rema-Kalenga Wildlife Sanctuary (study site) is situated in a very remote area at Chunarughat Upazilla, Habiganj. It is approximately 20 km away from Chunarughat town. The road from Chunarughat town to the study site is not well developed and therefore, we faced transportation problem to access the forest. We also faced accommodation problems during fieldwork in the study site. However, we had overcome from these difficulties due to the help from staffs of Forest Department and local people.

3. Briefly describe the three most important outcomes of your project.

The three most outcomes of my project are briefly outlined below:

1. **Identification of rare and endangered tree species in the study site**

Table 1 describes the 28 rare and endangered tree species belonging to 18 families and their conservation status. Figure 1 describes the occurrences of the rare species in the study site.

Table 1: The list of rare and endangered tree species identified at Rema-Kalenga Wildlife Sanctuary and their conservation status in Bangladesh

Species Name	Family	Conservation status
Buchanania lancifolia	Anacardiaceae	Not evaluated
Holigarna longifolia	Anacardiaceae	Data deficient
Mangifera sylvatica	Anacardiaceae	Not evaluated

Swintonia floribunda	Anacardiaceae	Data deficient
Desmos longiflorus	Annonaceae	Not evaluated
Sageraea listeri	Annonaceae	Not evaluated
Bombax insigne	Bombacaceae	Data deficient
Balsamodendron roxburghii	Burseraceae	Not evaluated
Canarium bengalense	Burseraceae	Not evaluated
Canarium resiniferum	Burseraceae	Not evaluated
Terminalia chebula	Combretaceae	Data deficient
Cycas pectinata	Cycadaceae	Least concern
Anisoptera scaphula	Dipterocarpaceae	Data deficient
Elaeocarpus acuminatus	Elaeocarpaceae	Not evaluated
Lithocarpus acuminata	Fagaceae	Not evaluated
Homalium schlichii	Flacourtiaceae	Not evaluated
Hydnocarpus kurzii	Flacourtiaceae	Not evaluated
Litsea clarkei	Lauraceae	Not evaluated
Calliandra umbrosa	Leguminosae	Not evaluated
Magnolia pterocarpa	Magnoliaceae	Not evaluated
Dysoxylum binectariferum	Meliaceae	Not evaluated
Knema bengalensis	Myristicaceae	Vulnerable
Pterospermum semisagittatum	Sterculiaceae	Data deficient
Aquilaria agallocha	Thymelaeaceae	Data deficient
Dipterocarpus turbinatus	Dipterocarpaceae	Critically Endangered
Shorea robusta	Dipterocarpaceae	Least concern
Phyllanthus emblica	Euphorbiaceae	Data deficient
Terminalia bellirica	Combretaceae	Data deficient

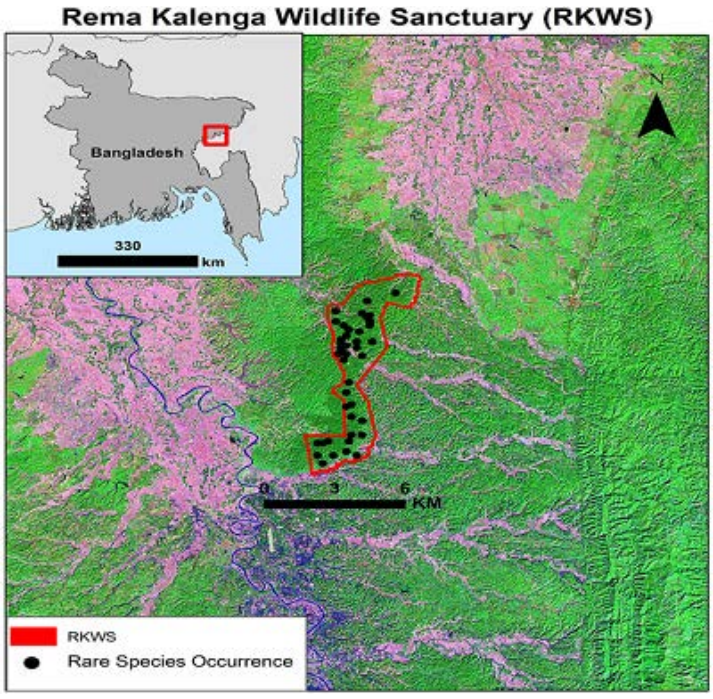

Figure 1: Rare and endangered tree species occurrences in the study area: the red mark inside the panel indicates the location of Rema-Kalenga Wildlife Sanctuary (RKWS) in Bangladesh, the black dot points are the positions of rare species occurrences in the study site.

2. Modelling three rare medicinal tree species distribution in changing climate scenarios

We selected three rare medicinal tree species namely *Terminalia chebula, Terminalia bellirica,* and *Phyllanthus emblica* in our study for spatial distribution modelling under future climate scenarios. We used presence only data of these three rare species from field survey and Bangladesh Forest Department (Figure 2). We used current and future climate (for the years 2050 and 2070) data from WorldClim database in our study. We selected only one Representative Concentration pathway (RCP) scenario (RCP8.5) in our study. At first, 20 bioclimatic variables were selected and after doing a multicollineraity test, 11 variables were finally selected for model building (Table 2). We used MaxEnt modelling algorithm for species distribution modelling.

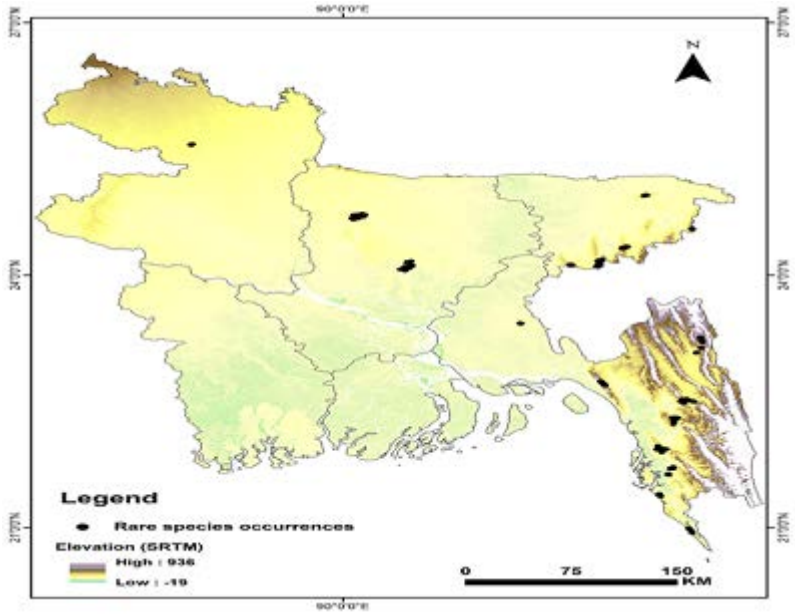

Figure 2: Presence only data of three rare medicinal tree species (i.e. *Terminalia chebula, Terminalia bellirica,* and *Phyllanthus emblica*) across Bangladesh (source: field survey and Bangladesh Forest Department).

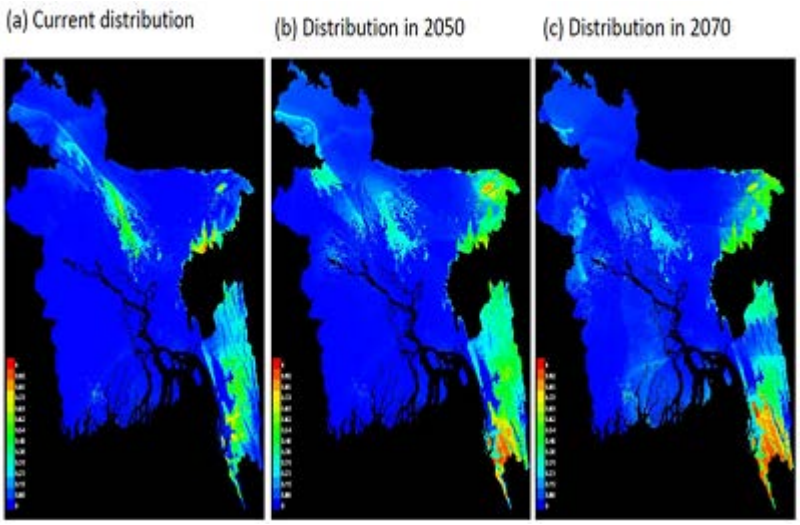

Figure 3: Prediction distribution of *Terminalia chebula, Terminalia bellirica,* and *Phyllanthus emblica* species: (a) current distribution; (b) distribution in 2050; and (c) distribution in 2070. The values in the colour scale (0 to 1) denote the habitat suitability distribution. The value 1 indicates the most habitat

suitability of the species. The habitat of rare species in the central (deciduous forests) and north-eastern (evergreen forests) region of Bangladesh are more vulnerable to climate change compared to south-eastern (semi-evergreen forests) region.

Figure 3 explains the likely distribution of the studied rare species in Bangladesh forests. The values in the colour scale (0 to 1) denote the habitat suitability distribution of the rare species. The value 1 indicates the most habitat suitability of the species. The Rema-Kalenga Wildlife Sanctuary is situated in the north-eastern region of Bangladesh (Figure 1). It appeared that in the north-eastern region (evergreen forests) of Bangladesh, the likely distribution of rare species will be decreased continually at higher emission pathway RCP8.5 in 2050 and 2070 (Figure 3). The central part of the country where the rare species are found in the deciduous Sal (*Shorea robusta*) forests will experience same scenarios (Figure 3). The semi-evergreen forests located in the Southeast part of Bangladesh will be comparatively more suitable for the rare species in changing climate scenarios (Figure 3).

3. Identification of bioclimatic and environmental variables that are the key drivers for three rare species distribution in changing climate scenarios

Predictor variables

The key bioclimatic predictor variables were altitude (42.4%) following annual rainfall (16.6%) and precipitation of driest quarter (13.5%) in the model (Table 2). The precipitation of warmest quarter (10.6%) was also influential. Other bioclimatic variables did not contribute significantly to the model (Table 2).

Table 2: The percent contribution of the environmental variables for building the MaxEnt model of the rare species

Variables	Descriptions	Contribution (%)
BIO1	Annual Mean Temperature	0.7
BIO3	Isothermality (BIO2/BIO7) (* 100)	0.2
BIO6	Min Temperature of Coldest Month	3.9
BIO7	Temperature Annual Range (BIO5-BIO6)	2.4
BIO8	Mean Temperature of Wettest Quarter	2.4
BIO12	Annual Precipitation	16.6
BIO14	Precipitation of Driest Month	0.3
BIO15	Precipitation Seasonality (Coefficient of Variation)	7.1
BIO17	Precipitation of Driest Quarter	13.5
BIO18	Precipitation of Warmest Quarter	10.6
alt	altitude (elevation above sea level) (m) (SRTM)	42.4

4. Briefly describe the involvement of local communities and how they have benefitted from the project (if relevant).

The local people were directly involved during the fieldwork of this project. We had a focus group discussion with the local people and guide regarding the rare and endangered tree species of the study area. We had a reconnaissance survey where the local communities were the key informants regarding the availability of rare tree species in different patches of the forest. Some local people participated in the transect walk around the forest boundary. The refreshments for the participants were arranged from the project fund. In the focus group discussion, the local people came to know about the climate change impacts on rate and endangered tree species distribution in Bangladesh. This project played a significant role in creating awareness regarding climate change impacts on rare tree species to the local communities living in and around the forests.

5. Are there any plans to continue this work?

Yes, I have a specific plan to continue this work regarding climate change impacts on the endangered plants and wildlife species in Bangladesh. In this project, I have modelled the predictive distribution maps of three rare medicinal tree species under future climate scenarios in Bangladesh. The findings of the project are significant to quantify the species-environment relationships in the fragmented landscapes in Bangladesh. There are some endangered mammals and other wildlife species available in the forests of Bangladesh and their vulnerability to climate change impacts are yet to be determined. I would like to continue species distribution modelling research on endangered wildlife species in Bangladesh for conservation planning. I am going to design a future research project on this aspect which will be helpful to prepare guidelines for conservation planning of the endangered species in Bangladesh.

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

I have already arranged a workshop and seminar in the Department of Forestry and Environmental Science at Shahjalal University of Science and Technology, Bangladesh with the active participation of Forest Department officials, conservationists working in NGOs and graduate students of the university to disseminate the project findings. I am planning to disseminate the project findings to the wider range of audiences working in conservation ecology field through peer reviewed publications.

7. Timescale: Over what period was The Rufford Foundation grant used? How does this compare to the anticipated or actual length of the project?

The total time period of the project was for 1 year (July 2014 to July 2015). During this period, the RSG funds were used for reconnaissance survey, field data collection, transportation, accommodation, data analysis and report writing. The length of the period

for organizing fieldwork, field data collection took long as I anticipated. However, the project is successfully finished within the time period.

8. Budget: Please provide a breakdown of budgeted versus actual expenditure and the reasons for any differences. All figures should be in £ sterling, indicating the local exchange rate used.

Item	Budgeted Amount	Actual Amount	Difference	Comments
Stationery	40	40		There was no difference for this budget
Photocopies	30	30		Do
Recycable Paper	20	20		Do
Miscellaneous (e.g. permissions, contacts etc)	20	20		Do
Purchase of References	20	15	+5	The surplus was used for item no. 10.
Purchase of different maps, GIS softwares, GPS, etc.	200	250	-50	It was adjusted with item no. 12.
Travel from stay to research site	850	900	-50	Study site was far away from the working place. The difference was adjusted with item no. 8.
Intra transportation within and around research site	250	200	+50	The surplus was used for item no. 7.
Graduate Field Assistant - 2 persons	800	800		There was no difference for this budget
Local Field Facilitator / Guide	300	320	-20	It was adjusted with item no. 5, 15, and 16.
Publication of reports and preparation of technical papers	250	215	+35	The surplus was used for item no. 14.
Workshops and seminars	550	500	+50	The surplus was used for item no. 6.
Accommodation	700	600	+100	The surplus was used for item no. 14.
Food	700	850	-150	The price of food was more at the study site as I anticipated. It was adjusted with item no. 11, 13, and 16.
Medicine	50	40	+10	The surplus was used for item no. 10.
Miscellaneous	70	50	+20	The surplus was used for item no. 10, and 14.
Total	**4850**	**4850**		

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

This project explored many rare and endangered tree species in a protected area of Bangladesh. It can be assumed that a notable numbers of endangered plants and wildlife are available across all forests in Bangladesh and these species are highly vulnerable to climate change. This project developed the species distribution models in changing climate scenarios for three rare medicinal tree species. Unfortunately, potential impacts of climate change on forest plants and wildlife still remains as one of the most neglected areas of climate change research in Bangladesh. Therefore, more research works are needed to explore the spatial distribution of threatened species of Bangladesh under future climate scenarios. The findings of this project will be helpful for conservation planners working in Forest Department, and NGOs. Moreover, the awareness of local people is very much important regarding the value of conservation of endangered species.

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

Apart from RSG final report, I will use RSG logo in the presentation of project findings in seminars and meetings. I am preparing a manuscript for submitting in a peer reviewed international journal where the project field data is used. The RSG grant will be acknowledged in that paper and I will send a copy of the paper after the publication of the article.

11. Any other comments?

I am a faculty member in the Department of Forestry and Environmental Science at Shahjalal University of Science and Technology, Bangladesh. Being an early career researcher, it is very important to have some experiences in doing research projects. My research focuses at the interface of biodiversity conservation and climate change using remote sensing and GIS tools. My university has very limited funds for doing such kind of extensive research. Therefore, RSG project is a huge motivation and inspiration to continue my research works in conservation ecology field. I would like to thank RSG for their inspiring support to complete this research project successfully.