Final Evaluation Report

Your Details	
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Project Title	Assessment of Population, habitat and threats to *Cycas pectinata*, a vulnerable taxa in Bhutan.
Application ID	29480-1
Grant Amount	£ 5,912
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Date of this Report	

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 estimate the individual plants from two population in the east				The team has made field visits to both the sites, carried out sampling, and estimated population. In Ramjar site our study estimated around 25000 adult plants and in Lingmethang (Kurizampa) entire population of 62 *C. pentinata* plants were counted.
To assess habitat for the existing population				Habitat in both the sites were studied during field visits and habitat characterised. *Cycas pectinata* plants in both the populations thrives in open spaces of Chirepine forest and lemongrass-dominated ground vegetation. Plants are generally seen growing in rugged terrain and steep slopes.
Identify immediate threats to the population				Upon habit assessment, threats to different populations were identified and communicated through awareness and report writing. In Ramjar site, natural threats from pest infestations are more prominent compared to anthropogenic threats in Lingmethang area, particularly habitat destruction and human collection.
To create awareness of the species amongst local people and encourage them to be citizen scientist for conservation				The Covid-19 situation and strict restrictions put on public and large group gathering has limited public gathering for awareness campaign as outlined in project proposal. However, the public (parents and relatives of students) have been reached through questionnaires and responses collected. Clarifications were made through social media.
Educate school children about the species				With change in Covid-19 protocols in the country, close gatherings in small groups were allowed which has made possible to visit in schools as proposed. Students were presented with the project findings

				and encouraged to be citizen scientists in protecting species, particularly threatened taxa.
Involve students from Sherubtse College to enhance their field skills for scientific research.				Selected students were involved for field visits and data collection after required methods and skills discussed.

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

Global pandemic due to Covid-19 has greatly impacted this project, particularly field visits and awareness education programme to the students and community. Field visits had to be postponed to a later date and could only be accomplished when Covid-19 protocols were relaxed. The project intended to complete in 1 year but we had to extend this to accommodate field visits and out reaching to students. Education awareness programme could only complete that too partially with Covid-19 protocol relaxation. Students were presented with research findings in small groups and parents (as a part of community) were reached through questionnaire sent through students after presentation.

The accessibility to some areas of the sites in Ramjar was very difficult. Sampling plots were randomly selected, and quadrate laid only in those areas of habitat accessible.

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

Population structure of *Cycas pectinata* was determined. Age classification of individual plants measured in the field showed *Cycas pectinata* population has an opposite pyramid age structure in Ramjar site (Figure 1 A). There are more older plants but fewer younger ones in contrast to population from Kurizampa with more young individuals compared to older plants (Figure 1 B). This difference can be partly explained by low rate of regeneration, associated with sex ratio and fewer coning individual plants. In both populations, the number of plants bearing cones is very low compared to the total number of adult and old individuals which all have the potential of bearing one kind of cones. Further, the percent of plants bearing female cones is lower than the male cone bearing plant. Population in Ramjar site have 2% and 11.75% of female and male coning individuals respectively. In Kurizampa population have 15.79% and 31.58% of the adult bearing female and male one respectively.

Threats to Cycas pectinata population includes both natural and anthropogenic associated activities. In Ramjar site natural threats are more prominent which includes infestation of young tender leaf shoots by larva belonging to Lipidoptera and millipede inhabiting at the base of crown of leaves. This both have significantly retarded growth of the plants by de-foiliating new leaves. Anthropogenic threats are more prominent for population in Lingmethang areas. The threats include habitat destruction and collection for ornamental values

unsustainably.

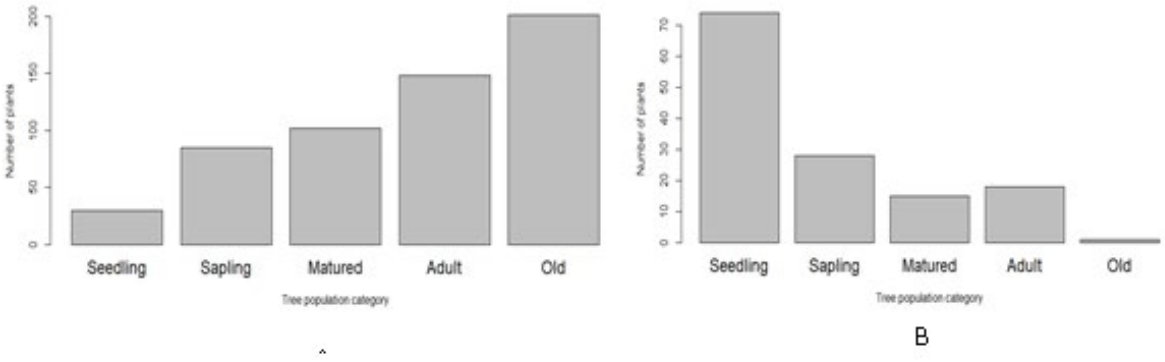

Figure 1 Population structure of Cycas pectinata plant from, A-Ramjar in Trashiyangste and B-Kurizmapa in Mongar

Awareness of this threatened plant taxa is significantly lower among younger generation despite residing in the areas. Only one student knew the local name for the plants despite having seen planted in the garden. Traditional knowledge about the species such as cultural significance of the plants are completely unaware among the young generation. Generation gap is evident between generations in sharing traditional knowledge, as evident from parents of students much aware of the species.

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

Few individuals from the communities in the areas were contacted to share the local knowledge on the plant species, including location of the species in the locality. Students from two schools located in the region were engaged during presentation educating and creating awareness amongst younger generation. Students from Sherubtse College were engaged in the field for data collection.

5. Are there any plans to continue this work?

Cycads do not have growth rings which are commonly studied to estimate the age of trees, which would enable understand the age structure of the population. Modern techniques like image processing can be applied to correctly measure the growth rate thus determining age of the trees from their height.

Cycas pectinata populations generally seen growing in difficult terrains and studying additional population in the regions would greatly enhance better understanding of the populations

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

The findings of the projects have been shared with students and schools in the locality through presentation and brochure.

Manuscript of the project finding is communicated to Journal of Threatened Taxa and awaits to except for publication.

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

The project grant was used for 23 months from January 2020 to December 2021. The actual length of the project was greater than anticipated. Due to Covid-19 pandemic field visits and education programmes had to be postponed for several times.

8. Budget: 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. It is important that you retain the management accounts and all paid invoices relating to the project for at least 2 years as these may be required for inspection at our discretion.

Item	Budgeted Amount	Actual Amount	Difference	Comments
Research clearance fee	56	56		No variation
Workshop and outreach programme	1048	1020	-28	Participants for the awareness program had to be minimized to accommodate Covid-19 protocols
Field equipment	2625	2432	-93	The field equipment cost varied at the time of purchase compared to a proposed.
Daily subsistence allowance for field visits	1582	1728	+146	Change in national financial rules implemented after this proposal has resulted in higher cost for field visit
Transportation	601	601		No variation
Total	**5912**	**5837**	-75	The excess amount is kept for publication fee for the journal. This was not included in the proposal since at the time of this project proposal, publication in Journal of Threatened taxa didn't charge any fee, but now have implemented.

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

1. Similar study in other population of *Cycas pectinata* from the region.
The study of other populations from the region would further enhance better understanding of the taxa in the region. Full assessment of the extent (which some might be accessible) of the population would further strengthen the findings of the project. Implementation of modern techniques like image processing to measure growth rate of the plant would reasonably help improve accuracy of age estimation.

2. Continuous monitoring of the population
Conservation efforts would not be completed through one time study of the taxa. Thus, continuous monitoring and collecting additional information of the populations would help provide correct information for conservation planning. Further exploration and identification of other populations of *C. pectinata* from the region would help better understand distribution and prioritising conservation areas. Continuous sharing of the findings of the project through education would greatly help reach information to greater audience.

10. 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 Rufford Foundation logo was consistently used in all the report submitted including final report. The same logo was used and stressed during education programme in schools. Similarly, logo was used in brochure for outreach programme. The Rufford Foundation was duly acknowledged in manuscript communicated.

11. Please provide a full list of all the members of your team and briefly what was their role in the project.

Sonam Tobgay (Department of Environment and Life Science, Sherubtse College) conceived this project idea and proposed for funding including team formation. Study was design and involved in field visits and awareness education programme.

Jamyang Dolkar and Tshering Nidup (Department of Environment and Life Science, Sherubtse College) helped logistic arrangement and data collection in the fields.

Tenjur Wangdi, Tashi Wangchuk, Yonten and Ngawang Penjore (all from Sherubtse College) helped data collection from the field and conducting outreach programme to schools.

12. Any other comments?

I and all my team members for this project like to sincerely thank The Rufford Foundation for funding this project. The objectives of The Rufford Foundation towards supporting young researchers giving opportunity to carry out such projects and integration of the community towards common goal of conservation in the

region is greatly appreciated. Such conservation-oriented projects not only benefits researcher but community as well through their integration in the project from which conservation efforts can be enhanced.