

Final Evaluation Report

Your Details	
Full Name	Dawa Yoezer
Project Title	Evaluation of habitat quality of Gangtey-Phobji Ramsar wetland through land use and water quality interaction for the conservation of black-necked crane
Application ID	32133-1
Grant Amount	£5830
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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
Quantify extent of land use types of the Gangtey-Phobji wetland				Prepared the LULC map of the Gangtey-Phobji wetland and its catchment using Landsat 8 OLI image and validated with field knowledge and existing LULC literatures. Drainage area and major land use types for each tributary were assessed. Forest and natural vegetation constituted the major vegetation type covering about 80 % of the study area (133 km ²). Marshland which constitutes the core zone of the Gangtey-Phobji wetland makes up about 10 % of the catchment area. Settlements including unpaved roads (4.7 km ²) and agriculture fields (7.5 km ²) dominate the flatter valley bottoms along the mainstem and tributaries of the wetland.
Investigate relation between dominant land use types and corresponding water quality parameters				<p>Water quality of the wetland was assessed in relation to LULC of the wetland and its catchment. Discharge and water quality parameters including dissolved oxygen, electrical conductivity, pH, temperature and turbidity at each station representing different riparian land use types were measured at 22 different sites in a nested catchment sampling design. Water samples were collected for laboratory analysis of nitrogen and phosphorus concentration.</p> <p>The riparian land use adjacent to the sampling points in the river were better predictors of water quality than percentage of LULC upstream. Natural LULC, which predominantly occupies the headwater areas of catchment corresponded with better water quality. In contrast, sampling sites dominated by agriculture and marshland, which is degraded by livestock grazing, had significantly higher load and yield of</p>

			nitrate-nitrogen and phosphorus. Agricultural and degraded marsh sites also had significantly higher electrical conductivity and turbidity, indicating higher minerals and sediment input from human activities, including livestock grazing and the presence of developed areas, including roads.
Evaluate dynamics of land use and water quality interaction and cascading implications on habitat quality of the wetland for conservation of the black-necked cranes			<p>The DPSIR evaluation of the Gangtey-Phobji wetland revealed that LULC change driven by growth of conventional agriculture, tourism development, shift from transhumance to sedentary farming and climate change are main factors impacting water quality.</p> <p>The stakeholder analysis revealed that both NGOs and government ministries have potential roles in the implementation of responses to mitigate water quality degradation. The Royal Society for Protection of Nature (an NGO), local government administration of Gangtey and Phobji Gewogs, and the National Departments of Agriculture, of Forests and Park Services, of Livestock, Tourism Council of Bhutan and the National Environment Commission Secretariat were identified as the stakeholders best able to implement responses to mitigate the factors depleting water quality. The recommended responses include: to shift from conventional to organic farming; regulate infrastructure development; and reduce livestock grazing in the low-lying marshlands. Implementation and strict adherence to the mandates of the Gangtey-Phobji Environment Management Committee, which comprises most of the key stakeholders identified, serves as important platform in assuring stakeholders collaboration and peoples' participation to promote "wise use" of the wetland as advocated by Ramsar convention, thereby supporting the conservation of black-necked cranes.</p>

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

The project was implemented without major hurdles amidst the challenges posed by Covid-19. Initially, three times fieldwork was planned for thesis research (deadline April 2021), however, only two trips was possible due to second nationwide lockdown in December 2020. Thesis mentors recommended to undertake a third round of field work in summer of 2021 to include seasonal variation in water quality and flow. The third round of field work was carried out towards end of July 2021. Other challenge was finding required research equipment and consumables which needs to be mostly imported.

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

The most important outcome of the project are linked with the three major research objectives:

1. Established baseline information on the water quality and flow of the Gangtey-Phobji wetland and its tributaries and reassessed the dominant land use types of the Gangtey-Phobji wetland. This data can be used for long term monitoring of the wetland.
2. This study addressed the repeatedly highlighted research gap on the relationship between the land use types and water quality. High nutrient loads correlated with human impacted land use types indicating impacts from conventional fertiliser intensive potato farming on the wetland and its water quality.
3. The study also evaluated major drivers causing wetland water quality depletion and identified key stakeholders who could mitigate those issues.

The findings from this study will be made available through credible sources to have wider outreach and impact.

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

This project had no direct involvement of local communities as the research project focused on technical aspects of assessing land use and water quality. Face to face interaction with local communities were avoided adhering to government regulations to minimise social gatherings as research was undertaken during peak periods of the Covid-19 pandemic. Online interviews with key informants were conducted to validate already available information, particularly on fertiliser use and stakeholders. This research was built on earlier research findings which were based mostly based on social and community interviews. The findings of this research project will help communities and local authorities in taking evidence-based decision-making with regard to management and "wise use" of the Gangtey-Phobji Ramsar wetland.

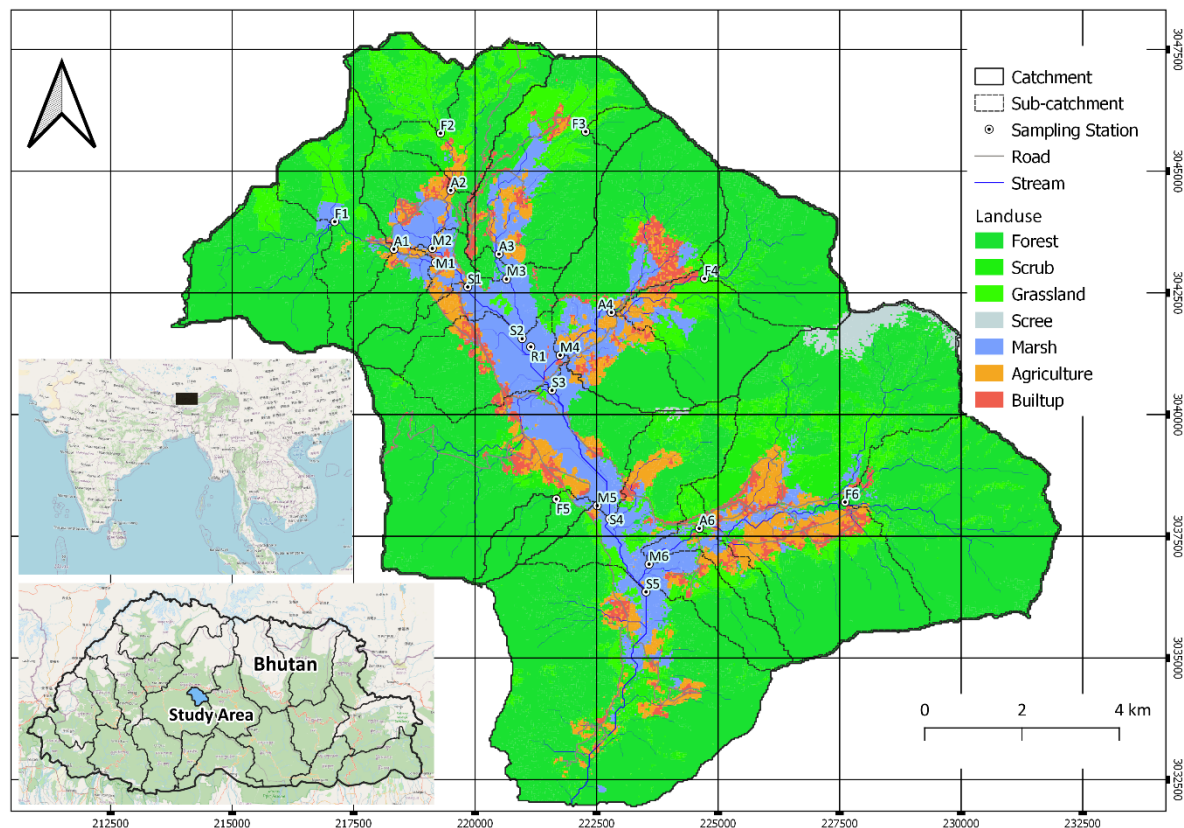


Figure 1. Location overview and LULC of the study area assessed in this study with sampling stations and their sub-catchment. Location R1 indicates main roosting site in the core zone of the Gangtey-Phobji wetland.

5. Are there any plans to continue this work?

Long-term monitoring and generation of water quality data with baseline information from current study will be crucial for assessing and undertaking future wetland management priorities in view of increasing anthropogenic and climate impacts. The findings of the study will be shared with key stakeholders to urge for need of long-term water quality and land use monitoring. Opportunities to conduct similar research in other important and Ramsar wetlands will be explored.

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

The findings of this project are submitted as a thesis report to the IHE Delft Library which will be accessible to students and researchers of IHE Delft Institute for Water Education and its affiliates. The findings will be published in a credible journal with the inclusion of summer data (July 2021) after expiry of thesis embargo period requirement. Will also explore opportunities to present the findings of the study in national and international conferences including in the seminar series at the Institute.

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

The grant was used from October 2020 to August 2021 which was adjusted to include summer data collection (July 2021) to consider seasonal variation. The proposed period was from October 2020 to April 2021.

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
Fund Management Overhead Charges	200	290	+90	5 % of the approved amount as the fund management fee
Essential Field Accessories	400	400		Same as justified in the proposal
Local Transportation	840	1560	+720	Increased due to need for repeated travel to Thimphu for lab work (3 times return travel). Earlier estimate did not include return travels between office and study site and transportation of samples to Lab in Thimphu which has almost doubled the duration of need of vehicle.
Food for field team	450	450		Same as justified in the proposal
Portable Turbidimeter	1300	1300		Same as justified in the proposal
Dissolved Oxygen Probe	1200	150	-1050	Hired the field meter from IHE Delft lab, Netherlands. Therefore, only required postal and packaging charges for DO, EC and pH meters from Bhutan to the Netherlands
Subsistence Allowance for field team	1440	1680	+240	Increased to cover DSA for lab work in Thimphu. DSA for additional 5 days for lab work in Thimphu after each field work (3 times * 5 days *16= 240)
	5830	5830		

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

Though this study has generated baseline information on the relationship and impacts of LULC on water quality, much more needs to be done. There is a need to institute long-term monitoring of water quality with due consideration of seasonal changes as the Gangtey-Phobji wetland experiences high variation in seasonal hydro-climatic variables (precipitation and discharge) and in anthropogenic activities (cropping and tourism). Long-term information on LULC change and water quality will enable better understanding of state of the wetland, guide effectiveness of policies in place and assess need for additional interventions. More comprehensive assessment of water quality parameters including plastics, pesticides and herbicides is recommended with increasing sources of pollution. Long-term studies on wetland vegetation, macro-invertebrate composition and bird population in relation to water quality will provide important insights on ecological status of the wetland.

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 was duly acknowledged for supporting this work during the thesis proposal defence and in the graduation presentation. The Rufford Foundation was also acknowledged in the thesis report submitted to IHE Delft Institute for Water Education. The lectures and students (who are mostly from under/developing countries) of IHE Delft became aware of the Rufford Foundation support for environmental and conservation thesis research.

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

Individuals		Contribution to the Project
Mr. Dawa Yoezer	Researcher, Ugyen Wangchuck Institute for Conservation and Environmental Research (UWICER)	PI of the project
Dr. Gretchen Gettel	IHE Delft Institute for Water Education	They made very important contribution to the successful completion of the project as a thesis mentors/supervisor. They provided expert guidance and encouragement, starting from formulation of the research to implementation and completion of this project in the form of thesis report
Dr. Anne ven Dam	IHE Delft Institute for Water Education	
Prof. Ken Irvine	IHE Delft Institute for Water Education	
Mr. Jamyang	Specialist, Soil and Plant Analytical	He is the Lab Specialist and consented to provide lab services for my project.

	Laboratory (SPAL)	He was immensely helpful, reliable and expert who guided the collection and laboratory analysis of water samples.
Mrs. Karma Choden	Lab Technician, SPAL	She was involved in the running of water samples for nutrient content analysis.
Mr. Jigme Wangchuk	Researcher, UWICER	Assisted in undertaking fieldwork (Selection of sites, discharge and water quality measurement, sample collection, data recording and transportation of equipment to site). His previous study in the same area helped to guide the selection of sampling sites.
Mr. Sangay Pelzang	GIS Expert, UWICER	Helped in preparing land use land cover (LULC) map of the study area and assisted in fieldwork and ground-truthing for LULC map.
Mr. Nima Tshering	UWICER	Driver and helped in arranging field logistics.
Mr. Sonam Dhendup		Vehicle owner and driver

12. Any other comments?

I would like to sincerely thank The Rufford Foundation for supporting my thesis research project. Rufford Foundation has been particularly helpful in funding start-up conservation works of young researchers/conservationists, opening door of opportunities for them to further their work and develop capacities and strengthen professional networks. Congratulations and wish for your continued support!