Darwin Initiative Capability & Capacity: Final Report

To be completed with reference to the "Project Reporting Information Note": (https://www.darwininitiative.org.uk/resources/information-notes/).

It is expected that this report will be a **maximum of 20 pages** in length, excluding annexes.

Submission Deadline: no later than 3 months after agreed end date.

Submit to: BCF-Reports@niras.com including your project ref in the subject line.

Darwin Initiative Project Information

Project reference	DARCC002
Project title	Building capacity and community resilience for grassland conservation in Bhutan
Country(ies)	Bhutan
Lead Organisation	Royal Botanic Garden Edinburgh, 20a Inverleith Row, EH3 5LR
Project partner(s)	Government of Bhutan, Department of Forest and Park Services. Government of Bhutan, National Biodiversity Center
Darwin Initiative grant value	£99,990
Start/end dates of project	May 2022 / March 2024
Project Leader's name	Colin [redacted]
Project website/blog/social media	n/a
Report author(s) and date	Colin [redacted] & Tshering [redacted] June 2024

1 Project Summary

The aim of the project was to develop Bhutan's in-country capacity in the ecological assessment and conservation of grasslands, focussing on one high-altitude community which is particularly heavily dependent on rangeland resources. It sought to address existing weaknesses in grass identification and developed new print and digital identification materials for Bhutanese graminoids (grasses, sedges and rushes). It worked with local communities to promote resilience and enhance livelihoods through improved rangeland management and by building awareness of sustainable NWFP collection and exploring other sustainable economic opportunities.

Despite their economic and cultural importance, grasslands remain among the most poorly understood habitats in Bhutan. Bhutan's conservation efforts have largely focussed on birds, mammals, trees and its network of national parks and wildlife sanctuaries. The conservation of other important habitats outside the protected area system, which accounts for 49% of the total land cover in Bhutan, has received relatively little attention. The neglect of Bhutan's grasslands has largely been due to the lack of in-country technical expertise in grass taxonomy. The understanding of the ecology and distribution of grasses remains poor. Documentation of grass species, their use and conservation have received little attention and they have not yet been brought into the mainstream of Bhutan's conservation policies.

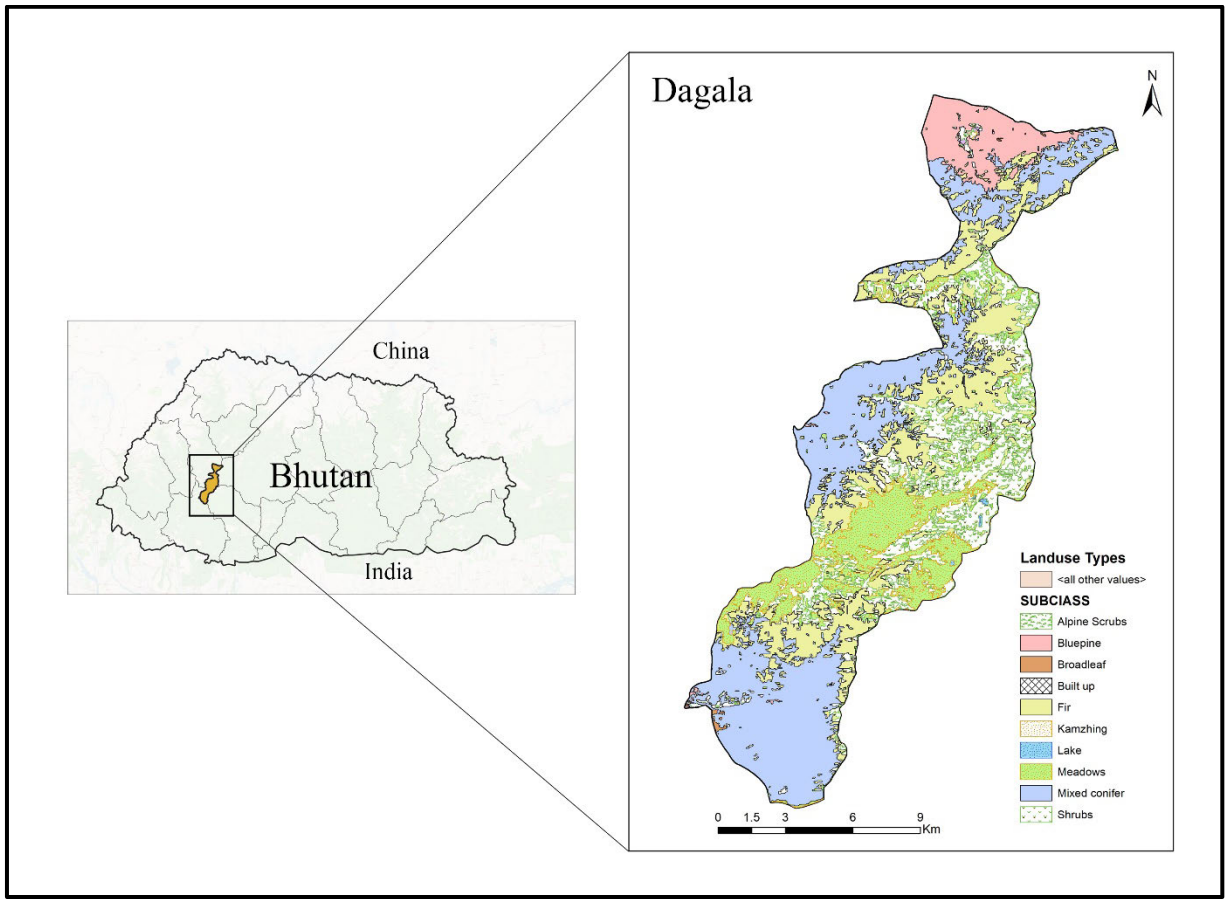
Grasslands have been shown to be among the most vulnerable of Bhutan's habitats and they are inordinately affected by anthropogenic pressures. Grasslands continue to be lost as they are replaced by commercial plantations of bamboos and timber trees. Furthermore, many grasslands in Bhutan have been severely impacted by invasive alien species. These threaten not only the ecological integrity of the grasslands, but also the livelihoods of the many communities depending on them.

With more than 80% of the Bhutanese population dependent on agriculture, secure grassland resources are key to the maintenance of livelihoods. While there are numerous examples of Bhutanese communities which depend on grasslands to support their livelihoods, the Jom Daga NWFP group in Thimphu is an extreme example as they are completely dependent on their grasslands in the absence of any other economic activities. These grasslands are threatened by shrub encroachment and decrease in productivity. A two-pronged solution is therefore required to sustain livelihoods in Dagala by consolidating rangeland resources while simultaneously developing alternative economic activities such as the sustainable harvesting of medicinal plants.

The study focused on the alpine and subalpine grasslands of Dagala mountain range which cover about 88 km^2. The elevation ranges from 3,000 to 4,500 m, with the vegetation changing from temperate conifer forests in the lower regions to Rhododendron scrub and alpine grasslands at higher elevations. Mean annual temperature and rainfall in the area are 5.5 °C and <650 mm respectively. Dagala mountain range is inhabited by about 40 yak-herding family groups and is used as a summer grazing area. During the colder seasons they descend to lower elevations on either side of the range.

The Dagala herders face challenges to support themselves using their traditional pastoralist activities in the face of climate change and a changing socioeconomic situation. In recent years herd numbers have fallen and at the same time pastures have become encroached by shrubs, leading to a reduction in the biodiversity associated with these habitats. Shrub encroachment is a complex process, but one of the prime drivers is the ban on the use of fire to keep pastures open which has been in place since the enactment of the National Forest Act of 1969 which prohibited the use of fire in state reserved forests, followed by the Land Act of Bhutan (1979) which nationalized all rangelands, making it illegal for the yak herders to burn and cut shrubs encroaching on the pastures they had traditionally managed for their grazing resources.

The problem was jointly identified by Thimphu Forest Division and the local community of Dagala. This occurred during Tshering Dorji's work at Thimphu Forest Division where he led an ecological assessment survey of the Critically Endangered *Nardostachys jatamansi* in the Dagala area. As with the current project, he was working closely with the local communities in the identification of growing sites of *Nardostachys*, when the problem of shrub encroachment, low rangeland productivity, challenges of grass identification, and low socio-economic income became apparent. Realizing the need for intervention, and the lack of in-country capacity, RBGE's help was sought by the Ministry of Agriculture and Forests. Their proposal was to train Tshering to MSc level and conduct research into the Dagala high-altitude community.



Map of land cover in the Dagala region and its location within Bhutan

2 Project Partnerships

The proposal was developed jointly by RBGE and Thimphu Forest Division in consultation with the National Biodiversity Center and the local community of Dagala. The project was conceived and developed as a direct request from the Royal Government of Bhutan through the then Ministry of Agriculture and Forests (now Ministry of Agriculture and Livestock). This support was evident from the very start when Tshering was granted a two-year sabbatical to undertake this project while his position at Thimphu Forest Division remained protected. The roles of each of the formally named institutes are as follows:

- RBGE, as the project lead, was responsible for the overall coordination, financial management and administration of the project. It also hosted Tshering for the period of two years starting from training of photography of plants, the use on Padme, as well as guiding him through his MSc course. Dr Caroline Lehmann and her research group provided crucial advice and directions for ecological survey, data analysis and community engagement. Similarly, Tshering benefited from working closely with Research Associates like Dr David Long and Dr Henry Noltie on matters beyond this project. RBGE has a long experience of Himalayan research and wrote the Flora of Bhutan which was a 27-year project funded by the ODA. It was the first Flora for the country, with identification keys and descriptions for the 5,600 species known from Bhutan at the time of its completion in 2002. Since 2003 it has been the coordinating organisation for the Flora of Nepal project. It was therefore the natural choice to be the partner for this project.
- In Bhutan the Department of Forests and Park Services was the first contact point for communication and was responsible for coordination and implementation of field activities. This was achieved through a direct formal and informal links with Thimphu Forest Division (one of the regional offices) under the Department. Other institutes under the Department such as the Social Forestry and Extension Division and the Watershed Management Division critical technical guidance and logistical support towards the project. Paro Forest Division relieved their employee to participate in the project during fieldwork in Y2 and as a facilitator during the working conducted in Y2Q4.
- The National Biodiversity Center provided technical and logistical support during the fieldwork, particularly in the collection of specimen collection and plant identification. They also providing mounting services of the herbarium specimens which are now housed at their herbarium (THIM). The organization also facilitated the transfer of duplicate herbarium specimens from Bhutan to the UK (E).Additionally, it was actively engaged in the planning and implementation process for the workshop on capacity building of community members on biodiversity conservation, and raising awareness on CBD, CITES, Global Frameworks and Nagoya Protocol on Access and Benefit Sharing Policy. Their involvement in this project was crucial for the fulfilment of the project Output in relation to raising community awareness and enhancing livelihood opportunities through providing alternative economic opportunities to reduce poverty. They have also been engaging with the Jom Daga community in the implementation of Nagoya Protocol, bringing the community in partnership with BioBhutan, a private specializing on producing organic products. AS part of this ABS regime, the community members source local Rhododendron species to BioBhutan to produce essential oils and soaps.

Although not named as formal partners in the project, institutes from the host countries such as the National Soil and Plant Analytics Laboratory and the College of Natural Resources provided support in the analysis of soil and plant samples at concessional rates. Members of Jom Daga NWFP Group were among the key stakeholders who took a keen interest in this project and were the primary beneficiary of the workshop held during Y2Q4. They hosted and welcomed the survey team into their homes during the fieldwork and eagerly shared their knowledge and expertise. The National Soil Service Center provided free soil testing services with the project having to bear the cost of only a chemical which they organization didn't have. Similarly, the College of Natural Resources under the Royal University of Bhutan provided expedited testing services for the plant biomass samples at a concessional rate. Translation services for the bilingual identification guide was provided by the Ministry of Agriculture of Livestock, while the

Dzongkha Development Commission translated two words (Inflorescence and rhizome) on the project's request.

The partnership between Tshering and RBGE will be further strengthened and extended to the University of Edinburgh through the PhD programme which he will embark on in September 2024 (See 3.1 Output 4). This project is also very important for the relationship between RBGE and ICIMOD (International Centre for Integrated Mountain Development) (see again 3.1 Output 4). The partner organisations in Bhutan are keen to develop their links with the UK and potential activities were discussed during Colin Pendry's visit to Bhutan in Y2Q4.

Proper communication was cornerstone to the success of this project and was prioritized from the very outset. Communications between UK and Bhutan have been frequent, and cordial achieved using video conferencing, emails and text messaging. The project also found that communication in Bhutan was very straightforward, due in large part to the small size and cohesiveness of Bhutan's research community and its efficient institutional network. Future projects in Bhutan can certainly benefit from these features.

3 Project Achievements

3.1 Outputs

Output 1: Improved national capacity in Bhutan for plant biodiversity research and documentation, enabling the characterisation, identification and effective management of temperate rangeland plant species (grasses, sedges and medicinal plants).

1.1 The primary output of the project was the successful completion of the year-long MSc in Biodiversity and Taxonomy of Plants by Tshering. This was achieved on time and the consistently high standard of his work was reflected in the Distinction he was awarded **(Annex 5: 1.1 MSc degree certificate)**. Tshering's research project focussed on the ecology of the Dagala rangelands, which quantified the effect of shrub encroachment on biodiversity. There is no equivalent educational programme in Bhutan and the transferable skills, knowledge and professional network which he has gained during this intense course will be invaluable in Tshering's future career as he matures as an independent researcher. The recognition of the value of this training by his colleagues in Bhutan was evident during the visit there in Y2Q4.

1.2 Tshering carried out fieldwork in Y1Q2 and Y2Q2, each lasting two weeks. Ahead of the first fieldwork he received training in macro digital photography to enable him to capture high quality close-up images of plants for his digital field guide **(Annex 5: 1.2 Training on macrophotography)**. Over 10,000 photographs of 180 species were collected during the fieldwork.

1.3 RBGE uses Padme, an in-house database system, to manage taxonomic data. Tshering was trained in the use of Padme and created a database with 2169 records of Bhutanese graminoids from the herbarium collections at RBGE, CAL and the specimens he collected during his fieldwork **(Annex 5: 1.3 Padme summary)**.

The Olympus TG-6 camera used for the imaging proved to be suitable for withstanding the extreme weather conditions in Dagala. However, the process of taking images of graminoids in the field was found to be extremely challenging due to their relatively small floral characters. To supplement these images dissected floral characters were photographed using microscopes, access to which was provided by the National Biodiversity Center.

Output 2: Enhanced understanding of the ecology and conservation of temperate rangelands, the biology and identity of key graminoid species, and the threats and opportunities for high-altitude pastoralist communities.

2.1 The ecological study of Dagala rangelands published as Tshering's MSc thesis **(Annex 5: 2.2a Dagala 2022 Report_compressed; 2.1 & 4.3 MSc Dissertation_compressed)** is the first such study in this area, and recorded 308 species at 42 locations using the survey methods designed by Caroline Lehmann's research group ('Global Grassy Group'). This survey technique was created specifically for rangeland surveys and allows for the quantification of species richness and composition by recording species and functional groups in a configuration of twenty one circular plots (0.79m^2) at each site. This method has been applied in about 500 sites across Africa, South America and Asia, making Tshering's data directly comparable with an ever-expanding global dataset. The results of the study have been summarized in a manuscript which is in preparation for submission to the Journal of Ecology.

The ecological sampling method employed in this project enabled the quantification of species diversity over a large area (0.25 ha) in a relatively quick time (ca. 2-3hours per site). This was the first time that this protocol was tested in an alpine ecosystem and provides for a good opportunity for comparison with other regions worldwide. Team members from the Global Grassy Group also provided training on data processing and analysis from this protocol, providing an excellent pathway for scientific paper writing.

2.2 Herbarium specimens have been made of 40 species of graminoids and medicinal plants, and these specimens are housed at Bhutan's national herbarium (THIM) **(Annex 5: 2.2 MTA 2023 & 2024 combined_compressed)**.

2.3 Bilingual identification guides (in English and Dzongkha) to 20 species of graminoids have been prepared using the 'Plants and You' format **(Annex 5: 2.2 & 3.3 Plants and You pages combined_compressed)**. The format was developed for the Flora of Nepal following discussions with a wide range of user groups to create identification tools aimed at non-specialists.

2.4 The updated Pl@ntNet identification model showed much improved performance after training on the Dagala images **(Annex 5: 2.4 Bhutanese.graminoids.Final.result)**. Evaluations were made on 73 observations of 26 species and correct identifications at the species level in top 1 from 5.47% to 71.23%, and in top 5 from 15% to 83.5%. When a species is found by the identification model, it was on average in position 7.8 before training and position 1.4 with the new model.

Output 3: Increased community awareness of the importance of rangeland biodiversity, key economically important plant species, and the sustainable management of rangeland resources in the face of invasion by non-native species.

3.1 In Y1Q1 a one-day consultation meeting was conducted at Dagala Gewog Center in collaboration with officials from Thimphu Forest Division, Social Forestry and Extension Division, and National Biodiversity Center **(Annex 5: 3.1 & 3.2 Final workshop Report; 3.1a Supplementary_ HH Survey questionnaire)**. The meeting was attended by members from the Gewog Administration and about 23 HH which was 58% of the entire yak-herding community of Dagala. The number of HH was estimated at 50 before the project, but there are actually only 40 HH in this community. The meeting was convened as a formal introduction of the Darwin Initiative project to the local community. They were appraised of the objectives of the project and the intended activities outlined over the two-year period. The remaining households were still based in the highlands and were unable to travel south

to the village centre, which would have taken them two days of walk. However, efforts were made to disseminate information to those HH who could not attend the meeting through direct calls and group chats, and personal interaction during fieldwork. Even after the return of Darwin Fellow to the UK, in-country partners continued to collect survey data from 9 additional HH taking the respondent coverage to 80%.

A total of 23 HH and members of the Gewog Administration attended the meeting.. er, Tshering and his team were able to meet most of them during his field trip to the study-site.

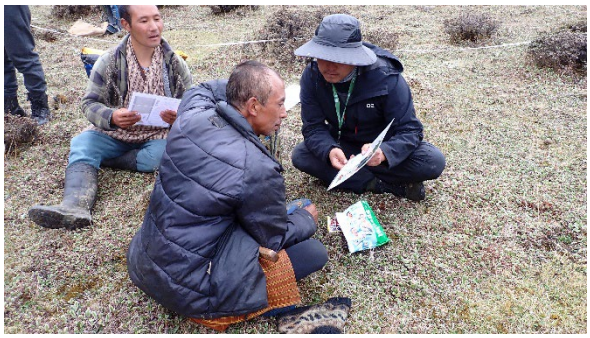
3.2 The awareness-raising programme consisted of a single day event in Y2Q4, attended by 73 HH, accounting for almost 90% of the entire Jom Daga NWF Group members (total member of the group being 83) **(Annex 5: 3.1 & 3.2 Final workshop Report)**. This included 35 HH from the yak herding community and 38 from the non-yak herding community members of Jom Daga NWFP group. , Other dignitaries form the Local Government and the Department of Forests and Park Services also attended the meeting. The workshop was chaired by Colin Pendry and facilitated entirely by in-country officials from the Department of Forests and Park Services and the National Biodiversity Center. The programme was reduced to a single day so that Tshering could present his research findings at the ICIMOD workshop and attend the test burning programme. Awareness-raising activities therefore took place through informal interactions with Dagala community members in subsequent visits.

The workshop was held to raise awareness on rangeland biodiversity, key economically important pant species, conservation threats and sustainable utilization of biological resources. It began with the identification of ten key economically important plant species and mapping their current distribution range and collection area. This activity was incorporated in the workshop following a request from Thimphu Forest Division and forms the basis of the upcoming management plan, enabling the creation of detailed guidelines for sustainable harvesting and management of resources. This was followed by a presentation by Gyeltshen Dorji (Paro Forest Division) on the conservation threats of different plants and animals, relevant clauses of Forest and Nature Conservation Act 2023. The participants were appraised by Tshering on the rangeland biodiversity with particular emphasis on graminoids and important forage plants in Dagala. He also presented findings from his MSc thesis on the impact of woody plant encroachment on rangeland ecosystems and its potential socio-economic impact. Finally, there was a practical demonstration on the identification of different graminoid species using Plants and You guide which the attendees participated in with great enthusiasm.

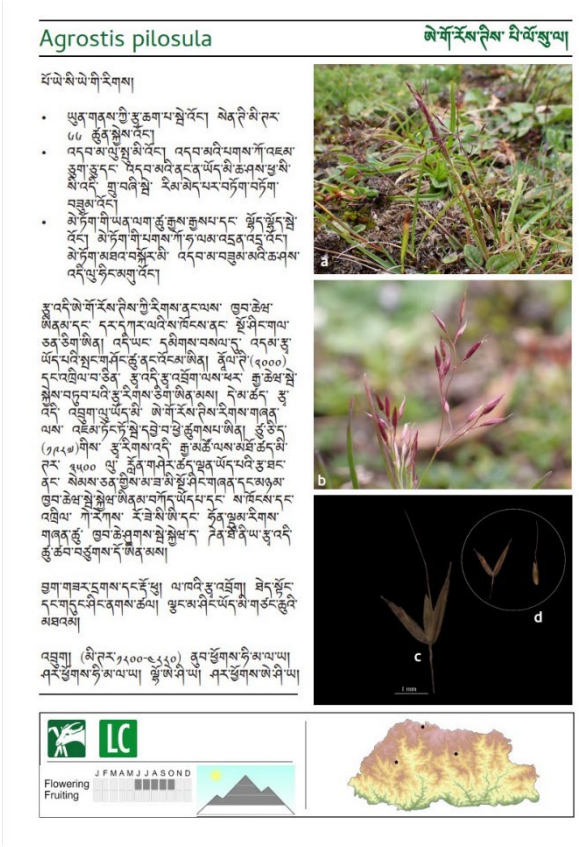
Training participants at the workshop at Dagala on 15 March 2024

3.3 Prototype identification guides were prepared for 20 graminoid species (Annex 5: 3.3 Plants and You user testing report) and tested at the final project workshop. There is a critical gap in identification guide in Bhutan, especially for graminoids which are considered among the most difficult plant groups to identify. The Flora of Bhutan, which provides a comprehensive account for graminoids in Bhutan, remain largely inaccessible to most casual users for being too technical. A simple pictorial identification guide was felt necessary that would assist in easy identification with the main beneficiaries aimed at local yak herders. This was developed using RBGE's in-house Plants and You system, which has been successfully implemented for developing similar bilingual guidebooks for Nepal.

The 10,000 pictures that Tshering took during his fieldwork were complemented by 400 pictures from RBGE's archives which Tshering scanned while he was in RBGE. Information on their use and local names were collected from the field from key informants and other local yak herders. Relevant literature from the region was reviewed regarding rangeland ecology, forage quality and grazing tolerance for each of the 20 selected species. At the end of Y1, five protype identification guides were prepared and tested in the field to receive feedback for further improvements.



The feedback received during Y1 was incorporated during Y2 and tested further during the workshop in Y2Q4. The source materials prepared in English were translated into Dzongkha using a professional service from the Ministry of Agriculture and Livestock. These finished identification guides were then used for the assessment of the participants' ability to identify different graminoid species using key characters.



About 79% of the HH reported that their understanding of rangeland biodiversity increased. HH who reported about knowledge of ABS policy increased from 10% in Y1 (3 out of 34) to 82% in Y2 after the workshop, showing that they are now more aware of the links to rangeland biodiversity with economic livelihoods. Although 87% of the respondents claimed that they knew at least 10 graminoid species, it was evident from later interactions and fieldwork that this was not the case. It was later discovered that there was a big translational gap with the local communities assuming graminoids being synonymous with all plants their yaks eat,

including other forbs and shrubs. The proportion of HH who reported increased understanding of graminoids and their identification after the workshop was 79%.

Output 4: International collaboration network established by Darwin Fellow with national herbaria, grassland specialists, and experienced Darwin Initiative project partners in India, Nepal and UK (x3) to improve capacity for future research.

Study visits were made to visits to 4 herbaria with significant Himalayan graminoid collections in Kolkata (CAL), Kathmandu (KATH) and London (Natural History Museum: BM, Royal Botanic Garden Kew: K) and contacts were made with the grass specialists at each of these institutions **(Annex 5: 4.1 Report on the field visits to major herbaria).**

A strong collaboration has been established with Dr Caroline Lehmann (RBGE and the University of Edinburgh), an international authority on grassland ecology with a dynamic lab group and research interests in Africa, Madagascar, Australia and SE Asia. Tshering has developed a PhD programme with her to build on the Dagala study and has secured funding from the University of Edinburgh's E4 DTP programme which will begin in September 2024 **(Annex 5: Annex PhD Proposal _ Woody encroachment in Bhutan).** This programme is highly competitive with fewer than 30 successful applications from a field of over 700 applicants. The PhD will use the expertise gained in this project to answer three questions:

i. What is the rate and extent of encroachment in Bhutanese grasslands and how does it relate to major policy reforms in the country over the 20th Century?

ii. How do plant functional traits of woody species relate to encroachment in different environmental conditions?

iii. How do stakeholders from different communities and demographics perceive shrub encroachment and ecosystem services of grasslands under different stages of encroachment?

It is particularly noteworthy that through the project Tshering has developed close links with the International Centre for Integrated Mountain Development (ICIMOD), a high-profile intergovernmental organisation which works on the Hindu Kush Himalaya (HKH). ICIMOD is based in Kathmandu and works in its eight regional member countries to improve the livelihoods of people of the HKH and protect mountain environments and cultures. ICIMOD operates at government level to influence policy and outcomes, and currently has an active programme working on rangelands which are under threat across the Himalayas because of climate change and socioeconomic factors. Tshering's MSc and PhD research feeds directly into this programme and ICIMOD is partially funding his PhD as a CASE studentship. The link with ICIMOD will dramatically amplify the impact of his work.

Colin Pendry joined Tshering in Bhutan for the final project activities in Y2Q4, supervising the final workshop, holding meetings with project partners to assess project activities, developing contacts with specialists in Bhutanese research organisations and ICIMOD, and meeting the Minister for Agriculture and Livestock.

3.2 Outcome

Outcome: Enhanced capacity for plant biodiversity research in Bhutan, focussed on the management of high-altitude grasslands, leading to improved livelihoods of pastoralists and the conservation and sustainable use of natural resources.

The primary outcome has been achieved, with Tshering now having a greatly increased ability to carry out independent research in rangeland ecology, using the expertise gained from the project and the research network which he has established. This work, and its impact, will be developed still further through this PhD research. His PhD programme is a direct result of the project, and would not have been possible without it.

The groundwork has been laid for the secondary outcomes of improved livelihoods for the Dagala community and sustainable use of their rangeland resources. After carrying out two rounds of discussions with the local communities (before and after the project), the project has been able to identify that one of the main challenges with the Jom Daga NWFP group is the lack of income diversity, low bargaining power and the risk of overharvesting. This is caused because the management group is only restricted to only supplying of raw materials to private firms due to lack of capacity and infrastructure. In 20 May 2024, Tshering was able to submit a formal proposal on behalf of Thimphu Forest Division to the Department of Forests and Park Services, which he developed in consultation with Jom Daga NWFP Group. The proposal seeks financial and technical support to establish an incense-making and tea-processing plant in Dagala as part of the UNEP-Sustaining an Abundance of Forest Ecosystems (SAFE) Program, an initiative currently being piloted in four counties (Bhutan included) to support local actin for conservation and restoration of ecosystems. The proposal submitted focuses on enhancing local livelihoods by providing them with an alternate source of income and a building a resilient ecosystem and promote fair and equitable access and benefit sharing to its members.

The single biggest factor reducing productivity in high-altitude grasslands is the prohibition on the use of fire to control shrub encroachment, but changes to the management programmes can only take place as a result of research and engagement with government at the most senior levels. It will take time to make changes in the legislation, but the programme currently underway at ICIMOD and the research carried out within this project and the follow-on PhD will present a strong case to make the necessary changes. In the short term, Tshering's involvement with ICIMOD is geared towards developing guidelines for prescribed burning and weed management in rangelands to improve their productivity.

Although an approved management plan for Jom Daga NWFP Group already exists, it has limited scope as it focuses mainly on annual harvesting limits for some key medicinal and aromatic plants. In the absence of proper mechanisms for sustainable harvesting, there is a risk of overexploitation which could threaten the sustainability of some species and hamper their economic opportunities. With the plan due for revision, the data gathered from this project will be crucial in ensuring a sustainable and gender-inclusive plan which promotes fair and equitable access and benefit sharing. For example, the mapping of growing sites of key species in Y2Q4 is an important activity to support sustainable harvesting, as was the gender-based focus group discussion which aimed to understand gender-based issues and resource use patterns. With the potential for incense-making and tea-processing as an alternate source for income generation, Thimphu Forest Division will embark on a search for investment to set up a processing unit and build capacities of the management groups in processing, packaging, and marketing through visits to other facilities similar to those proposed for Dagala.

3.3 Monitoring of assumptions

The six key assumptions made prior to the project to ensure success were:

1. Darwin Fellow is awarded a UK visa to study at RBGE and work there beyond the end of the MSc.

2. Darwin Fellow is competent to successfully complete MSc course.

3. Darwin Fellow receives full support from local partners and government authorities.

4. Travel situation in Bhutan remains stable; Covid 19 and other natural disasters present only short-term disruption.

5. Local communities in Dagala region in Bhutan actively engage with the training and awareness-raising programme.

6. International herbaria in India (CAL), Nepal (KATH) and UK remain open to visitors with only minor disruption due to Covid 19.

Two of the assumptions relate to Covid-19 which was no longer a significant hindrance to work by the start of the project, so they are discounted. The remaining assumptions related to Tshering's ability to successfully arrange the necessary visa to study and work in the UK, his competence to undertake the educational and research activities and the support and engagement he received from local partners and community in which he was working. Throughout the course of his studies there were regular assessments of his progress, and these were uniformly excellent (eventually leading to the Distinction awarded for his MSc). Tshering worked closely with project partners during fieldwork in Bhutan and kept close contact with them whilst in the UK. The relationship with the Dagala community was friendly and engaged, which was evident at the final workshop.

4 Contribution to Darwin Initiative Programme Objectives

4.1 Project support to the Conventions, Treaties or Agreements

The overall aim of the project, with its support for the conservation of biological diversity, its sustainable use and the fair and equitable sharing of the benefits of the utilization of genetic resources aligns closely with the overall objective of the **Convention of Biological Diversity (Article 1), Nagoya Protocol (Article 5 & 6),** Bhutan's ABS Policy 2015, (Objectives 1, 2, 3 & 5, Post-2020 Global Biodiversity Framework - 2030 Action Targets Target 12,19 & 20).

The shrub encroachment research will be used to influence national legislation and conservation polices (**Article 6a, b. General Measures for Conservation and Sustainable Use**), (Post-2020 Global Biodiversity Framework - 2030 Action Targets Target 3 & 14) (Bhutan's UN SDG (13 and 15)

The rangeland survey work contributes baseline data for identification and monitoring of biodiversity and identifies threats to that biodiversity (**Article 7a, b, c, d. Identification and Monitoring**).

The sustainable use of rangeland grazing and medicinal plant resources supports in-situ conservation of those resources, despite Dagala being outside the Bhutan's system of formally protected areas (**Article 8c, d, f, h, i. In-situ Conservation**), (**Article 10b, c, d, e. Sustainable Use of Components of Biological Diversity**).

The development of identification materials to be used in wider rangeland conservation programmes within Bhutan and the communication of the expertise gained in the project contribute to Bhutan's research and training activities (**Article 12a, b. Research and Training**).

The work with the members of the Dagala community promotes public awareness of the conservation of biodiversity (**Article 13b. Public Education and Awareness**).

The MSc training during the project constitutes technical and scientific cooperation among the project partners (**Article 18.1, 2,. Technical and Scientific Cooperation**)

The revision of Jom Daga Management Plan with specific guidelines for CITES plants will contribute towards the conservation of species and promote legal and sustainable use (Goals I-

V, CITES Vision 2030), (Post-2020 Global Biodiversity Framework - 2030 Action Targets Target 5)

One of our key project partners, the National Biodiversity Center, serves as the National Focal Point for Nagoya Protocol on Access and Benefit Sharing in Bhutan and aims to bring about environmentally sustainable development, biodiversity conservation, and to enable meaningful ABS collaborations. Their involvement in this project was a key strategy in planning and implementation of activities related to the capacity building of community members on biodiversity conservation and poverty alleviation. This will include awareness on sustainable harvesting, CBD, CITES, Global Frameworks and Nagoya Protocol on Access and Benefit Sharing Policy. It was not possible to align our achievements with Bhutan's NBSAP (and Aichi Targets) as the existing one has expired and the new one has not yet been endorsed.

4.2 Project support to biodiversity conservation and multidimensional poverty reduction

Himalayan rangelands are anthropogenic habitats which tend to develop into forested or shrubby environments in the absence of management. They are biodiverse habitats in which are found high elevation species which are not shade tolerant, and if these cultural landscapes are not maintained biodiversity will be diminished.

The ban on the use of fire as a management tool in Bhutan since 1979, and Tshering's research has quantified the impact on biodiversity. This research will be used directly in the discussions around modification of the legislation controlling the use of fire.

Shrub encroachment reduces the productivity of rangelands, and modification of the fire regime will have the effect of raising productivity and boosting the livelihoods of yak herders.

4.3 Gender Equality and Social Inclusion (GESI)

Please quantify the proportion of women on the Project Board[1].	40%
Please quantify the proportion of project partners that are led by women, or which have a senior leadership team consisting of at least 50% women[2].	33% - RBGE's senior leadership team has 50% women

GESI Scale	Description	Put X where you think your project is on the scale
Not yet sensitive	The GESI context may have been considered but the project isn't quite meeting the requirements of a 'sensitive' approach	
Sensitive	The GESI context has been considered and project activities take this into account in their design and implementation. The project addresses basic needs and vulnerabilities of women and marginalised groups and the project will not contribute to or create further inequalities.	X

[1] A Project Board has overall authority for the project, is accountable for its success or failure, and supports the senior project manager to successfully deliver the project.

[2] Partners that have formal governance role in the project, and a formal relationship with the project that may involve staff costs and/or budget management responsibilities.

Empowering	The project has all the characteristics of a 'sensitive' approach whilst also increasing equal access to assets, resources and capabilities for women and marginalised groups	
Transformative	The project has all the characteristics of an 'empowering' approach whilst also addressing unequal power relationships and seeking institutional and societal change	

The project has strived for active gender inclusion in project planning and implementation process through all stages. Two of the three named partners in Bhutan are women, and their participation was critical to the delivery of this project on the ground. The National Biodiversity Center and its division National Herbarium are both headed by women, as well as the representative of the Dagala Block, who all provided critical inputs for the project. The workshop and the pre-project survey in Y1Q1 has a high female participation of 65% (15 out of 23) in Y1Q1 workshop and 53 % (39 out of 73) in Y2Q4. Workshop facilitators had at least 50% representation in both workshops. Similarly, the household surveys had a high female participation (65%) in Y1 and 48 % (28 out of 30) in Y2, While the collection of household information in Y2, the survey in Y2Q4 was led entirely (100%) by women. The workshop in Y1 included a gender-based focus group discussion to collect information on the issues and challenges faced by each gender especially with regards to access, inclusion, benefits and their roles in rangeland management. This proved to be an effective strategy in gathering key information which will serve as a critical input for the Jom Daga NWP Management Plan, which is due for revision in the coming years.

Similarly, fieldwork in Dagala also included equal gender representation with women participation from Thimphu Forest Division, National Biodiversity Center and the community of Dagala. The collection and processing of herbarium specimens were led by a female expert as was the sampling of plant biomass which was carried out by Melam and Buthi from Dagala community. All members of the team were actively engaged in the plant identification process to promote women in taxonomy.
The key lesson learnt through this project was that there are no issues related to equity and inclusion. Similarly, there was no significant gender-wise differences in their understanding of the rangeland biodiversity and conservation threats in Dagala. However, there are different gender roles in managing rangelands, the different workloads and the different ways in each gender are vulnerable to the effects of rangeland degradation. These lessons serve as a main factor for the formulation of Tshering's third objective of his PhD study that seeks to assess the perception and vulnerabilities to woody plant encroachment.

4.4 Transfer of knowledge

The project's two seasons of fieldwork has direct application to the development of the management plan for the Jom Daga NWFP Group. Melam's involvement during the fieldwork through this project was critical as this gave her a clear idea of the biodiversity, threats and challenges of Dagala while also strengthening her knowledge of field survey and plant identification. During the workshop in Y2Q4, on the direct request by Thimphu Forest Division, the project partners coordinated the mapping of habitats and ranges of medicinal and aromatic plants. Through this exercise, a clear demarcation of the collection sites for different NWFP were made in consultation with local community members. These are critical information which will aid the planning of the sustainable management and collection of NWFP resources and strengthening the management plan, which will in turn contribute towards the conservation of rangeland biodiversity and enhanced income opportunities for local communities.

There are also opportunities for transfer of knowledge through this project to the preparation of the Thimphu Divisional Forest Office Management Plan which Tshering is co-leading after re-joining his office at the end of the project. One of the main components of this management

plan identifying threats and prescribing management interventions for a High Conservation Value (HCV) area, which the office had chosen to be as Dagala for its rangeland resources, importance to local communities and serving as an important watershed area to the residents of Thimphu city. The 400+ species recorded from the area and 300+ herbarium specimens collected will serve as an important resource for this document.

In Y2Q4 Tshering was invited to present his MSc research on the impact of shrub encroachment on rangeland biodiversity and fodder resources at a workshop organised in Paro, Bhutan by ICIMOD. There were 32 attendees at the week-long workshop and these included senior government officials from Bhutan, international scientists, heads of local government and members of the yak herding community from across Bhutan. The workshop was the inaugural event in ICIMOD's programme of rangeland research and restoration in Bhutan, which will last till 2026. This multi-agency programme has the potential to make a significant contribution to both yak herders livelihoods and biodiversity conservation by changing legislation and undertaking research into effective management actions in these rangelands.

4.5 Capacity building

Tshering's newly acquired expertise has been recognised in several interactions in Y2 and since the end of the project. During his participation in the ICIMOD workshop he interacted with senior officials from the Livestock Department who showed keen interest in working with Tshering in their future projects.

Shrub encroachment of pasture is recognised as one of the most serious threats facing yak herders and the ICIMOD workshop included a prescribed burning trial organized by the Department of Forests and Park Services and ICIMOD in collaboration with the local yak herders. Tshering is now participating directly in this initiative by conducting biodiversity inventories of the burnt sites and testing interventions to reclaim degraded rangelands. In Thimphu Divisional Forest Office where Tshering works, he has been assigned the task of drafting of a Management Plan for the office. This document, which is a first of its kind in Territorial Forest Offices (ie. forest jurisdiction outside protected areas) will serve as an overarching scientific forest management plan with timebound vision, mission and management prescriptions.

Tshering has also been invited to be a resource person for a capacity building training for the field staff under the four Range Offices under Thimphu Forest Division. The training, funded by International Climate Initiative (IKI), is aimed at building local capacities in using smart technologies in forest conservation. Through this training, Tshering has already trained 62 forest officials on the management and analysis of forestry data using Microsoft Excel.

After Melam's involvement in the fieldwork during Y2, she led the inventory and survey of *Neopicrorhiza scrophulariifolia* in Dagala. Meanwhile, Jamyang Choden, who was involved in the planning of the project was promoted to Head of the ABS and Bioprospecting Division within the National Biodiversity Center. She is spearheading the biodiversity conservation program by strengthening the ABS regime.

5 Monitoring and evaluation

There were no major changes in the project design.

Monitoring and evaluation throughout the project was by regular meetings with Tshering to review progress on scheduled activities and receive updates on the marks from the modules on his MSc course etc. Monitoring and evaluation was mainly the responsibility of RBGE. Colin Pendry accompanied Tshering to Bhutan for the final project workshop and to meet with project

partners and stakeholders. All were satisfied with progress and there was a clear enthusiasm for the project's achievements and the plans for the ongoing research programme.

Throughout the project all aspects of its work progressed well and it was not felt necessary to bring in any additional evaluation.

6 Lessons learnt

What worked and what didn't?

The project reinforced the importance of having project partners with good, long-term working relations with the local community. Therefore, Melam's role in this was central to the success of this project. Despite Tshering's extended stay in the UK, her work on the ground and excellent working rapport with the Dagala community ensured that there was constant feedback mechanisms and communication between project partners.

Bhutan's low population and compact bureaucracy enabled swift and efficient communication making collaboration very easy. This was evidenced by the high level of official and unofficial support the project received throughout, ranging from administrative approvals to logistical help.

One of the main issues faced was during the translation of English texts into Dzongkha for the preparation of bilingual identification guides. Through this activity, it was learnt that there were few Dzongkha words for even seemingly basic terms like "inflorescence" and "rhizomes". The project sought the service from the Dzongkha Development Commision, which is the preeminent institute of all matters Dzongkha in Bhutan, for the coinage of Dzongkha words for some common botanical words. The challenges were further exacerbated by the prevalence of botanical words that are unique to only graminoids, for which there are no Dzongkha equivalents. The project team had to resort to defining botanical words instead of translating them to ensure accessibility for the local users.

What would you do differently?

The metric to assess the number of grasses a person can identify in the Y1 survey would need to be changed. This is because there is a translational issue with the definitions of grasses and fodder in Dagala, with the yak herders including all these plants within a single term. As a result, the number of grasses they claimed to be able to identify much inflated as they included non-grass fodder species. As a result, the questionnaire had to be slightly modified in Y2 to account for this translation gap.

What recommendations?

As a transhumant society, the community of Dagala spend most of their time with their yaks, constantly moving with their animals between seasons. The relatively low turnout in the Y1 in July coincided with their migration to their summer pastures at higher elevations, resulting in a relatively poor attendance at the workshop. Conducting the workshop at the higher elevation sites would have been impracticable as most of the rangelands are scattered. Learning from this lesson, there was a deliberate attempt to conduct the Y2 workshop in winter when most of the herders migrate to lower elevations near settlement. If it were necessary to hold workshops in the alpine grasslands it would be necessary to schedule them for the period when the all the families migrate to the common grazing area.

The audit costs should be included within the budget from the outset. In our case the charge of £2,100 was borne by RBGE out of the overhead payments.

7 Actions taken in response to Annual Report reviews

Section 4.1 of the report noted that it would be beneficial in understanding how the project team ensure the effectiveness of the community awareness course for HH unable to attend the meeting at Dagala. Key information regarding the meeting was disseminated through the WeChat group for the Jom Daga NWFP, which Tshering and Melam are currently part of. This group enabled regular communication between the project partners and the community members, aided by their very supportive Executive members. Further to the HH survey conducted during the meeting, an additional 9 HH were surveyed through direct contact during the Y1 fieldwork in Dagala and further continued by Melam after Tshering's return to the UK.

Section 4.2 stated that "the project team must ensure that they evaluate how useful the data collected during fieldwork in Output 2 is when developing their prototype identification guides in Y2." To this end, the fieldwork carried out in both years was crucial in the development of bilingual identification guides in Y2. The extensive fieldwork carried out in Dagala allowed the team to collect information on the ecology, distribution range and morphological differences of different graminoid species. This was complemented by information obtained by yak herders who reported on the uses, local names and relevant traditional knowledge for each species. Further, the reports towards Outputs in Annex 1 have been updated.

Section 4.3 requested more information on how Tshering's research will be harnessed across the national scale. Tshering will be carrying out similar studies across Bhutan in different altitudinal ranges through his PhD study and his link with ICIMOD.

The feedback in Section 5 noted that there were no reports on support for International Conventions and we have now made that link.

The comment in Section 6 regarding the limited discussion on positive impact on poverty reduction and to make reference to the original pathway proposed in application stage has been addressed in Section 3.2 of this report.

The comments on the need for greater discussion on issues and lessons learned within the outputs in Section 8 and the promotion of activities beyond Dagala after this project in Section 11 have been considered and addressed in Sections 6 and 9 of this report respectively.

8 Sustainability and legacy

Tshering Dorji re-joined his office at the end of the project and in September 2024 will begin his PhD research. He is expected to go on to a position in the Department of Forest and Park Services on completion of his PhD. Tshering is also a member of the Global Grassy Group and continue to engage with other researchers in the group discussing new developments and findings related to grassland research.

The project has collaborated with diverse in-country partners and institutions to ensure transfer of knowledge and experience. It has invested in building human capital and institutional linkages which have already resulted in some very positive outcomes. There is already a strong institutional set up which was achieved through the careful selection of project partners in Bhutan (DoFPS and NBC), with their mandates cantered on conservation and improving economic livelihoods.

The sustainability and exit strategy proposed in the application still holds and it is being implemented in collaboration with the Department of Forests and Park Services and the National Biodiversity Center. Stakeholder engagement will be expanded to the Royal University of Bhutan to discuss plans and strategies to train students in grass identification and the survey of grassland ecology. This could also include providing supervisory services for undergraduate and post graduate students in their research work, as well as engaging young university students and interested field officials from the host country in Tshering's PhD.

The engagement with the Dagala community will continue with Melam's permanent position as the focal point the Jom Daga NWFP Group. After her engagement in the fieldwork in Y2, she was able to lead the survey of *Neopichorhiza scrophularia* in 2023. Such surveys are likely to continue for other threatened and economically important species, generating important knowledge and information for sustainable harvesting and conservation.

Tshering has continued to collect images and ecological information of graminoid species since the completion of the project. RBGE continues to provide access to the Plants and You Platform to him so that additional identification guides can be created. External funding will be sought for the publication of graminoid identification guides, in what would be the first of its kind for the plant group in Bhutan. Similarly, engagement with Pl@ntNet will continue as more pictures of graminoid species from Bhutan will be databased, beyond those from the alpine rangelands, which will provide identification help to users from the Himalayan region.

One of the lasting legacies of the project is through Tshering's MSc research on the impact of woody encroachment on rangeland ecosystems. This has been a largely unexplored area not only in Bhutan but also the larger alpine ecosystems in the Himalayan region. The knowledge and skills that Tshering received and networking with relevant experts in the field will be crucial as Tshering embarks on his PhD later this year. His findings will deepen our understanding on the intricate relationships between woody encroachment, biodiversity, soil carbon, people and fire management policies in Bhutan

9 Darwin Initiative identity

The project has been referred to as 'The Darwin Project' in all interactions with local communities, and the Darwin logo was used on the questionnaire and the workshop banner.

The funding was recognised as a distinct project and was not part of another programme.

There is general knowledge of the Darwin Initiative among Bhutanese biodiversity specialists after several successful projects there.

The project has not used social media.

Tshering is identified as a Darwin Initiative Fellow in RBGE.

10 Risk Management

No new risks have arisen in the last 12 months and the project has therefore not needed to make any adaptations.

11 Safeguarding

Has your Safeguarding Policy been updated in the past 12 months?	No
Have any concerns been investigated in the past 12 months	No
Does your project have a Safeguarding focal point?	No
Has the focal point attended any formal training in the last 12 months?	n/a
What proportion (and number) of project staff have received formal training on Safeguarding?	Past: 0% Planned: 0%
Has there been any lessons learnt or challenges on Safeguarding in the past 12 months? Please ensure no sensitive data is included within responses. There have been no safeguarding issues during the project	
Please describe any community sensitisation that has taken place over the lifetime of the project; include topics covered and number of participants. None	
Have there been any concerns around Health, Safety and Security of your staff over the lifetime of the project? If yes, please outline how this was resolved. No	

12 Finance and administration

12.1 Project expenditure

Project spend (indicative) since last Annual Report	2023/24 Grant (£)	2023/24 Total actual Darwin Initiative Costs (£)	Variance %	Comments (please explain significant variances)
Staff costs (see below)	[redacted]			The monthly stipend was increased by [redacted] because of the significant increase in living costs since the application was written
Consultancy costs				
Overhead Costs				
Travel and subsistence				
Operating Costs				The field expenses were much lower than had been anticipated, so we were able to use the underspend to fund the increase in the monthly stipend
Capital items (see below)				
Others (see below)				
TOTAL	36,724	36,770.14	**+0.1**	

Staff employed (Name and position)	Cost (£)
Tshering [redacted] - Darwin Fellow	[redacted]
TOTAL	

Capital items – description	Capital items – cost (£)
TOTAL	

Other items – description	Other items – cost (£)

TOTAL	

12.2 Additional funds or in-kind contributions secured

Matched funding leveraged by the partners to deliver the project	Total (£)
Colin Pendry salary	[redacted]
Mark Watson salary	
Bhaskar Adhikari salary	
TOTAL	**30741.01**

Total additional finance mobilised for new activities occurring outside of the project, building on evidence, best practices and the project	Total (£)
PhD studentship at University of Edinburgh, commencing September 2024	[redacted]
ICIMOD CASE funding	
TOTAL	

12.3 Value for Money

The main costs incurred by the project were the University fees and stipend to allow Tshering to study at RBGE. These costs were unavoidable as no other UK institution has the capacity, experience and connections to support this project. The overhead costs recovered were at a typical level. Tshering made outstanding use of these funds by excelling in all aspects of the taught course and research project.

Savings were made in the Operating Costs because fieldwork estimates were based on costs incurred for Flora of Nepal plant collecting expeditions. Large field teams in Nepal require considerable support staff, but the fieldwork was not directly comparable with Tshering's project. There was much logistical support from local partners which had not been factored into the orginal budget, and furthermore costs could be kept down for the smaller field team with much less equipment.

Savings from the operational budget were used to supplement the stipend costs. The cost of living in the UK rose considerably between over the lifetime of the application and the project, and we were fortunate in having the financial headroom to meet these additional costs.

13 Other comments on progress not covered elsewhere

Part of the underspend in the operational budget was used to send surplus copies of The Flora of Bhutan to the National Biodiversity Center. The Flora is a vital resource for scientists and

land managers in Bhutan, but in-country access to it has been limited because the volumes were printed in the UK and high shipping costs made it expensive to send. Unsold stock held at RBGE comprising fifteen complete sets (each consisting of 9 books) was sent along with 35 partial sets and 24 other publications relevant to Himalayan research (a total of 301 books). The NBC will distribute these volumes to researchers and conservationists in Bhutan. This was much appreciated by our project partners and will have a long term legacy in Bhutan.

14 OPTIONAL: Outstanding achievements of your project (300-400 words maximum). This section may be used for publicity purposes

I agree for the Biodiversity Challenge Funds Secretariat to publish the content of this section (please leave this line in to indicate your agreement to use any material you provide here).

The outstanding achievement of this project is Tshering's progression of his MSc summer research study into a fully-funded 4-year PhD project which will investigate rangeland ecology over the whole of Bhutan. Tshering will join a dynamic research lab whose members work in grasslands across Africa, South America and Asia. His ground-breaking research will examine the impacts of woody encroachment on biodiversity and ecosystem services, placing the Himalayan rangelands in a global context for the first time, and having the potential to aid restoration of both their biodiversity and traditional communities.

Tshering has secured funding of over £through the University of Edinburgh's highly competitive E4 DTP scheme which annually funds fewer than 30 projects from over 700 applicants. One particularly exciting feature of the project is that he has developed a close relationship with ICIMOD, the International Centre for Integrated Mountain Development, a high-profile NGO which works across the Himalayas, operating a governmental levels. ICIMOD has just embarked on a programme to restore rangeland productivity and support traditional lifestyles and is partially funding Tshering's PhD. Their involvement gives Tshering's research direct access to policy makers and will dramatically increase the impact of his study.

None of this would have happened without the Darwin Capability and Capacity funding.

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File Type (Image / Video / Graphic)	File Name or File Location	Caption, country and credit	Online accounts to be tagged (leave blank if none)	Consent of subjects received (delete as necessary)
Image	DARCC002-14-A	Survey on the ecology of rangelands - Y1	RBGE socials?	**Yes** / No
Image	DARCC002-14-B	Survey examining the effects of woody encroachment in rangelands - Y2		**Yes** / No
Image	DARCC002-14-C	Yak among grasses		**Yes** / No
Image	DARCC002-14-D	Fieldwork team in Y2		**Yes** / No
Image	DARCC002-14-E	Subalpine Rhododendron pasture		**Yes** / No
Image	DARCC002-14-F	Workshop participants - Y1		**Yes** / No
Image	DARCC002-14-G	Gender-based FGD led by male and female facilitators in Y1 workshop		**Yes** / No
Image	DARCC002-14-H	Workshop partcipants - Y2		**Yes** / No

Annex 1 Report of progress and achievements against final project indicators of success for the life of the project

Project summary	Progress and achievements
Outcome Enhanced capacity for plant biodiversity research in Bhutan, focussed on the management of high-altitude grasslands, leading to improved livelihoods of pastoralists and the conservation and sustainable use of natural resources.	The Darwin Fellow has greatly enhanced capacity for biodiversity research and his research has a pathway to directly improve livelihoods in the study area and beyond.
Outcome indicator 0.1 Bhutan has increased in-country capacity for post-graduate research in plant biodiversity of rangeland species led by one new MSc graduate, by Y2 Q2	The Darwin Fellow has excelled in the taught and research components of his MSc and is developing a programme of PhD research which follows on from it.
Outcome indicator 0.2 Knowledge of rangeland species biodiversity and links with livelihoods enhanced, and species identification tools developed for at least 20 key graminoid species by end of project	Ecological assessment of Dagala rangeland resources completed and identification tool developed
Outcome indicator 0.3 Awareness of the value of rangeland biodiversity and its sustainable use enhanced by 75% of at least 50HH (Households) by end of project	73 participants from 73 households participated in project activities and are more aware of the value of rangeland biodiversity and its sustainable use.
Output 1 Improved national capacity in Bhutan for plant biodiversity research and documentation, enabling the characterisation, identification and effective management of temperate rangeland plant species (grasses, sedges and medicinal plants).	
Output indicator 1.1 Darwin Fellow (Tshering Dorji) successfully completes MSc in Biodiversity and Taxonomy of Plants at RBGE, including a summer research project on Bhutanese high altitude graminoids, by Y2 Q2	MSc successfully completed to distinction level **(Annex 5: 1.1 MSc degree certificate)**
Output indicator 1.2, Darwin Fellow trained in digital plant photography, and high quality digital macro photographs captured for identification manuals of at least 30 graminoid and medicinal plant species by Y2 Q2	Photography training completed and 10,000 photographs of 180 species taken **(Annex 5: 1.2 Training on macrophotography)**
Output indicator 1.3 Darwin Fellow trained in RBGE's in-house specimen management database (Padme) and generating spatial data on plant distribution for at least 20 graminoid species by Y1 Q2	Database training completed and 2169 records added from RBGE, CAL and THIM **(Annex 5: 1.3 Padme summary)**

Output 2. Enhanced understanding of the ecology and conservation of temperate rangelands, the biology and identity of key graminoid species, and the threats and opportunities for high-altitude pastoralist communities.	
Output indicator 2.1. Pilot study in grassland composition and ecology in the Dagala region of Bhutan conducted to assess conservation and threats to livelihoods and economic opportunities, by Y2 Q1	42 sites sampled using the Global Grassy Group sampling protocol to study ecology of rangelands and the impact of woody encroachment on biodiversity **(Annex 5: 2.2a Dagala 2022 Report_compressed; 2.1 & 4.3 MSc Dissertation_compressed)**
Output indicator 2.2. Reference research collections of at least 30 graminoids and economically important medicinal plant species created and preserved at national and international herbaria by Y2 Q3	300 herbarium specimens of graminoids and medicinal plants and specimens housed at RBGE and NBC **(Annex 5 2.2 MTA 2023 & 2024 combined_compressed)**.
Output indicator 2.3. Bilingual identification guides for at least 20 species of graminoids developed using high quality images and the Plants and You style by end of project	Bilingual identification guides (in English and Dzongkha) to 20 species of graminoids prepared **(Annex 5: 2.2 & 3.3 Plants and You pages combined_compressed).**
Output indicator 2.4. Identification confidence scores improved by 50% using the Pl@ntNet app for target 20 graminoid species, by end of project.	Correct identifications at the species level in top 1 went from 5.47% to 71.23%, and in top 5 from 15% to 83.5% using the updated Pl@ntNet identification model **(Annex 5: 2.4 Bhutanese.graminoids.Final.result)**.
Output 3. Increased community awareness of the importance of rangeland biodiversity, key economically important plant species, and the sustainable management of rangeland resources in the face of invasion by non-native species.	
Output indicator 3.1. The awareness of the importance of rangeland biodiversity and links with livelihoods increased by 75% for at least 50 HH by end of project (Baseline established Y1 Q2).	About 79% of the HH reported that their understanding of rangeland biodiversity increased, while a similar proportion of the HH reported that they had increased understanding of graminoids and their identification. HH who reported about knowledge of ABS policy increased from 10% in Y1 (3 out of 34) to 82% in Y2 after the workshop, showing that they are now more aware of the links to rangeland biodiversity with economic livelihoods **(Annex 5: 3.1 & 3.2 Final workshop Report; 3.1a Supplementary_ HH Survey questionnaire)**.
Output indicator 3.2. More than 50 HH participate in workshops providing training in sustainable management of rangeland resources by end of project	73 HH participated in workshop on community awareness of biodiversity conservation, graminoid identification, and ABS Policy implementation for sustainable utilization and the fair and equitable access and benefit sharing. 90% of members of the Jom Daga NWF Group participated in the workshops **(Annex 5: 3.1 & 3.2 Final workshop Report)**

Output indicator 3.3 Bilingual prototype identification guides to 5 sample graminoid species user-tested with community groups by Y2 Q1	Identification guides for 5 graminoid species were tested for feedback at start of second fieldwork **(Annex 5: 3.3 Plants and You user testing report)**.
Output 4. International collaboration network established by Darwin Fellow with national herbaria, grassland specialists, and experienced Darwin Initiative project partners in India, Nepal and UK (x3) to improve capacity for future research.	
Output indicator 4.1. Expertise of Darwin Fellow in graminoid taxonomy and identification enhanced through study visits to 5 institutions with significant Himalayan graminoid collections and liaising with graminoid specialists in India (CAL), Nepal (KATH) and UK (Natural History Museum, RBG Kew, RBG Edinburgh), by end of project	Study visits were made to 5 herbaria with significant Himalayan graminoid collections - Kolkata (CAL), Kathmandu (KATH) and London (Natural History Museum: BM, Royal Botanic Garden Kew: K; RBG Edinburgh: E), contacts were made with the grass specialists at each of these institutions and a research network was established **(Annex 5: 4.1 Report on the field visits to major herbaria).**
Output indicator 4.2. Enhanced capacity in Bhutan for leading on Darwin Initiative projects, by end of project	Darwin Fellow has been engaged in the development of application, planning and implementation of activities, and report writing. New collaborations developed with University of Edinburgh and ICIMOD **(Annex 5: 4.2 Ability to lead Darwin Initiative Projects).**
Output indicator 4.3. Improved understanding of grassland ecology, sampling methods, and sustainable management by end of project	Research integrated with global research programme and PhD project set up . **(Annex 5: Improved understanding of grassland ecology).**

Annex 2 Project's full current indicators of success as presented in the application form (unless changes have been agreed)

Project summary	SMART Indicators	Means of verification
Outcome: Enhanced capacity for plant biodiversity research in Bhutan, focussed on the management of high-altitude grasslands, leading to improved livelihoods of pastoralists and the conservation and sustainable use of natural resources	1. Bhutan has increased in-country capacity for post-graduate research in plant biodiversity of rangeland species led by one new MSc graduate, by Y2 Q2 2. Knowledge of rangeland species biodiversity and links with livelihoods enhanced, and species identification tools developed for at least 20 key graminoid species by end of project 3. Awareness of the value of rangeland biodiversity and its sustainable use enhanced by 75% of at least 50HH (Households) by end of project	1. MSc certificate, project reports 2. Project reports, herbarium occurrence vouchers, identification tools (print and electronic) 3. Project reports, survey reports
Output 1 Improved national capacity in Bhutan for plant biodiversity research and documentation, enabling the characterisation, identification and effective management of temperate rangeland plant species (grasses, sedges and medicinal plants)	1.1 Darwin Fellow (Tshering Dorji) successfully completes MSc in Biodiversity and Taxonomy of Plants at RBGE, including a summer research project on Bhutanese high altitude graminoids, by Y2 Q2 1.2 Darwin Fellow trained in digital plant photography, and high quality digital macro photographs captured for identification manuals of at least 30 graminoid and medicinal plant species by Y2 Q2 1.3 Darwin Fellow trained in RBGE's in-house specimen management database (Padme) and generating spatial data on plant distribution for at least 20 graminoid species by Y1 Q2	1.1 MSc certificate 1.2 Photographs, project reports 1.3 Photographs, project reports
Output 2 Enhanced understanding of the ecology and conservation of temperate rangelands, the biology and identity of key graminoid species, and the threats and opportunities for high-altitude pastoralist communities	2.1 Pilot study in grassland composition and ecology in the Dagala region of Bhutan conducted to assess conservation and threats to livelihoods and economic opportunities, by Y2 Q1 2.2 Reference research collections of at least 30 graminoids and economically important medicinal plant species created and preserved at national and international herbaria by Y2 Q3	2.1 MSc Thesis report 2.2 Reference collections at national and international herbaria, project report 2.3 Plants and You guides and report 2.4 Pl@ntNet app test report

	2.3 Bilingual identification guides for at least 20 species of graminoids developed using high quality images and the Plants and You style by end of project. 2.4 Identification confidence scores improved by 50% using the Pl@ntNet app for target 20 graminoid species, by end of project.	
Output 3 Increased community awareness of the importance of rangeland biodiversity, key economically important plant species, and the sustainable management of rangeland resources in the face of invasion by non-native species.	3.1 The awareness of the importance of rangeland biodiversity and links with livelihoods increased by 75% for at least 50 HH by end of project (Baseline established Y1 Q2). 3.2 More than 50 HH participate in workshops providing training in sustainable management of rangeland resources by end of project. 3.3 Bilingual prototype identification guides to 5 sample graminoid species user-tested with community groups by Y2 Q1.	3.1 Project report: baseline and end of project surveys. Workshop reports. 3.2 Workshop report 3.3 Plants and You user testing report
Output 4 International collaboration network established by Darwin Fellow with national herbaria, grassland specialists, and experienced Darwin Initiative project partners in India, Nepal and UK (x3) to improve capacity for future research.	4.1. Expertise of Darwin Fellow in graminoid taxonomy and identification enhanced through study visits to 5 institutions with significant Himalayan graminoid collections and liaising with graminoid specialists in India (CAL), Nepal (KATH) and UK (Natural History Museum, RBG Kew, RBG Edinburgh), by end of project 4.2. Enhanced capacity in Bhutan for leading on Darwin Initiative projects, by end of project 4.3. Improved understanding of grassland ecology, sampling methods, and sustainable management by end of project	4.1. Report by Darwin Fellow with qualitative assessment 4.2. Report by Darwin Fellow with qualitative assessment 4.3. Report by Darwin Fellow with qualitative assessment

Activities (each activity is numbered according to the output that it will contribute towards, for example 1.1, 1.2 and 1.3 are contributing to Output 1)

Output 1

1.1 Enrol Darwin Fellow (Tshering Dorjii) to MSc in Biodiversity and Taxonomy of Plants at RBGE/The University of Edinburgh, and provide support throughout the course. Course option taken through the year included into the student project will be based on those which best support the project outcome.

1.2 Organize training programme for Darwin Fellow in digital plant photography, with particular focus on macro photography with periodic reviews and supervision.

1.3 Organize training programme for Darwin Fellow on database management of graminoid species.

Output 2

2.1 Conduct one month field study in Dagala region of Bhutan to study the grassland communities to assess the conservation status of graminoid species, and threats and opportunities to livelihoods.
2.2 Collect ecological and population data, and voucher herbarium specimens of at least 30 key graminoids and economically important grassland species of medicinal importance.
2.3 Prepare bilingual identification guides for at least 20 species of graminoids using high quality images using Plants and You format developed at RBGE.
2.4 Upload image profiles and occurrence data in Pl@ntNet system for at least 20 species of graminoids to improve the identification confidence scores of the Pl@ntNet identification app.

Output 3

3.1 Conduct awareness raising programme on the importance of rangeland biodiversity and carry out initial baseline and end of year surveys in amongst 50 HH in Dagala region in Bhutan to measure the change at the end of the project
3.2 Conduct awareness raising programme including 3 days community workshop for least 50 HH in importance of biodiversity and sustainable management of rangeland resources.
3.3 Test and revise prototype bilingual identification guides with the community groups and use the feedback to improve the identification guides developed in Output 2

Output 4

4.1 Identify herbarium specimens using the resources in India (CAL), Nepal (KATH) and UK (Natural History Museum, RBG Kew, RBG Edinburgh), and liaising with the grass specialists at these institutions
4.2 Gain experience and receive mentorship in biodiversity/poverty alleviation projects from experienced Darwin Initiative project leaders/partners at RBG Kew and RBG Edinburgh
4.3 Work with specialists at RBG Kew (Maria Vorontsova) and RBG Edinburgh (Caroline Lehmann) to improve understanding of grassland ecology, sampling methods, and sustainable management

Important Assumptions

1. Darwin Fellow is awarded a UK visa to study at RBGE and work there beyond the end of the MSc.
2. Darwin Fellow is competent to successfully complete MSc course.
3. Darwin Fellow receives full support from local partners and government authorities.
4. Travel situation in Bhutan remains stable; Covid 19 and other natural disasters present only short-term disruption.

5. Local communities in Dagala region in Bhutan actively engage with the training and awareness-raising programme.
6. International herbaria in India (CAL), Nepal (KATH) and UK remain open to visitors with only minor disruption due to Covid 19.

Annex 3 Standard Indicators

Table 1 Project Standard Indicators

DI Indicator number	Name of indicator	Units	Disaggregation	Year 1 Total	Year 2 Total	Year 3 Total	Total achieved	Total planned
DI-A01	Number of people in eligible countries who have completed structured and relevant training	People	Men	1	1		1	1
DI-A03	Number of local/national organisations with improved capability and capacity as a result of project.	Number of organisations	National research organisations		2		2	2
DI-B01	Number of new/improved habitat management plans available and endorsed	Number	Languages (local/other); Typology of species management plans; (Harvest, Trade, Invasive species management, recovery, re-introduction, ex-situ		1			1
DI-C05	Number of projects contributing data, insights, and case studies to national Multilateral Environmental Agreements (MEAs) related reporting processes and calls for evidence.	Number	MEA, Information typology (data, insights, case studies).					
DI-C09	Species reference collections made (known to science, new to science)	Number	Herbarium specimens	140	162			Not defined
DI-C16	Number of records added to accessible databases	Number	Pl@ntNet		232			Not defined
DI-C17	Number of unique papers submitted to peer reviewed journals	Number	Journal of Ecology paper		1			
DI-C19	Number of other publications produced	Number	Plants and You pages		20			20
DI-D01	Hectares of habitat under sustainable management	Area	Community controlled		24,608 ha			Not defined

Table 2 Publications

Checklist for submission

	Check
Different reporting templates have different questions, and it is important you use the correct one. Have you checked you have used the **correct template** (checking fund, type of report (i.e. Annual or Final), and year) and **deleted the blue guidance text** before submission?	
Is the report less than 10MB? If so, please email to BCF-Reports@niras.com putting the project number in the Subject line.	
Is your report more than 10MB? If so, please discuss with BCF-Reports@niras.com about the best way to deliver the report, putting the project number in the Subject line. All supporting material should be submitted in a way that can be accessed and downloaded as one complete package.	
If you are submitting photos for publicity purposes, **do these meet the outlined requirements (see section 14)?**	
Have you included means of verification? You should not submit every project document, but the main outputs and a selection of the others would strengthen the report.	
Have you involved your partners in preparation of the report and named the main contributors?	
Have you completed the Project Expenditure table fully?	
Do not include claim forms or other communications with this report.	