

## The Rufford Foundation

### Final Report

---

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

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

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

Please submit your final report to [jane@rufford.org](mailto:jane@rufford.org).

Thank you for your help.

**Josh Cole, Grants Director**

---

Grant Recipient Details	
<b>Your name</b>	Mukti Ram Poudeyal
<b>Project title</b>	Population Ecology and Harvesting Sustainability of Threatened Medicinal Plant Species <i>Neopicrorhiza scrophulariiflora</i> and <i>Meconopsis napaulensis</i> in Nepal Himalaya
<b>RSG reference</b>	20505-1
<b>Reporting period</b>	March, 2017-November, 2018
<b>Amount of grant</b>	£4995
<b>Your email address</b>	<a href="mailto:muktipoudeyal@gmail.com">muktipoudeyal@gmail.com</a>
<b>Date of this report</b>	December 2018

**1. Please indicate the level of achievement of the project's original objectives and include any relevant comments on factors affecting this.**

Objective	Not achieved	Partially achieved	Fully achieved	Comments
<p>To assess the variation in demographic properties that contribute to the population growth and also examine their variation in relation to environmental factors</p>				<p>The demographic properties of studied species (<i>Neopicrorhiza scrophulariiflora</i> and <i>Meconopsis napaulensis</i>) was intensively carried out from 2015 to 2018. This study covered two regions with contrasting harvest situation in alpine habitat- one with open-access, in Api-Nampa Conservation Area (ANCA) and other commercially protected in Langtang National Park (LNP). Geographically, both the species were patchily distributed in narrow habitat amplitude in the study areas in between 3500 and 4800 m. The plant density in both the species decrease with increasing elevation, the negative effect of elevation was more significant above 4200 m. However, other environmental factors such as shrub cover estimate showed positive effect on plant density and plant populations are more sensitive rocky areas. Flower production and fruit setting was negative in both the species but seed formation in <i>Meconopsis</i> was mostly found increasing along the elevation.</p>
<p>To examine the effects of in situ harvesting on plant demography and fitness-related traits along an altitudinal gradient</p>				<p>Heavier anthropogenic factors such as harvest was found to be negative for <i>Neopicrorhiza</i> population, and livestock grazing was tolerable for plant population; sometimes it appeared positive for the increasing vegetative density in case of <i>Neopicrorhiza</i> but grazing effect was found to be more negative to <i>Meconopsis</i> populations. The harvest for commercial collection was detrimental to density, biomass</p>

			<p>and sexual reproduction in <i>Neopicrorhiza</i> population such as in open access area but in controlled harvest conditions, usually at low intensity, plant density showed a positive response. Relatively, vegetative stage plants can tolerate a greater extent of harvest than can the reproductive stage. Less negative effect of harvest was usually buffered by shrub land populations but negative effect of harvest was less tolerable for populations in rocky and high alpine area (&gt;4500 m). Harvest effect on <i>Meconopsis</i> was less noticeable but livestock grazing impact was detrimental to density, flower production and highly negative for regeneration process. The harvest and grazing impact slightly reduced along the elevation in the case of <i>Neopicrorhiza</i> population. However, in the case of <i>Meconopsis</i>, harvest did not reveal any significant pattern along the elevation. Livestock grazing showed strong negative effect on plant population but its effect reduces increasing along the mountain slope, so plants are better protected increasing along the steepness of the mountain.</p>
<p>To evaluate the socio-economic contribution of targeted MPs in the livelihoods of local people</p>			<p><i>Neopicrorhiza</i> was the most used herbal medicine in both the study areas, commonly used for headache, cough and cold. In the both the areas, the plant is primarily harvested for herbal use. Plant is banned for commercial collection in protected areas due to legal restriction. However, in open access area, heavy harvesting for trade was serious for the long-term sustainability. Each household harvest average of 150 kg dry weight each year for commercial collection and earned Nepali rupees 90000 (≈USD 818) which showed one of the cash income</p>

			<p>generating environmental product in remote villages.</p> <p>In the case of Nepal endemic species <i>Meconopsis</i>, its distribution is restricted only in protected area (LNP) and plant is utilised to treat digestive disorder, chest pain, sore throat and headache. However, the collection is limited only for local use. So, its ecological importance is overlaid the economic importance.</p>
<p>To develop a model of sustainable harvesting that reconciles ecological, socio-cultural and economic values of the species</p>			<p>We evaluated the harvest response of <i>Neopicrorhiza</i> by simulating the local harvest practices. Heavier harvest effect (removal of &gt;50% plant) took longer time to recovery. Based on the preliminary analysis, lower intensity such as 25-50% removal of showed positive effect on density, however, plant response was depending on habitat type. Some shrubland plots were able tolerate up to 75% harvest impact.</p> <p>However, in <i>Meconopsis</i>, we did not apply harvest treatment, even removal of 0% of individuals (computer simulation on collected data set) of flowering individual showed negative impact on population growth.</p> <p>Empirical field based data were collected. The analysis work is undergoing, so development of sustainable management model is yet to be finalised.</p>

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

Both the studied areas were located in remote of the Nepal Himalaya, the remoteness is further challenged by rugged terrain, weak and fragile land structure, strong river barriers due to steep mountains and a lack of infrastructure at local level. We experienced two big landslides and many smaller ones and one river barrier during field visit in ANCA area in 2017. It took one more week to complete the fieldwork. Although, we had a limited experience in the case of Langtang area, of central Nepal but we invested extra effort for arrangement of time, human resources and budget to over these limitation in the case of ANCA.

Another great challenge in both areas was to protect the established permanent plot and plant therein for observation of growth rate per year. It is because of dependency of local people to our study species. We had trained, sensitised and provided intensive information to local people including herder, medicinal plant user and harvester regarding the importance and practical application of our study species. We received 70-80% tagged plants in ANCA that plant collectors harvested some of the tagged plants from our study pots (almost 10%) and 90-100% in LNP. In ANCA, during interview with local people, few informants were reluctant to provide for the traded amount per annum, due to the government policy for restriction for trade in some of the year, however from crosscheck interview we obtained the detailed information. In fact, this was not a direct limiting factor, it may effect on some discussion points for finalisation of results. However, we obtained tremendous information on utilisation pattern, their ecological and economic contribution. The available information could be considered sufficient for the development of sustainable utilisation and management model.

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

#### **A. Effect of anthropogenic effect on plant population**

The existing anthropogenic disturbances, including grazing and harvesting effect on plant populations of both *Neopicrorhiza scrophulariiflora* and *Meconopsis napaulensis* was studied in terms of plant density, biomass and morphological trait variation across an environmental continuum such as along the elevation gradient. Heavier harvest effect was negative in ANCA in the case of *Neopicrorhiza* but lower intensity of harvest was positive to the plant population.

Existing harvest effect had no detrimental effect on *Meconopsis napaulensis* but plant populations are threatened with heavier grazing impact. However, in the case *Neopicrorhiza* garzing had almost positive effect as plant is found to be grazing tolerant. Both harvest and grazing impact reduce along the increasing elevation and reducing temperature beacame the limiting factor for both anthropogenic impact and plant population growth.

#### **B. Socio-economic contribution of targeted species and livelihood importance**

In open access region, there are almost five times as many plant collectors than in protected region and their intensive harvest coupled with significant pre-mature collection were recorded during field observation time. The range of collection per household for healthcare did not vary in both regions but amount of collection for trade was serious concern in open access region. Commercial collection ranging from 50-450 kg dry weight of *Neopicrorhiza* per household per annum provides major and consistent cash income resource to the locals at protected area. The commercial collection leading to premature collection and intensive harvest on the same population was the challenging problem for sustainable use of this resources. In the case of *Meconopsis*, intensive grazing on population providing resources for the traditional pastoralism and we suggest management authority not to provide livestock activity at least 2 months on those population for sustainable management of resources, otherwise livestock impact was less negative on those populations.

### **C. Socio-economic contribution of targeted species and livelihood importance**

Based on our findings population growth rate of *Meconopsis* is almost constant and consistent through out the study period, provided that plant population exhibited interrelation with livestock grazing impact. The lower intensity of livestock activity facilitating the plant population for seed dispersal; reduction of competitive forage species as *Meconopsis* is not first choice forage species; urination, digging and dropping for increasing fertility and loosening soil layers for arrival new seedlings and many more. However, repetitive and heavier grazing showed negative effect. So, we suggest regulatory intervention on livestock grazing system in the study populations.

In the case of *Neopicrorhiza*, we applied simulation of local harvest practices, 0-100% removal of plant in experimental plots. Lower level of harvest, such removal of plants from 25-50% showed positive impact on plant density. However, it depends on habitat types level of tolerance is higher in shrubby habitat and lower in rocky habitat. Also, level of harvest tolerance is decreased along the increasing elevation, negative effect was noticeable >4500 m above the sea level. Thus, we suggest to develop the area and habitat based plant harvest guidelines for the sustainable management.

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

One of the objectives of this project is to increase local participation in the conservation and management issues of study species. As outlined in methodology, at least 16 local people in different years participated in our population sampling and monitoring work LNP and equal number of people were participating in plant population studied in ANCA. They were aware about the negative impact of heavy and repetitive harvest in the same plant population and recognised the ways to reduce ecological costs of harvesting. People involved in these research stages are able to carry out the take care of plant population and independently can carry out job as citizen scientists. We have recommended these personnel to the concerned offices both in LNP and ANCA so that conservation offices can be indirectly benefit through this empowerment and help them to develop management strategies for non-timber forest products. Besides this number, significant number of people participated for transportation and hospitalities in our project. We conducted interview and public campaign with 165 people in ANCA and 38 people in LNP, figure provides the relationship between this project and local communities.

### **5. Are there any plans to continue this work?**

Both the study areas in LNP Rasuwa north-central and ANCA Darchula north-western Nepal are remote mountains of the Himalaya and local communities have several traditional practices such as transhumance, harvest and trade of high value alpine medicinal plants. *Meconopsis* is an endemic species and its global population distributed within the LNP. It may needs different aspect of study that are not cover by present research project. However, *Neopicrorhiza* is an important herbal drug



both for domestic consumption and trade-related species and specially in ANCA, it was found to be one of the cash income generating resources, owing to limited diversified opportunities to local people. Present research providing the baseline information of the targeted species from the selected range of study areas. This type of study desperately needs higher number of researches in wider areas, with trained, and driven people for conservation and management of alpine plant resources in Nepal and this would be the ideal opportunity for me to be a part of this.

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

At local level we conducted a 1-day preliminary result sharing workshop among local communities, people, traders, and herders in during field work time (July-August 2017) in ANCA and once in each year in 2017 (August) and 2018 (July) in Lauribina and Chandanbari, Safru village in LNP. Also, we informed about our findings in LNP and ANCA during the meeting with officials, fieldwork report was submitted after the completion of each field trip.

Preliminary findings of the research was shared at National level two workshops (in November 2017 and 2018) organised by Tansiting Green-growth Nepal where the governmental officials from Department of National Parks and Wildlife Conservation, Department of Forest, Department of Plant Resources, National Trust for Nature Conservation, World Wildlife Fund, Nepal, and Tribhuvan University. Also, on that programme people related to environmental resources from different non-governmental sectors and traders were participated.

The research findings was shared with international community by attending in six oral presentation three prior to granting this grant and next three during 2017 and 2018. As planned, some of the findings will be shared in international peer reviewed journals and local journals. Based on this project work, three article manuscripts has been prepared all of them are in the finalisation process from the exports and respective grant providers will be duly acknowledged.

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

The project plan was a part of ongoing PhD research. The PhD scholarship was funded by Danida scholarship programme through local governing organisation transiting to Green Growth: Natural Resources in Nepal (TGG-N) started in 2014. A major part of the ecological work was started in LNP and ANCA in 2015/016. The project was seeking additional funds to continue the field work planned for 2017 and 2018 for about 18 months.

The third field visit was organised in late June to October 2017 to monitor the already established plots and further to conduct some extra ecological sampling in new plots. Additionally, permanent plots were re-monitored and data were successfully gathered. We had conducted public consultation workshop and socio-economic survey before, during and after the ecological sampling in each year. Stakeholder meetings were conducted with LNP and ANCA at the beginning (May/June 2017)

and end (August/September 2018) of the project to share preliminary findings, existing conservation problems, and discuss possible solutions. In addition, full-day workshops were conducted in Thulosafu village of LNP and Ghusa village and Pilkandaha of ANCA in both years (July/August) including herbal practitioners, harvesters and traders. In each fieldwork completion, the project progress was informed to the Rufford Foundation, the fieldwork and result production was carried out as stipulated in the project.

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

Item	Budgeted Amount	Actual Amount	Difference	Comments
Transportation	480	550	70	We had to use hired vehicle during our trip to Darchula, and Rasuwa that increased the cost
Porter charge -including food and accommodation	576	626	50	We stayed more days due to landslides in the study areas
Assistance cost for socio-economic survey for Local resource person	190	200	10	Cost for Local resource person was slightly greater than we stipulated in proposed plan
Assistance cost for complete field survey: Botanist	1118	1200	82	We stayed more days due to landslides in the study area
Socio-economic survey and public campaign	1000	1000	0	Cost was sufficient
Production of cost Stationary/educational and awareness materials	185	200	15	As per market inflammation
Accommodation cost during field work	992	1220	228	We stayed more days due to landslides in the study area
Camping material ( including tent and sleeping bags	0	0	0	Supported by other funding
Miscellaneous (10% of RSG budget total)	454			Budget from this title was transferred to deficit title
<b>Total</b>	<b>4995</b>	<b>4996</b>	<b>455</b>	

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

The present report prepared according the time format/limit according to the RSG guidelines. The result based answers provided in this report are based on preliminary



analysis. We have a lot of work related to this project to finalise the result and draw the conclusion. We will have following next steps: a) Analysing the data for preparing the manuscript that revealed a model of sustainable harvesting that reconciles ecological, socio-cultural and economic values of the species for international scientific forums; (b) Preparing a manuscript for popular media related to the ecological and economic importance of endemic species like *Meconopsis*, harvest on plant species is not always negative but it varies with plant regeneration strategies, habitat types and harvest intensity; and (c) Planning for the next step research effect on harvest effect on *Neopicrorhiza* with wider geographical range such as to cover eastern Nepal which is not covered at present and to develop research project on population dynamics of more number *Meconopsis* species of the Himalaya Nepal and related monocarpic plants.

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

We had used the logo of Rufford Foundation in posters, oral presentations, public discussion and workshop discussion in both study areas. The financial contribution was duly acknowledged result shared in each four international conference presentations and other scientific forums

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

The project work and their related activities were conducted by under the close supervision of research supervisors (Dr. Suresh Kumar Ghimire, Dr. Henrik Meilby and Dr. Bharat Babu Shrestha). However, the location of population and other ethnobiological information were collected by employing the local resource person in each study area. Further, local resource person helping us for the identification of the species sites varying with quality and quantity so that we are able compare the population status, establishment of permanent plots, information discrimination and protection of the permanent plots throughout the study period.

The following people had major role for the completion of the project successfully.

**Mukti Ram Poudeyal (Principal investigator)**

Role: Team leader, field preparation and arrangement, data collection, data analysis, report production/submission.

**Bikarm Jnawali (Central Department of Botany, Research assistant)**

He had actively participated during field visits, data collection and ethnobotany/socio-economic survey in each population in both Apinampa and Langtang National Park in 2017, helping for public participation and data digitization.

**Sunita Shrestha (Central Department of Botany, Research assistant)**

She had participated during field visit in Lantang National Park in 2017, monitoring of plant populations and data digitization.

**Shristi Nepal (Central Department of Botany, Research assistant)**

She had participated during field visit in Apinampa Conservation Area in 2017, helping for ethnobotany/socio-economic survey, monitoring of plant populations and data digitization.

**Ashish Dhimi (Central Department of Botany, Research assistant)**

He participated during field visit in Lantang National Park in 2018, helping for ethnobotany/socio-economic survey, monitoring of plant populations and data digitization.

**Neelam Pandey (Central Department of Botany, Research assistant)**

She participated during field visit in Lantang National Park in 2018, helping for ethnobotany/socio-economic survey, monitoring of plant populations and data digitization.

Similarly, Santosh Thapa-Magar, Chet Mani Chaudhary from Central Department of Botany, Tribhuvan University and Gokul Neupane, Aayurved Campus, Tribhuvan University were participated and supported for the data collection of previous stage (prior to receive the RSG Grant, 2014-2016) of field study.

## **12. Any other comments?**

This project work could not have reached completion without financial support of RSG project and this grant support became an avenue for strengthening my research carrier to undertake such a long-term study and analysis of positive and negative effect of biotic and abiotic factors in remote mountains of Himalaya. The project is a part of undergoing PhD research. Although my PhD research is fully-funded by DANIDA fellowship programme but my field work was quite challenging due to earthquake in 2072 and consequent aftershocks which compelled me to extend my study duration. The RSG support became milestone to my PhD research. I am highly grateful to research supervisors and RSG project referees for their valuable supports and recommendations. Also, I am very much thankful to the Department of National Park and Wildlife Conservation (DNPWC), Api-Nampa Conservation Area and of Langtang National Park (LNP) for granting permission to carry out this project work inside the protected area and for providing necessary information.

I am duly thankful to them those who directly and indirectly supported this research project. I submitted hereby and prepared manuscripts would not be in the present shape and order. However, the detail analysis is yet to be carried out to analyse the remaining data and develop the management sustainability model for targeted species. The sustainable utilisation and management of studied medicinal plants issue arose by this project is greatly acknowledged throughout the Himalaya. However, the distribution and abundance of alpine medicinal plants are narrowing due to increase in trade, overexploitation and lack of the standard method to deal

with sustainability. Hence, this project outcome could be a milestone to develop the methodological strategy for the suitable conservation of proposed species from peril and equally the problem-related to the socio-economic harmonisation of wild plant harvest.

Some of photo pictures captured during the project period (2017-2018)



Left: Traditional healer who collect *Neopicrorhiza* for herbal treatment. Right: Applying harvest treatment employing local harvester in study plots.



Left: Discussion with local people related to traditional utilization and harvest. Right: Meeting with stakeholders and result sharing program at National level, Kathmandu Nepal (©D. Pyakurel)