



FINAL REPORT

Estimating population of Maire's Yew and engaging community in its conservation

CLP ID: 03422518



Final Report

Prepared for	:	Conservation Leadership Programme
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Institutions involved in organizing the project or participating in project	:	Greenhood Nepal (project host), Interdisciplinary Centre for Conservation Science, University of Oxford (advisory support)
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Project advisors		Dr. Amy Hinsley and Dr. Diogo Verissimo
Overall goal (10-15words)	:	Ensuring long-term viability of wild population of <i>Taxus mairei</i> in Nepal
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SECTION 1:

PROJECT PARTNERS AND COLLABORATORS

Project Partners & Collaborators

Roles

Government

- Department of Plant Resources (DPR)
- Local Government Kavreplanchowk
- Division Forest Offices

Department of Plant Resources granted permission to conduct this project in Nepal, Division Forest Office of Kavreplanchok, Sindhuli and Makawanpur were Actively participated in the project activities especially awareness programmes and supported the fieldwork providing local contacts and necessary information

Local stakeholders:

- Taxus harvester's community
- Taxus nurseries
- Community Forestry Users Groups

Participated in the interview conducted by the project team, assisted to locate the taxus populations in the wild, contributed in the development and testing of the sustainable harvesting guidelines; and, engaged in taxus conservation discussions and awareness programmes.

NGO

- Greenhood Nepal

[Greenhood Nepal](#) as a project host facilitated the official process in Nepal and coordinated with the project stakeholders. All the team members were based in Greenhood Nepal. Also, it provided free office space for team members.

Academic Institution

- Oxford University

The project advisors: Dr. Amy Hinsley and Dr. Diogo Verissimo from Interdisciplinary Centre for Conservation Science at the University of Oxford supported to design the project tools and data analysis including other relevant support.

ACKNOWLEDGEMENT

We received constant feedback and encouragement from everyone we consulted during this project. The journey of this project would not have been possible without cooperation, warm support and company of many people.

We would like to extend our first and foremost gratitude and sincere thanks to our project advisers- Dr. Amy Hinsley and Dr. Diogo Verissimo for their expert advice on project design and data analysis and encouragement throughout this project, as well as Dr. RC Paudel for providing training to the field team in *Taxus* species identification.

We are grateful to Conservation Leadership Programme for the funding support to implement this project. Sincere gratitude to Mr. Stuart Paterson, Ms. Christina Imrich and CLP unit for providing timely guidance, constructive feedback and other necessary support. We are thankful to Greenhood Nepal for hosting this project, Resources Lab for providing field assistance and Oxford Martin School, University of Oxford for scientific guidance.

We would like to acknowledge the Department of Plant Resources for project permission, Division Forest Offices of Kavrepalanchok, Sindhuli and Makawanpur for active participation in the project. We are indebted to Chairperson of community forests and attendant of botanical gardens of our project sites who helped us to identify field guides.

We owe a special debt and are grateful to our local resource persons who acted as our field guides, harvester communities for assisting to locate the *Taxus* trees in the wild, nurseries and Community Forestry User's Groups for active participation in the development of sustainable harvesting guidelines. We are thankful to Mr. Anil Thapa, Mr. Prakash Poudel for their tireless support in the field activities, Miss Pooja Shrestha for her immense support in GIS mapping, and Mr. Kalyan Dahal, Miss Shikha Acharya, and everyone who's involved in project activities directly or indirectly.

Lastly, we thank everyone who has at any time helped and contributed valuable suggestions, comments or criticisms, whether or not we have been able to incorporate these into the work. Their constructive comments, constant help, guidance and practical suggestions inspired us to accomplish this work successfully.

Last but not the least, we are forever grateful to our friends and family members for their constant support, whose direct and indirect participation was very encouraging.

SUMMARY

Yews are threatened across the world by over-exploitation, as their bark, leaves and trunk contain a compound ‘taxol’ with proven cancer curing benefits. However, there is little data about wild yew populations and the sustainability of different harvesting methods, especially in Nepal. This project is the first of its kind that aims to estimate the wild population of *Taxus mairei* in Nepal including exploring the impacts of different harvesting techniques followed by local communities. The research revealed that Maire’s Yew is sparsely distributed in three districts- Sindhuli, Makwanpur and Kavreplanchowk of Central Nepal with only a couple of thousand individuals left in the wild. This is likely a result of long-term unsustainable harvesting in lack of harvesting guidelines which the project has drafted, shared among both local harvesters and central level government stakeholders. Moreover, the harvesters are not taking into account the health of the trees they harvest from in the community forest. Likewise, the local government is currently promoting private cultivation by providing seedlings obtained by stem cutting of a single tree, which may affect the genetic diversity of yew populations. The wild population, distribution and the sustainable harvesting guideline could help the community harvesters, and feed into IUCN and national red list assessments. Further, it allows government agencies to plan for the long-term sustainable harvest and conservation of yews.

INTRODUCTION

Yew (also referred as *Taxus* in this report) is a medicinal plant which is highly exploited for its cancer curing properties (Wang, Lo, & Wang, 2008; Gangadevi & Muthumary, 2008) around the world and in Hindu Kush Himalaya (Hao, Gu, & Xiao, 2015; Nimachow, Rawat, & Dai, 2010). Taxol is derived *Taxus* tree as its natural product (Wang, et al., 2000; Wu, et al., 2016; Strobel & Daisy, 2003; Guo, et al., 2006; Isah, 2015).

There are 13 species of taxus worldwide, among them Nepal hosts three species of taxus- *Taxus mairei*, *Taxus contorta* and *Taxus wallichiana* (Bhatta et al. 2017). Government of Nepal in several publications has mentioned it as a threatened plant prioritizing it for protection. These species are located at distinct geographical locations with wild population of *Taxus mairei* confined to mid-hills of the central Nepal in three districts- Sindhuli, Kavreplanchowk and Makwanpur (Poudel et al. 2014). The present habitat is threatened due to heavy exploitation (Maden, 2002; Poudel, et al., 2013; Poudel, et al., 2014; Bhatt, et al., 2017; Uprety et al., 2016; Kandel, et al., 2016). The IUCN Red List categorizes *Taxus mairei* as vulnerable species (IUCN, 2020).

Table 1: Details on the conservation status of *Taxus mairei*

Target Species	: <i>Taxus mairei</i> (Lemée & Lév.) S.Y. Hu ex T.S.Liu
English Name	: Maire's Yew, South China Yew
Local name in Nepal	: Dhengre, Lauth Salla, Barme Salla, Pate Salla, Talispatra
Global IUCN Red List status	: Vulnerable (VU) [listing not yet updated with Nepal as range-state]
Country wide threat status (Nepal)	: Critically Endangered (CR) A2cd, B2ab (iii,iv,v)
CITES	: Appendix II [listed under the name of <i>Taxus wallichiana</i>]

Wild population of *Taxus mairei* is expected to be less than a few thousands in Nepal. The reported habitats of *Taxus mairei* (Figure 1) lie within the vicinity of local people, providing easy access to the harvesters. These areas do not fall under protected areas and they are not listed as priority sites for conservation; rather, they fall under either community forests or private forests. Also, these areas consist of people from different socio-economic background and cultural settings including indigenous communities, actively engaged in sustenance farming including harvesting of medicinal plants like *Taxus*. Also, local people are planting them for commercial purpose considering their market demand and are very cautious regarding conserving them in their private farms. Unfortunately, there is very less awareness among people regarding its conservation for wild ones. Also, no harvesting guidelines exist for its sustainable harvesting and collection (Rokaya, et al. 2017). In this backdrop, the project aimed for a detailed conservation assessment, including preparing distribution map and engaging communities in its conservation. Further, the project drafted the sustainable harvesting guidelines to manage its sustainable collection and communicated with local level harvesters via awareness programmes and discussed with national level stakeholders through national level workshop to formalize the guideline.

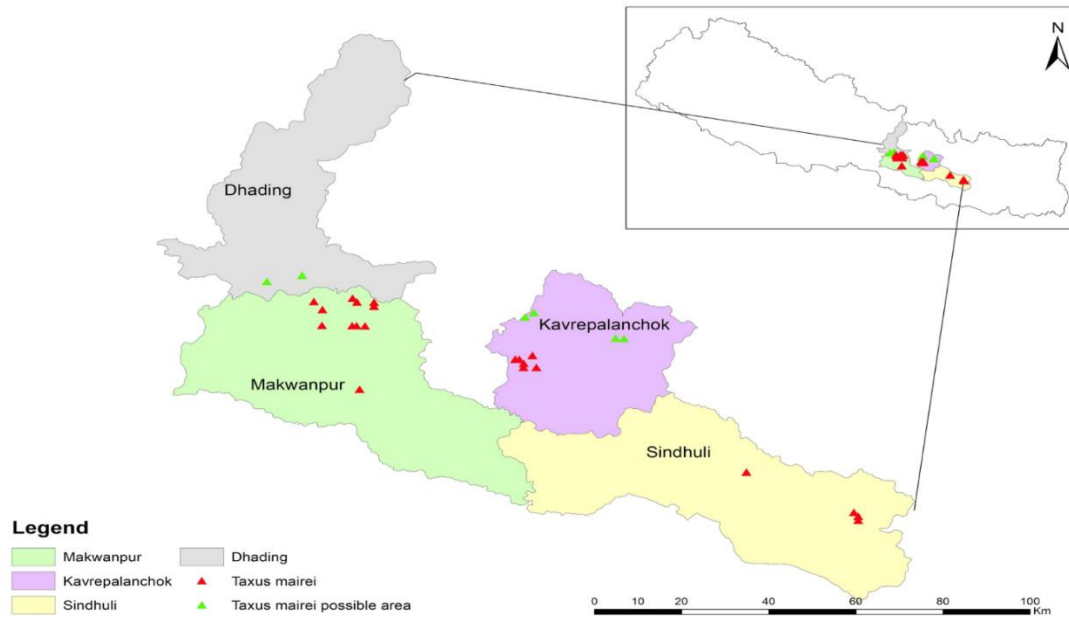


Figure 1: Map of reported habitat of *Taxus mairei* in Nepal

The project has high conservation implications both in terms of conserving wild population of yews within local community; at the same time, raising awareness about this species worldwide. IUCN Red List has not yet considered Nepal as a range country for *Taxus mairei* (IUCN 2020) which has in some way overshadowed the worldwide attention of this high value medicinal plant and hence its conservation in Nepal. There's no particular data on the population of this species besides the Government of Nepal through National Herbarium and Plant Laboratories (KAST), completed a brief survey of yews and recommended the need for detailed population estimation and conservation awareness (Bhatta *et al.* 2017). The current project has estimated the number of wild yews as 2231 (including trees, saplings and poles); in fact, the number of trees 271 (excluding saplings and poles), is even less than the number of rhinos in Nepal (for details see details in methodology and results section).

While this project was hosted by a non-governmental organization (NGO), Greenhood Nepal, the project activities were conducted by taking permission from Government agencies- Department of National Park and Wildlife Conservation (DNPWC), District Forest Offices (DFO) and local Government authorities of respective districts. The major contact points were the forest officials from sectoral and district forest offices, chairperson of Community Forestry User Groups (CFUGs) and district level botanical gardens who provided us with the list of key informants whom the project team could contact before fieldwork.

PROJECT MEMBERS

Project team included 7 members:

Reshu Bashyal: Reshu Bashyal is MSc Environment Science graduate from Tribhuvan University and currently pursuing MSc in International Wildlife trade at the University of Kent. She has more than five years of experience working on conservation issues including orchids and medicinal plants. She is working as a research coordinator at the Greenhood Nepal. In this project, she led the overall project activities, data collection and analysis, results sharing and reporting.

Kumar Paudel: Kumar Paudel is a conservationist graduated in environmental management from Pokhara University and currently doing MPhil in Conservation Leadership at the University of Cambridge. He carries years long working experience in species conservation and controlling illegal wildlife trade in Nepal. He is Co-Founder and Director at the Greenhood Nepal. He has co-designed this project and contributed in field data collection and analysis, stakeholder's engagement, and facilitation of the project activities.

Regan Sapkota: Regan Sapkota is MSc Environmental Science graduate from Tribhuvan University, he has experience of leading ground climate movements, pangolin ecology, conservation governance related research projects. Currently, he is working as a program coordinator at the Greenhood Nepal. In this project, he has contributed in the field data collection, mapping and project stakeholders' engagements.

Sanjay Paudel: Sanjay Paudel is one of the youngest team members of this project, he is an undergraduate zoology student at Tribhuvan University. He has good video making, poster design and field data collection skills. He is a member of Greenhood Nepal and working as a Research Assistant at Resources Lab. In this project, he was actively involved in field data collection, video/photo documentation, poster design and facilitating community engagements.

Sabitri Rai: Sabitri Rai is MSc Environmental Science graduate from Tribhuvan University, she is working to evaluate the conservation education programs in Nepal. She is an executive member at Greenhood Nepal. In this project, she contributed in literature review, community engagement programs and sustainable harvesting guidelines.

Anish Shrestha: Anish Shrestha is MSc Environmental Management graduate from Pokhara University. He is working as a Monitoring, Evaluation and Learning advisor at SNV. He also Chairs the executive board of Greenhood Nepal. In this project he advised on monitoring and evaluation aspect of the project activities and supported to organize national level consultation workshop.

Padam Budha: Padam Budha is MSc Environmental Science graduate from Tribhuvan University and a postgraduate from Indian Institute of Remote Sensing. He is executive member at Greenhood Nepal. Padam could not join the field activities as he was out of the country during this project though he has advised on mapping and field data management and supported to organize the national level consultation workshop.

Advisors: Dr. Amy Hinsley and Dr. Diogo Verissimo are both post-doc fellow at the University of Oxford with years long experience designing species conservation project, behaviour change and sustainable use and management of natural resources. The advisors have supported to design the project tools and data analysis and overall technical supervision.

SECTION 2:

AIM AND OBJECTIVES

Overall goal of the project: Ensuring long-term viability of wild population of *Taxus mairei* in Nepal.

Project purpose: To ensure the use of *Taxus mairei* in communities of Nepal is sustainable based on the current population

The objectives:

1. Estimate the wild population and conservation status of *Taxus mairei* in Central Nepal.
2. Assess the sustainable harvesting methods of *Taxus spp.*
3. Develop a capacity building program to support the long-term sustainable harvest and conservation of *Taxus mairei* by local communities

We made a few changes in the way these objectives were originally stated in the project proposal (including the project title) after undertaking the training programme hosted by CLP. However, the theme and focus were same. Initially the title of project was, “Estimating population and engaging community in Maire's Yew conservation in Nepal”, which was changed into, “Estimating population of Maire's Yew and engaging community in its conservation”. Likewise, we made changes in the project purpose (written above) which was initially written as, “Estimate the population of wild *Taxus mairei* and sustainable harvesting method for the local community people”. Also, a new log frame was designed and shared with CLP team for approval.

CHANGES TO THE ORIGINAL PROJECT PLAN

There were few workable changes in project activities particularly for the planned field activities, outreach activities and knowledge products as described below:

Changes in field activities:

As there was no prior correct documentation on exact number of yews and existing literature suggests only around 500 yews (we assume this number includes poles and saplings although nothing is written in detail about it) (Bhatt, et al., 2017), we planned our field activities accordingly. But, during our pre-visits we came to know that this number is higher, and it needs a lot of time to cover all the prospective sites. The team spent 100+ days in fieldwork in total including pre-visits (n= 15 days), field visits (n= 90 days), awareness and harvesting guideline sharing (n=10 days). This helped us to explore more yews than expected.

Capacity building activities:

The National level stakeholder’s meeting which was scheduled to be after the community awareness programmes for harvesting guidelines was conducted after the project period. This activity aligned with KSMA project and to make it more impactful, we decided to conduct it in mid-November with budget of CLP fund (50%) and KSMA fund (50%).

Knowledge products:

We proposed to prepare one short documentary during our project planning. But, looking at our results and field stories, we decided to prepare two videos, one as an introductory and

another includes views of a range of stakeholders: community harvesters and local government authority along with short glimpse of field activities (available in [Greenhood Nepal's YouTube page](#)).

Since, majority of the community (including local harvesters) were illiterate, we chose to prepare pictorial harvesting guidelines including photos from the field including explanation of every single detail. This has been highly appreciated by the community people and local government stakeholders as it was readable and easily understandable even by an illiterate person. Also, we prepared different designs of postcards with single message in each instead of policy brief which would be irrelevant to locals.

METHODOLOGY

Estimation of wild population of *Taxus mairei*

The first step included the identification of potential habitats for yews. The potential habitat was identified based on existing records, published and unpublished literature, consultation with representatives of the Department of Plant Resources (DPR), Department of Forest (DoF), District Forest Office (DFO), and Community Forest User Group (CFUG) by communicating with them via telephone, e-mails and direct visits. We considered contacting the CFUGs because they are a formal group of community members legally entitled to manage the forests (Rutt and Wagner 2019), harvest resources (Aryal, Laudari, and Ojha 2019) and for five-years under the Forest Act (1993), marketing forest products within and outside of their user groups based upon the mandate provided in their operational plans (Basnyat, B. et al. 2018) and the 100% of the revenue goes to community (Thani, P.R. et al. 2019).

Once the potential habitats were identified, the team visited one of the sites (here, Bethanchowk, Kavreplanchowk) along with a *Taxus* expert for one-day training on identification of different *Taxus* species. This training also involved the Chairperson of community forest and nursery owners. Out of three *taxus* species found in Nepal, Kavreplanchowk hosts two species- *Taxus wallichiana* and *Taxus mairei* which are much identical, so this training was very fruitful in terms of capacity building of the project team.

We gathered the information about *Taxus* nurseries and traders in these three districts contacting Division Forest Offices. Further, other local harvesters were identified based on the consultation with the nurseries and traders. Following this, local harvesters (n=90) were interviewed (Table 2). The interviews were semi-structured, primarily included a) demographic information on harvesters b) habitat and distribution c) harvesting techniques d) local uses and beliefs e) trade f) nursery and cultivation practises. This information was analysed in MS-Excel and used as supplement to verify the data obtained from field including triangulating the information published in other literature. The team has visited all three districts (3*5days) to pilot the instruments, track harvesters' communities, potential habitat and field plan.

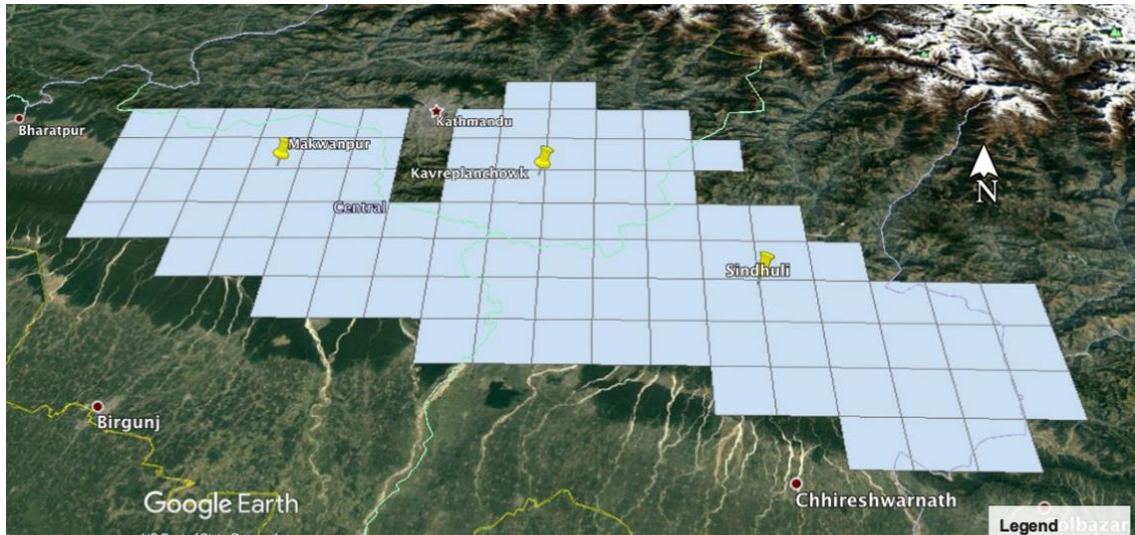


Figure 2: Grid overlays sample

Gridlines (1x1 sq. km) was overlaid over the potential *Taxus* habitat on the Google Earth image (sample map in Figure 2) which was shown to the community harvesters and they identified selected grids (n=47) as a potential habitat for *Taxus*. These habitats were visited for transect surveys. The transect survey (width=50m) was carried out to document the number of *Taxus mairei* population. The surveys involved a team of 1 to 2 experienced tree spotters (from local community) and 2 data collectors (research team) recording target trees by walking along the measuring tape. This method has been indicated as a best method to find an accurate measure of population extent and abundance, especially for taxa like *Taxus* that are poorly known in habitat preferences, or for generalist species that grow in many habitat types (Global Tree Campaign 2013).

The number of individuals recorded within each grid (see Appendix 3 for survey tools) were listed as either saplings (< 10 cm), poles (10 cm -30 cm), or trees (>30 cm) based on their diameter at the breast height. Further, associated habitats, aspect, height of tree, latitude/longitude/elevation were recorded. This information was analysed to understand the grid wise occupancy and density.

Assessment of sustainable harvesting methods

To assess the sustainable harvesting method for *Taxus*, firstly we reviewed the existing literature, published and unpublished reports and guidelines for *Taxus* and comparable tree species. We collected all relevant information on methods and best practices adopted in different areas and countries for sustainability from existing literatures. Moreover, we had a list of contact persons (obtained from pilot survey as explained earlier), we interviewed (n=90) harvesters to understand their existing harvesting methods and listed them. Likewise, *Taxus* experts, private *Taxus* farmers or nursery owners, foresters, botanists, and people in Department of plant resources (n=30) were interviewed.



Figure 3: Process flow for assessing sustainable harvesting guideline

The insights from all interviewees (Table 2) and information from the literature was compiled, documented and guidelines for the sustainable harvesting method (in Nepali language) for *Taxus* was drafted. The guideline was shared among relevant stakeholders both with local harvesters and local government representatives; and comments were incorporated to prepare the final draft which was then shared with national level government stakeholders. The comments (concerns) from government stakeholders mainly focused on usefulness of guideline and its formalization for future application. These comments and concerns were also incorporated in the final draft harvesting guidelines.

Table 2: Number, date and type of interviews for data collection

S N	Type of respondents	Interview techniques	Interview focus	No.
1	Local people-harvesters, CFUG members, nursery owners	Semi-structured questionnaire and Focus Group Discussion	To identify potential <i>Taxus</i> habitats; information on plantation, harvest and trade; assess their existing capacity (species identification, methods for harvesting) regarding <i>Taxus</i>	90
2	Government stakeholders (central and local level forest	Semi-structured questionnaire	To identify the list of contact person; potential <i>Taxus</i> habitats; existing rules and	18

	officials and ward representatives)		regulations for <i>Taxus</i> harvest and trade	
3	Experts	Semi-structured questionnaire	To understand the existing research focus, harvesting guidelines, future perspectives	12
	Total			120

Capacity building programs to support long-term sustainable harvest and conservation

Different capacity building programmes were designed to aware the people on the importance of *Taxus* conservation and also to communicate and ensure the uptake of revised guidelines (Table 3). For local community, there were two series of programmes in each district- one during the fieldwork to aware people on the importance of conservation of yews whereas one to share the sustainable harvesting guidelines (this activity aligned with KSMA activities). Similarly, a national level consultation event was held to share the harvesting guideline with central level stakeholders.

Table 3: List of stakeholders attended in the capacity building programme

S N	Awareness Programme	Participant types	Focus	No. of events	Attendees
	Training on <i>Taxus</i> taxonomy to project team by Dr. RC Poudel	CLP project team members	Identification of the species	1	8
1	Community awareness programme held at Dhunkharka, Kavreplanchowk	CFUG members, local harvesters and local government representatives	First programme to aware the locals (local people and local government) on the importance of <i>Taxus</i> conservation Second programme to share the harvesting guidelines and research results	3	57
2	Community awareness programme held at Fikkal, Sindhuli			2	24
3	Community awareness programme held at Deurali, Makwanpur			1	13
4	National level consultation programme held at Kathmandu	Central and provincial level government representatives, experts and emerging researchers	To share the research outcomes (existing status of <i>Taxus mairei</i> in Nepal), to share the draft harvesting guidelines and emphasize the need for <i>Taxus</i> conservation	1	28
Total				8	130

OUTPUTS AND RESULTS

Estimation of wild population of *Taxus mairei*

Overall, the population of naturally grown *Taxus mairei* was estimated to be 2231 individuals including saplings (904), poles (1056) and trees (271) recorded only in 47 grids (Table 4). Sindhuli hosted the largest number of individuals (1133) almost double the size of total population followed by Makwanpur and Kavreplanchok districts.

Table 4: Estimated population of *Taxus mairei* in Nepal

Districts	Grids with <i>T. mairei</i>	Saplings	Poles	Trees	No. of <i>T. mairei</i>
Kavreplanchowk	21	145	303	97	545
Makwanpur	7	287	197	69	553
Sindhuli	19	472	556	105	1133
Total	47	904	1056	271	2231

The highest number of *Taxus mairei* falling in single grid (grid density) was reported in Sindhuli district with 541 individuals in one grid. This was followed by Makwanpur (with 186 individuals in one grid) and Kavreplanchowk had the lowest grid density with only 93 maximum number of individuals in one grid. On the contrary, Kavreplanchok had the highest number of grids and wild *Taxus* were found to be scattered covering a large area of this district. Makwanpur had the lowest number of grids with *Taxus* but the number of individuals falling in those grids was large with only 2 grids with less than 30 individuals.

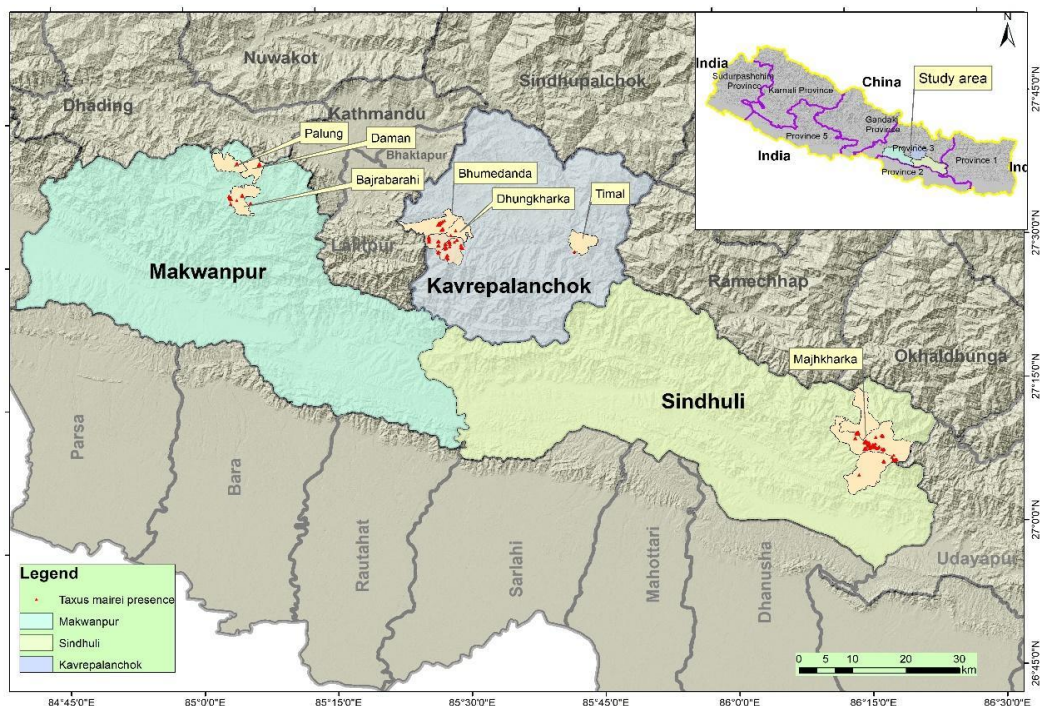


Figure 4: Map with the recorded *Taxus mairei* habitat in Nepal

Moreover, there were quite a few numbers of trees in total (n=271) while there were large number of poles (n=1056) and saplings (n=904) (Figure 5). The adequate number of saplings and poles is both a good and bad sign; on one hand it suggests that the regeneration process is ongoing and on the other, it indicates they are very susceptible to any kind of changes as they are immature. This also supports the local's opinion where they suggested that there was a massive destruction of yew years back. Further, the recorded individuals, especially the trees were mostly found in private land, so they were well preserved and looked healthy. However, most of the individuals those recorded from government forest were in very bad state and in risk of illegal harvest despite the punishment from local government authority.

Associated habitat

The associated habitat plays a vital role in conservation of plant species. In the study sites, following associated species were recorded:

Dominant ground species: *Ageratum conyzoides conyzoides*, *Aconogonum molle*, *Ainsliaea latifolia*, *Arisaema spicata*, *Arundinella nepalensis*, *Asparagus racemosus*, *Berberis asiatica*, *Cyperus rotundus*, *Dryopteris*, *Drymaria cordata*, *Dryopteris*, *Daphne papyracea*, *Rubus ellipticus*, *Rubus paniculatus*, *Rubia manjith*, *Rhamnus nepalensis*, *Persicaria capitata*, *Pyracantha crenulate*, *Pyracantha crenulata*, *Parthenocissus*, *Phyllanthus parvifolia*, *semicordata*, *Smilax aspera*, *Scurrula parasitica*, *Nephrolepis cordifolia*, *Nyctanthes arbor-tristis*, *Mahonia napaulensis*, *Mahonia napaulensis*, *Nyctanthes arbor-tristis*, *Murdannia scapiflora*, *Phyllanthus parviflora*, *Pyracantha crenulata*, *Themenda triandra*, *Murdannia scapiflora*, *Holboellia latifolia*, etc.

Associated tree species: *Alnus nepalensis*, *Castanopsis tribuloides*, *Castanopsis indica*, *Cinnamomum tamala*, *Ficus neriifolia*, *Rhododendron arboreum arboreum*, *Pinus wallichiana*, *Pyrus pashia*, *Saurauia napalensis*, *Maesa chisia*, *Myrica esculenta*, *Myrsine semiserrata*, *Saurauia napaulensis*, *Schima wallichii*, *Rhus javanica*, *Eurya acuminata*, *Quercus semecarpifolia*, *Ficus neriifolia*, *Lagestroemia parvifolia*, *Lyonia ovalifolia*, etc.

Harvesting methods of *Taxus* species

The respondents were aware about *Taxus* and said that they use it in some way considering its medicinal property. Majority (93%) of them said they used *Taxus* parts locally for several purposes like leaves for medicines, ingredients for tea and wood for timber (Figure 5).

The multiple local use of *Taxus* especially for household tools, religious artefacts, construction of suspension bridges and buildings is also suggested in various literatures (Bhatt, et al., 2017; Poudel, et al., 2013) while some raise concern on its over exploitation due to same (Thomas, 2013).



Figure 5: Demonstrating local use of *Taxus*

Similarly, one third of the respondents (n=30) said that they cannot identify between different taxus species because they had never seen a naturally grown *Taxus* or only one species grew in their locality. Whereas, a majority of them could distinguish using own strategies. They could differentiate between species based on the shape of leaf and colour of leaf and bark. For instance, they referred *Taxus wallichiana* as "rakte" based on its reddish-brown bark, it grows abundantly but has very less canopy. For *Taxus mairei*, they called "dudhe" based on its fresh green colour. Further, *Taxus mairei* had less height but more canopy unlike *Taxus wallichiana* which grows abundantly, has good height but has very less canopy.

As our respondents were *Taxus* harvesters, all of them were in some way involved in harvesting of yews. Some of them were involved in *Taxus* harvesting in community forests in a group while some own private yew farm.

There are not any official harvesting guidelines for this species in Nepal (also for other species of *Taxus*). The harvesters had their own way of harvest and trade (which even differed among individual and also sites). However, the most common practices were: They harvested *Taxus* on rotational basis at an interval of 2 to 3 years. Some of them used to sell the whole tree to other harvesters in a contract while some harvested every year considering only 1/4th part in one side for one harvest and similar technique for another year. Normally, they cut the branches (also reported by Bhatta, et al., (2017) and them trim them into pencil size however, some of them used to cut in pencil size using scissors from tree and finally dry in shade. Some of them did not follow any methods, they used to cut only the damaged and weak leaves using sickle for sale.

They used to make blocks and harvest all the trees in one block leaving 20 out of 100 (1/5th) at a time and cut the twigs of maximum 20 cm breadth only. They dried leaves while regenerating parts of twigs were used for nursery (either themselves or even sold to other nurseries).



Figure 6: *Taxus* harvester segregating the leaves soon after harvest

A majority of the harvesters used to cut large branches and cut them into small twigs and dry in shade for almost 15-20 days depending upon moisture content and weather. In some communities of Sindhuli, they used to cut large branches especially the apical parts, hand them upside down for around 5 days, then cut them into small twigs and dry (either in shade or open sun), pack them, weight and sell to contractors. There was a difference in price for seedlings generated from apical part or lateral part; the formal cost almost doubles the later. We consolidated these information (triangulating them with available literature and expert’s interviews) to draft the sustainable harvesting guideline. This is the very initial draft for the guideline which needs further research and attention from government stakeholders before it is fully operationalized.

Table 5: Price range as obtained from local harvesters

Type	Unit	Cost (range in NPR)
Trees	Individual	500-600
Leaves (dry)	Kg	150-240
Leaves (fresh)	Kg	70-80
Twigs (fresh)	Kg	15-40

Almost, 10,000 kg of *Taxus* leaves is required to produce 1 kg of taxol, (Isah, 2015). While the product, “taxol” is very expensive (1 kg taxol costs around 200,000 USD (Ho, et al., 2005), local harvesters get very minimal amount (Table 5). There are no any studies for this supply chain in Nepal (or, let’s say for *Taxus mairei*); the available data is an overview for *Taxus* species as presented in Isah (2015) and Ho, et al. (2005). Normally, harvester in one harvesting period would harvest around 500kg of *Taxus* leaves, sometimes reaching up to 30 quintals.

A few respondents, 38% observed the increase in *Taxus* availability (including both wild and cultivated). This may be because of increased commercialization of *Taxus*, awareness

programmes conducted by governmental and non-governmental organizations however, majority of them raised serious concern over the declining number of wild *Taxus*. All the harvesters were eager to cultivate *Taxus* if they would be provided appropriate training before cultivation and proper market after harvest.

Capacity building programs

Capacity building programme was the most important component of this project which was mainly designed to capacitate local level stakeholders (harvesters and local government representative). As such, there were a series of capacity building events starting from training to project team (n=1), community harvesters (n=6) and experts and national level knowledge sharing to government stakeholders (n=1); held at different time and location. Further, we reached to more than 100,000 national and international conservation enthusiasts via local news report, our social media posts using hashtag “#taxling”.



Figure 7: *Taxus* harvester sharing his insights in community workshop

The project team drafted sustainable harvesting guidelines for the *Taxus* species (the uptake in use of the guidelines is to be evaluated in KSMA project) and disseminated to the local harvester communities, local authorities, national level stakeholders and academic communities in the form of awareness events (n=7) with direct beneficiaries being (n=122). In addition, video (n=2), poster designs (n=5), blog (n=3) were prepared and shared widely to sensitize stakeholders in long term sustainable harvest and conservation of *Taxus mairei* in Nepal.

Apart from the project report, we also submitted the technical report to local government Division Forest Office, Kavreplanchok and provided support to formulate their long-term *Taxus* conservation plan.

We reached a large mass (more than 100,000) via our YouTube videos (n=2), blogs/news/articles/social media posts, participated and presented the research findings in national and international conservation events like ICCB 2019, University of Oxford and in SCCS 2020 (participation confirmed).

COMMUNICATION & APPLICATION OF RESULTS

We conducted three local level workshops in all the study sites to communicate the research findings including the harvesting guidelines. Harvesting guidelines (prepared in Nepali language) was highly appreciated by both community and scientific community. The most instant impact of our research was the building of information hub on *Taxus* by local government (Figure 8) following the social media posts of an old *T. mairei* which was about to be destroyed by a mining company which succeeded to attract the attention of media and central government which forced the local government to act upon its conservation.

National level consultation meeting on “Conservation and Sustainable Use of *Taxus mairei* in Nepal” with the aim of sharing of the research findings and discussions on the sustainable harvesting guidelines and collection of their feedback on it. The event held in Kathmandu involved high level government officials, botanists, researchers, and practitioners including Member of Parliament, Member of Provincial Planning Commission, National Academy of Science and Technology, academicians, *Taxus* traders) who appreciated the research efforts and the harvesting guideline. They have promised to adopt research results and the sustainable harvesting guideline in the policy process. At the same event, government level stakeholders has shown commitment to support the future research and conservation work on *Taxus*.



Figure 8: Participants during the National level event

MONITORING AND EVALUATION

The project monitoring and evaluation were conducted based on the regular team meetings and discussion among team members and sharing experience to the advisors. The progress of the project was tracked based on the “project implementation plan” developed and shared online among project team.

Besides, for every training and workshops organized, pre and post assessments were done which helped the team to understand where they must focus for the next activity; and, improvement could be reflected immediately in the activity following it. The assessment

trainings also showed that the community people could learn a lot about harvesting technique and pros and cons of random harvest if they were provided with right kind of trainings because we could see their improve in knowledge even after a training.

The project team came up with a hashtag- #Taxling. We used this hashtag for all of the social media posts which helped the team to track number of interactions and views which comes up to be more than 1 million interactions. Further, the team in support of Greenhood Nepal, coordinates with local authorities to make sure the project objectives are being implemented well.

ACHIEVEMENTS AND IMPACTS

In our first visit, we saw [300 years old *Taxus mairei*](#) which was about to be wiped out by a stone mining. Then we sent an appeal to the Ministry of Forest and Environment and local government authorities to save that tree from the mining. After six months, the local government issued restriction to the mine and allocated funds to protect that tree. Now, it turned out as a selfie spot.



Before: Old *Taxus mairei* tree about to wiped out by stone mining.



After: Division Forest Office has fenced the tree and installed notice board at nearby road to attract visitors to see the tree.

Figure 9: A small initiation for conservation of *Taxus mairei*

We signed a [Memorandum of Understanding](#) with the government of Kavreplanchok where both parties agreed to work together to conserve yews. We submitted a report on *Taxus mairei* of Kavreplanchok district to the local government and actively participating on their conservation planning.

In our field visit, we realized a big issue with "cutting" for propagation to prepare *Taxus* seedlings ignoring its dioecious nature. We highlighted male-female balanced *Taxus* propagation in the guideline and sensitized (n=94) locals.

The new number of wild *Taxus mairei* will add a new data. This will subsequently attract government's attention. For now, wild species are massively harvested and there is little attention in its conservation.

We identified more than a hundred yews harvesters in project sites. The number is helpful to understand the livelihood prospects and need of guideline.

We drafted and shared the yews harvesting guidelines to relevant stakeholders. The guideline is the first of its kind and we are planning to share it with central level stakeholders in Kathmandu to convey the knowledge and enhance the impact of the project.

We found a 300+ years old *Taxus mairei* near stone mining, appealed to the Office of the Prime Minister and Division Forest Office to save it. There were news following this including radio programmes. Local government prevented the mine from destroying it, managed a tree guard, and publicized it as an information Centre. The single tree has given a great gesture of conservation of yews in Nepal; also, the locals are working to declare their area as a pocket area of yews to attract researchers and tourists.

CAPACITY DEVELOPMENT AND LEADERSHIP CAPABILITIES

The project has significantly contributed to enhance the research and leadership skills of the project team who were active during the project cycle. This was the first project on medicinal plants for the project members who were able to expand their knowledge on a separate discipline. The project included a lot of interaction with the local community and the Government, as a result the project team learnt new insights on coordination and interaction with these stakeholders to execute project activities. Moreover, the team got the opportunity to learn about the new method to locate tree populations in the wild, to our knowledge interview-based occupancy for the tree species was first of its kind in Nepal.

The project team was trained on identification of *Taxus mairei* before moving to the field by the prominent taxonomy expert Dr. RC Poudel. The team has learnt *Taxus* and other plant identification skills during the project. The team has developed its first sustainable harvesting guidelines for plant species and conducted a series of consultation workshops from local harvester community to national policy makers. It was a great experience of leadership working with a range of stakeholders. Some of the team members developed skills to design the conservation communication materials such as posters, videos, handbook and blog posts.

Spotting tree population in remote forest areas and GIS mapping of them was one of the major components of the project. The field team has got unique experience working in difficult terrain and with diverse communities.

SECTION 3

CONCLUSION

Medicinal plant harvest and trade is increasing in Nepal with poor understanding about their wild population and sustainable harvesting techniques. Estimation of wild population, distribution of the species and ways to engage communities in sustainable harvest should be a regular part of the conservation programmes and plans.

This project has ignited the *Taxus* conservation issues in Nepal both at the local level and policy discussions. Now, the communities have started to practice the sustainable harvesting guidelines, nurseries are aware about the dioicous nature of the *Taxus* and revising propagation techniques to get sex balance seedlings, local government showing stewardship to protect the remaining *Taxus* trees in the wild and numerous debates are ongoing at the central level.

In addition to the local use, cancer treatment properties have driven the harvest of *Taxus mairei* though its habitat is limited only in three districts in Nepal. Which are also being damaged by the mines and road construction. In this scenario, there is a need for restoration of the wild population of the species and change the harvesting behaviour of the communities for its long-term conservation.

PROBLEMS ENCOUNTERED AND LESSONS LEARNT

The research method, particularly “Harvester interview” helped us to spot many trees. This is the reason for the increase in number of *T. mairei*. Further, our concept of occupancy modelling and consultation with the Chairperson of CFUG helped us to design project activities successfully and attract many people in awareness programmes.

One of the major problems was the difficulties in finding relevant literature, particularly for the harvesting guidelines. We could hardly get around 20 literatures. But we coped this based on the interview with experts and harvesters themselves.

Extended fieldwork following the increased number of yews in project sites. This was followed by harsh weather, inaccessible road and mobile networks.

Problem of battery backup following harsh weather which prevented us from using mobile devices for data collection, we used printed papers to collect data which increased data segregation, data entry and analysis time.

Few sites were inaccessible and quite risky; considering local’s suggestion, we estimated the trees numbers based on tree spotters.

Some sites were mentioned in literature as the *Taxus* hotspots but when we visited and talked to chairperson of respective CF, there were no *Taxus*. However, we reported new sites where these species are found; most of them were in private land; maybe because of this previous researcher presumed them as commercially farmed though no-one planted them and they were naturally grown. We included these numbers.

Capacity building programmes and harvesting guideline sharing works were very effective. Further, we shared our project outcomes at the University of Oxford and at ICCB 2019.

IN THE FUTURE

The knowledge and communication documents- draft harvesting guidelines, project report including scientific publication of the wild *Taxus mairei* will provide baseline information to the local, regional and central level Government, conservation agencies and future researchers. The project host, Greenhood Nepal and the team are dedicated towards its future follow-up works while they have already secured some of the positive response from relevant authorities.

Project host, Greenhood Nepal and local Government has signed a Memorandum of Understanding (MOU) for the future collaboration and conservation of these species in Kavreplanchowk. Likewise, central level Government (provincial and scientific authorities) agreed to expand funding opportunities for *Taxus* research (informally decided during the national level event). Moreover, the project team is undertaking another similar project supported by Kate Stokes Memorial Award where most of the activities are focused on conservation awareness.

As this research is the first of its kind for *Taxus mairei*, including the draft harvesting guidelines; the acceptance and formalization of harvesting guideline from the Government would add to the conservation of yews in Nepal. Our next step is to restore the wild population, we have identified the sites for its restoration in the project areas with support from local government and community forest users' group. Also, we have few nurseries in contact who are interested to involve in the restoration programme.

The market problem was quite evident in project sites with variation in market price. Another plan is to provide a detailed data on the value chain considering the discrepancy (and, India based uncertain) market (particularly in rates that local harvester gets) of yew in Nepal. The local government could work on uniformity in the prices such that harvester communities will be able to get benefits from commercial farming which will eventually reduce pressure on wild population.

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APPENDICES

Appendix 1: Financial Report

Table 6: Summary of financial statement

Itemized expenses	CLP requested (USD)*	Total CLP used (USD)	% Difference
PHASE I - PROJECT PREPARATION			
Communications (telephone/internet/postage)			
Field guidebooks, maps, journal articles and other printed materials			
Insurance			
Visas and permits			
Team training	450.00	420.40	7%
Reconnaissance	525.00	492.52	6%
Sub-total		912.93	
EQUIPMENT			
Scientific/field equipment and supplies	340.00	343.01	-1%
Photographic equipment			
Camping equipment	765.00	723.83	5%
Boat/engine/truck (including car hire)	300.00	263.85	12%
Sub-total		1,330.69	
PHASE II - IMPLEMENTATION			
Accommodation for team members and local guides	3,600.00	3693.93	-3%
Food for team members and local guides	2,400.00	2462.62	-3%

Travel and local transportation (including fuel)	540.00	556.29	-3%
Customs and/or port duties			
Workshops	330	321.02	3%
Outreach materials (brochures, posters, video)	900.00	886.10	2%
Sub-total		7,919.96	
PHASE III - POST-PROJECT EXPENSES			
Administration			
Report production and results dissemination	1,920.00	1899.74	1%
Other (Phase 3)	430.00	439.75	-2%
Sub-total		2,339.49	
Total	12,500.00	12,503.08	-0.02%

Appendix 2: Monitoring and Evaluation table of CLP

Table 7: Conservation Leadership Programme M and E table

Output	Number	Additional Information
Number of species assessments contributed to (E.g. IUCN assessments)	3	We assessed all the three reported habitats of <i>Taxus mairei</i> and estimated the population. This site assessment will contribute to national and global level commitments
Number of site assessments contributed to (E.g. IBA assessments)		
Knowledge management and communication documents		Poster designs (n=5), YouTube video (n=2), Report submitted to local government (n=1), reports submitted to CLP (n=3)
Amount of extra funding leveraged (\$)	2	Kate Stokes Memorial Award and Kavreplanchowk local government office
Publications related to project	4	<ul style="list-style-type: none"> ▪ Published on 4th November 2018: https://www.hakahakionline.com/np/2018/11/04/15435/ ▪ Published 5th July 2019: http://therisingnepal.org.np/news/32726 ▪ Published on 31st January 2019: Karobar news ▪ Published: Kantipur News https://ekantipur.com/news/2018/11/07/154155610377618079.html ▪ Published on 20th August 2018: http://annapurnapost.com/news/53988
Number of species/site management plans/strategies developed	1	In Kavreplanchok
Number of stakeholders reached	130 (directly)	Awareness programmes
Examples of stakeholder behaviour change brought about by the project.		Harvesters used to cut large branches of <i>Taxus</i> and split them into smaller twigs, after the awareness programmes, they seem to change their behaviour and cut the smaller portion from tree
Examples of policy change brought about by the project	2	DFO Kavreplanchowk signed MOU with Greenhood Nepal to work on long-term conservation of yews

		National level stakeholders agreed (verbally) to allocate funding for research in <i>Taxus</i>
Number of jobs created	10	Resource person, field team
Number of academic papers published	1	ongoing
Number of conferences where project results have been presented	3	ICCB 2019, University of Oxford, SCCS 2020 (to be shared on March 2020)

Appendix 3: Survey tools

Taxus: Community Harvester Interview

Interviewer: Time: Start..... End.....

1. Demographics

1.1. Respondent code	
1.2. Age	
1.3. Sex	1. Male 2. Female 3. Others
1.4. Caste/Ethnicity	
1.5. Education	1. Illiterate 2. Primary School 3. High School 4. University Degree
1.6. Hometown	

2. Taxus Identification

2.1. Have you ever heard about taxus species? (<i>Show pictures of the taxus</i>) Yes / No							
2.2. What do you know about taxus?							
2.3. Where did you see them? (<i>Ask them to show in the map & list all the places even they are not there now</i>)							
<i>Current taxus places</i>				<i>Previous taxus places</i>			
<i>Municipality</i>	<i>Ward</i>	<i>Forest name</i>	<i>no. of taxus</i>	<i>Municipality</i>	<i>Ward</i>	<i>Forest name</i>	<i>no. of taxus</i>
2.4. Can you identify different species of taxus? Yes / No If yes, what strategies do you use to identify them? or, how do you differentiate?							

3. Local Use of Taxus Parts

3.1. Do people use any taxus parts? Yes/No

If so, which parts are being used, and what for?

Parts	Uses
Leaves	
Flower	
Pulp	
Seed	
Trunk	
Root	
Other (if any)	

4. Harvest

4.1. Is anyone from your community involved in taxus harvesting? Yes / No
If so, how many people?

4.2. Have you ever participated in the taxus harvest? Yes/ No
If so, how often do you harvest?

4.3. How do you harvest taxus?

4.4. Is there any harvesting guidelines/rules? Yes / No
If so, what are the key rules?

4.5. Do people follow the rules/guidelines? Yes/ No
If not, why they don't?

4.7. Which parts of taxus do you collect and how they are being used?

Taxus parts	How much do you harvest per year?	How they are being used?
Leaves	Sack: Kg:	
Flower/Pulp	Number: Kg:	
Seed	Number: Kg:	
Trunk	Number: Cubic Ft:	
Root	Number: Kg:	
.....		

4.8. Is there enough Taxus for the collection? Yes/No
Have you felt changes in the availability of Taxus parts compared to the previous years? If so, details.

5. Trade and Cultivation

5.1. Do people in your community would be interested to cultivate taxus?

5.2. Which taxus parts are being sold in your community? (<i>leave, bark, stem, all</i>)				
5.3. Do you know who buys the taxus parts in your community?				
5.4. If the community exports, then where do they send?				
5.5. How much does it cost for taxus parts in your village? (<i>Record pricer all of these things using a standard weight or measure (e.g. per truck, per kg, per bag of leaves - whatever turns out to be the most appropriate measure)</i>) Leaf: Trunk: Flower: Pulp: Root: Other.....:				
5.7 Do you think it is possible to cultivate taxus in private forest? Yes/No If so, how long does it take to grow a taxus seedling to a mature tree?				
5.8 Is there any taxus cultivated farm (private/community/government)? Yes/No List them all.				
Name of the farm/forest	Address	Area (ha)	Number of taxus	Owner

6. Conservation Awareness

6.1. Do you think taxus an important tree? Yes/No If so, why it is important?	
6.2. What are the major threats to taxus species?	
Over-harvesting	
Forest fire	
Illegal harvest	
Habitat degradation	
Exotic species	
Disease	
Other disasters (<i>name them</i>)	
Others	
6.3. Do you know any regeneration/recover plan for taxus in your community forest?	

<p>6.4. Are you aware of any conservation programme specially for taxus in your community and around? If so, details.</p>
<p>6.5. In your opinion what should be done to conserve the wild population of taxus in your forest?</p>

Transect Survey to estimate the wild population of *Taxus mairei*

A. General Information

Name of Surveyor	:	
Date	:	
Plot ID	:	
Name of community/forest	:	
Name of Ward	:	
Latitude/Longitude	:	
Elevation	:	
Forest Type	:	
Strata	:	
Canopy Cover	:	
Evidence	:	

B. Dominant ground cover species

C. Associated tree species

D. Number of *Taxus* in transect (50 m*50 m)

Saplings:

Poles:

Trees:

Transect survey: For *Taxus* inside each transect

Transect code	GPS Point		Distance from Centre	DBH (cm)	Type of tree	Base (cm)	Angle	Height of tree (m)	Remarks
	Lon	Lat							

Appendix 3: Distribution lists

Sustainable harvesting guideline (attached in email)

Financial report (attached in email)

Poster samples (attached in email)

Photos

[YouTube video](#)

Postcard designs:



वनमा अथवा बाढीको छेउछाउ सार्वजनिक स्थलमा प्राकृतिक रुपमा पलाएका लौठसल्लाका बिरुवाहरुलाई उखैलेर आफ्नो निजी खेतबारीमा रोप्ने गरेको पाइन्छ ।

यसरी प्राकृतिक स्थानमा हुर्किएका बिरुवाहरु मासिँदै जाने हो भने अहिले संकटापन्न अवस्थामा रहेको लौठसल्ला भोलि गएर लोप नहोला भन्न सकिन्न ।

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लौठसल्ला के हो ? यसको संरक्षण कसरी गर्न सकिन्छ ?

लौठसल्ला सल्ला वर्ग भित्रकै एक रुख प्रजाती हो । यसलाई अङ्ग्रेजीमा यू र ट्याक्सस पनि भनिन्छ । यो भाले र पोथी बोट फरक फरक हुने रुख हो । नेपालमा तीन प्रजाति (ट्याक्सस माइरेई, ट्याक्सस वालिचियाना र ट्याक्सस कोन्टार्टा) पाइन्छन् । मध्य नेपालका काभ्रेपलान्चोक, सिन्धुली र मकवानपुर जिल्लामा मात्र पाइने माइरेई लौठसल्ला विश्वमै लोपोन्मुख नेपालको लागि अति संकटापन्न वनस्पति हो ।

लौठसल्लामा क्यान्सर विरुद्धको औषधीय गुण हुने भएको हुनाले संसारभर यसको माग उच्च छ । रुखको स्वास्थ्यमा असर नपर्ने गरी उचित वैज्ञानिक संकलन विधिको बारेमा आवश्यक ज्ञान र तालिम प्राप्त गरेर मात्र पात संकलन गर्नुपर्छ । पात संकलन गर्दा रुखलाई पूर्ण रुपमा नाङ्गो बनाउनु हुँदैन । प्राकृतिक वासस्थानका लौठसल्लाको सङ्ख्या निकै कम हुँदै गएकोले रोपण तथा संरक्षण गरौं ।

लौठसल्लाको विषयमा तपाईंसँग कुनै रोचक जानकारी छ वा यस बारेमा जान्ने ईच्छा छ भने हामीलाई सम्पर्क गर्नुहोस् ।

ग्रीनहुड नेपाल

नयाँ बानेश्वर, काठमाण्डौं, नेपाल ।

फोन नं: ०१५२४४३३३

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लौठसल्लाको पात र फल विषालु हुने हुँदा घरेलु औषधीको रूपमा जथाभावी प्रयोग गर्नु राम्रो होइन ।

नेपालका विभिन्न ठाउँहरूमा लौठसल्लाको पातलाई क्यान्सर, प्रेसर, घाउ खटिरा, घाँटी र पेटको दुखाइ, पखाला आदिको उपचारमा प्रयोग गर्दै आएको पाइन्छ । यसरी हचुवाको भरमा प्रयोग गरिनु घातक पनि हुनसक्छ ।



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पात संकलन पश्चात छुट्याउने र सुकाउने कार्यहरू जति सक्दो छिटो गरिनुपर्छ । कीरा लागेको पात र स-साना हाँगाहरूलाई छुट्याइ अलगगै राखिनुपर्दछ । यसो गर्नाले लौठसल्लामा हुने सारतत्वको मात्रामा ह्रास आउने सम्भावना कम हुन्छ ।

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लौठसल्लाको बेर्ना उत्पादनका लागि कटिङ्ग लिँदा एकै प्रजातिको विभिन्न ठाउँका भाले र पोथी बोटबाट लिनुपर्दछ । यसो गर्नाले त्यसमा प्राकृतिक प्रजनन हुनुका साथै आनुवांशिक विविधता कायम हुन्छ र रोग प्रतिरोधात्मक क्षमतामा पनि बृद्धि आउँछ ।



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Relevant photographs:
Photos from fieldwork



Photos from awareness programmes:

