Grand Report on Pteridophytes

Second Quarter Report of Pteridophytes

Bhutan has good resources of biodiversity in both vascular and non-vascular plants. But, this biodiversity is getting depleted day by day due to country's modern economic development. The destruction of green forest and stock taking from natural resources is an imminent need. So far, there was no detail account of Pteridophytic flora of Bhutan except in NWFP (Non-Wood Forest Product 2008) and check list of Pteridophytic by Tandin Wangdi (December 2008). It shows, what will be the challenges that can happen in future. Fear of losing much of these delicate and evolutionary important groups of species before it gets too late. Bhutan has remained largely a neglected group of vascular plants. I am bound about some shortcomings and omissions. Although every effort has been made to update possibilities of some more name changes that cannot be over-looked. I sincerely hope that field data information and herbarium specimens made will be in main repository and can excess by student of Botany, Forester, Connectionist, outside nature lover and even educated farmers as well. It was also evaluated the roles of the abiotic environment and dispersal in the assembly of fern communities at contrasting spatial scales within an old growth, deciduous forest and cool broad leaved forest. It was also important to have specifically examined correlations among the geographic location of adoption separately.

Activities from the Field

During recent field expedition, the ecological data, herbarium specimen's collection and photography were done in southern parts but it was observed that there is no differences in diversity as compared from west and east of the country. Due to lack of references and technical guide, identification of Pteridophytes has come out some problem, never the less, I am in touch with Fern specialist based in Nepal and working together to bring more precise information and identification to find new record species in Bhutan and Asia Pacific countries. As of now, I have come out with 70 species identified both epiphytic and terrestrial. In Pteridophytes of Bhutan, "A list of families, genera and Species" they have roughly estimated 411 species which have mistake in species identification. Yet lot more to increase the list of ferns and I feel and believe that there are some endemic species and also endangered species. I have some species which could not be identified despite referring many Pteridophytes book from India, Nepal, Nagaland and other nearby countries sharing the same himalayan ranges.

It is very important to know by the communities, how the Pteridophytes plays role in functioning of ecosystems and changes in their living standard over the time. One of the main objectives of the study is to give inputs for those foresters for awareness. Before I proceed to community awareness, it is very important to get trained focal field forest staff to carry out preliminary survey and to convey what exactly the conservation of ferns in forest is important. I have conducted seminar to the field staff at Western parts of the country. The staffs that are aware (trained) about the conservation and the status of ferns need to be as facilitators to communities. I trained forester field staff, how to follow the protocol of fern specimen collections providing necessity equipments and how important is to know the identification work.

Seasonal Timing

There is such a drastic variation in the climatic conditions at different altitudinal zones, with wide range of Himalayas sharing the chain of huge mountain range. The four well defined seasons in a year, Winter (December to February), Summer (March to May), Rainy season (June to September) and Autumn (October to November).

However, Bhutan is entire hilly where land is prone to natural destruction like soil erosion, forest fire, etc. the cause of such disasters are partially responsible through economic development of the country and sometime it is the natural cause like forest fire.

The pain full fact is that once a species becomes extinct, no amount of human ingenuity can resurrect it. It shall be difficult to conserve quite a few other species which are already endangered in the state if no determined efforts are made by us for their protection.

GPS coordinates of the different location where herbarium specimens are collected from the high altitude

Sl.No	Location	Latitude (N)	Longitude (E)	Altitude (masl)	Accuracy (m) ±
1	Singye Dzong	27° 58' 20.31"	91° 18' 12.68"	3850	4
2	Phumachen	27° 59' 38.73"	91° 24' 51.54"	4064	3
3	Below Pema Dzong	27° 58' 30.10"	91° 17' 25.25"	3967	8
4	Terda Latsho	27° 58' 39.06"	91° 16' 45.07"	4408	8
5	Below Terda Latsho	27° 58' 34.04"	91° 17' 11.06"	4178	5
6	Narimthang Base	27° 59' 34.04"	91° 59' 11.75"	4356	5
7	Guru Shangchu	27° 58' 58.04"	91° 17' 56.17"	4051	3
8	Tshokar	28° 00' 31.77"	91° 17' 26.00"	4654	3
9	Tshoneg	28° 59' 56.03"	91° 17' 17.28"	4514	3
10	Narimthang	27° 51' 31.07"	91° 17' 57.07"	4324	3
11	Tshokar	28° 00' 27.98"	91° 17' 24.44"	4525	3
12	Tshoneg	27° 59' 55.00"	91° 17' 17.37"	4516	4
13	Narimthang	27° 51' 31.07"	91° 17' 57.07"	4324	3
14	Way to Tshokar Tshona	27° 59' 21.87"	91° 17' 53.09"	4243	3
15	Singye Dzong (Zhimachen)	27° 58' 49.85"	91° 17' 56.87"	4006	7
16	Below Singye Dzong Fir Forest	27° 58' 10.99"	91° 18' 21.70"	3848	3
17	Tajuthang below Singye Dzong	27° 58' 10.99"	91° 18' 21.70"	3848	4

There are two same pictures in the pictorial form to know more about the species and it has different characters to identify of having advantages to the level from genera to species level.

Figure 1: *Selaginella involvens*

Figure 2
Athyrium fimbriatum

Figure 3

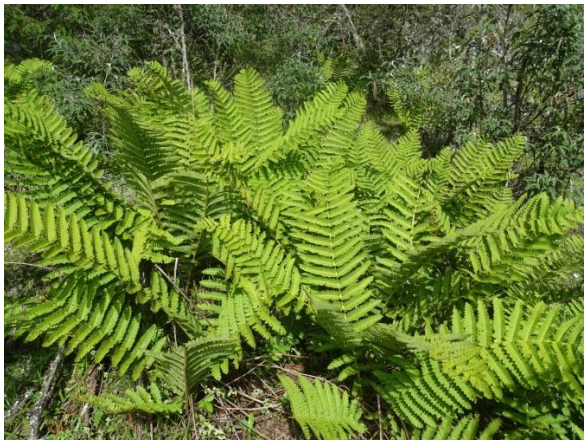


Figure 4
Osmunda claytonia

Figure 5

Figure 6
Pteris vittata

Figure 7

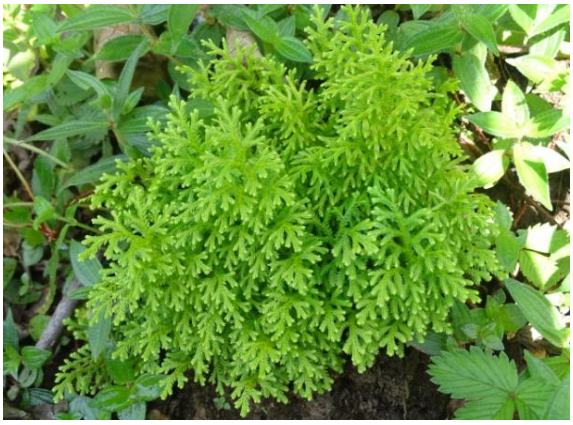


Figure 8.
Selaginella emodi

Figure 9.

Figure 10
Botrychium lanuginosum

Figure 11

Figure 12
Pteris wallichiana

Figure 13

Figure 14
Selaginella sp

Figure 15

Figure 16
Goniophelbium argutum

Figure 17

Figure 18
Lepisorus clathratus

Figure 19

Figure 20.
Araiostegiella hookeri

Figure 21

Figure .22 *Huperzia squarrosa*

Figure 23. *Pteris vittata Subsp. emodi*

Figure 25. *Arthromeris wallichiana*

Figure 26. *Polypodiodes amoena*

Figure 27. *Polypodiodes scabririgens/P. normalis*

Figure 28. *Polypodiodes scabririgens*

Figure 29 *Pyrrosia boothii*

Figure 30 *Pyrrosia boothii*

Figure 31 *Hyperzia hamoltonii*

Figure 32. *Hyperzia hamoltonii*

Figure33. *Dryoteris wallichiana*

Figure 34. *Polyiogyria pycnophylla*

Figure 35. *Dryopteris gamblei*

Figure 36. *Polystichum longipaleatum*

Figure 37. *Polystichum squarrosum*

Figure 38. Implimented transect survey methodology in undistrubed virgin rough forest and steep slope

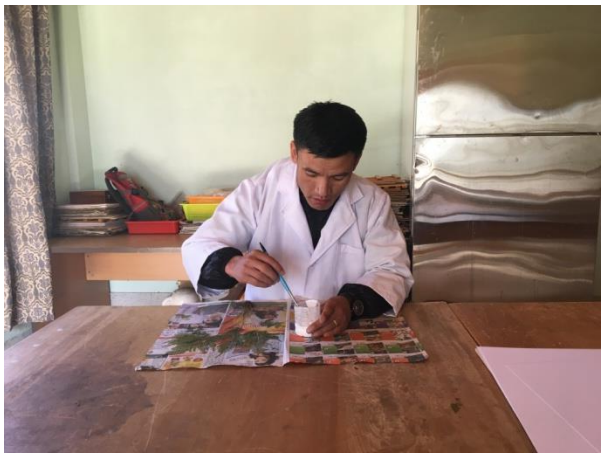


Figure 35

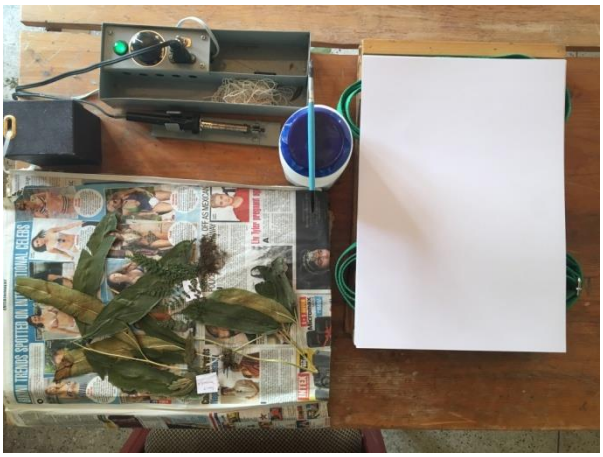


Figure 36

Above figures is mounting of specimens using different tools to make complete herbarium specimen.

Figure 37

Figure 38

Above figure shows the complete processing of specimen mounting work

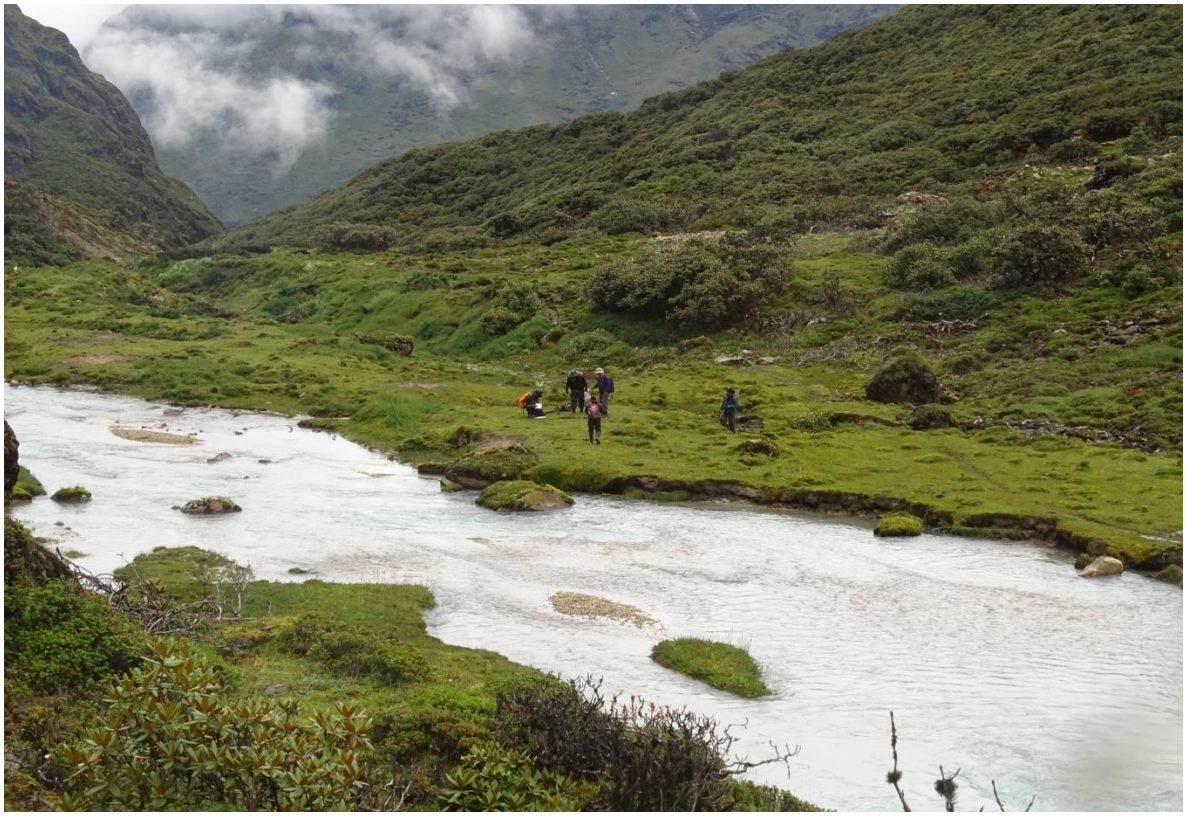


Figure 37. A team collecting high altitude ferns above 4000 masl

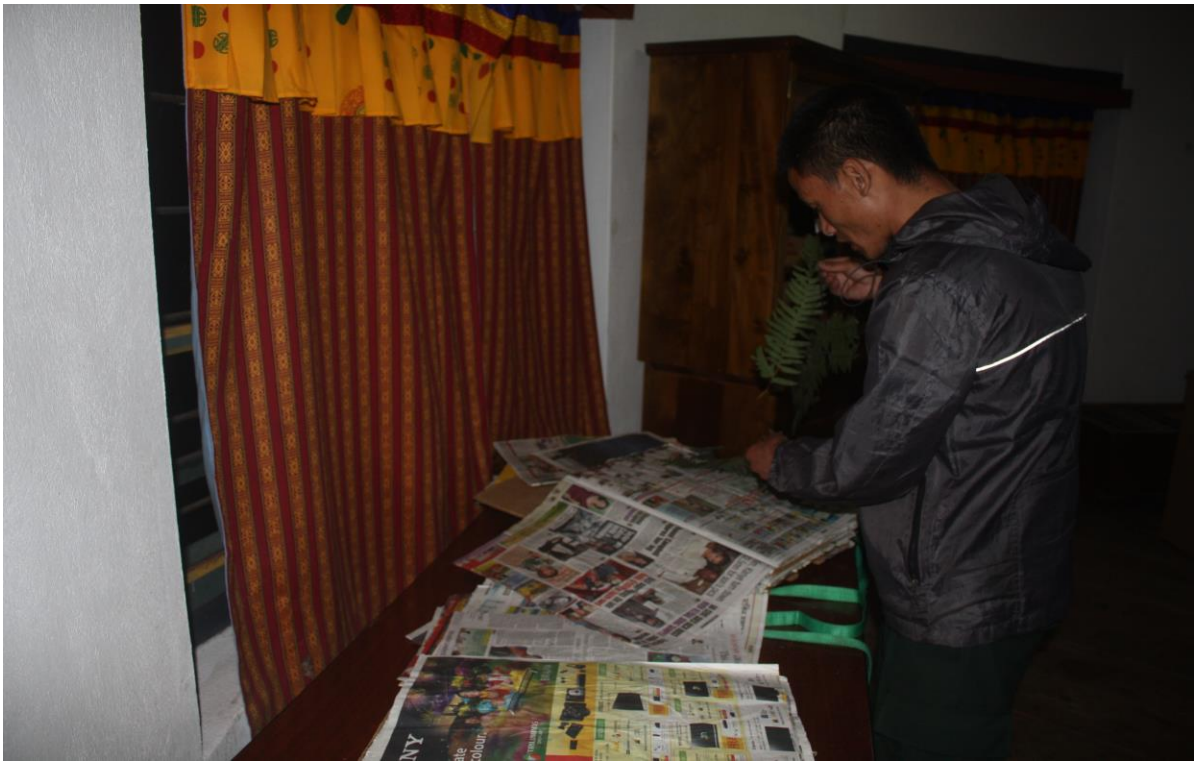


Figure 38. After field work, changing the paper for specimens at base camp.

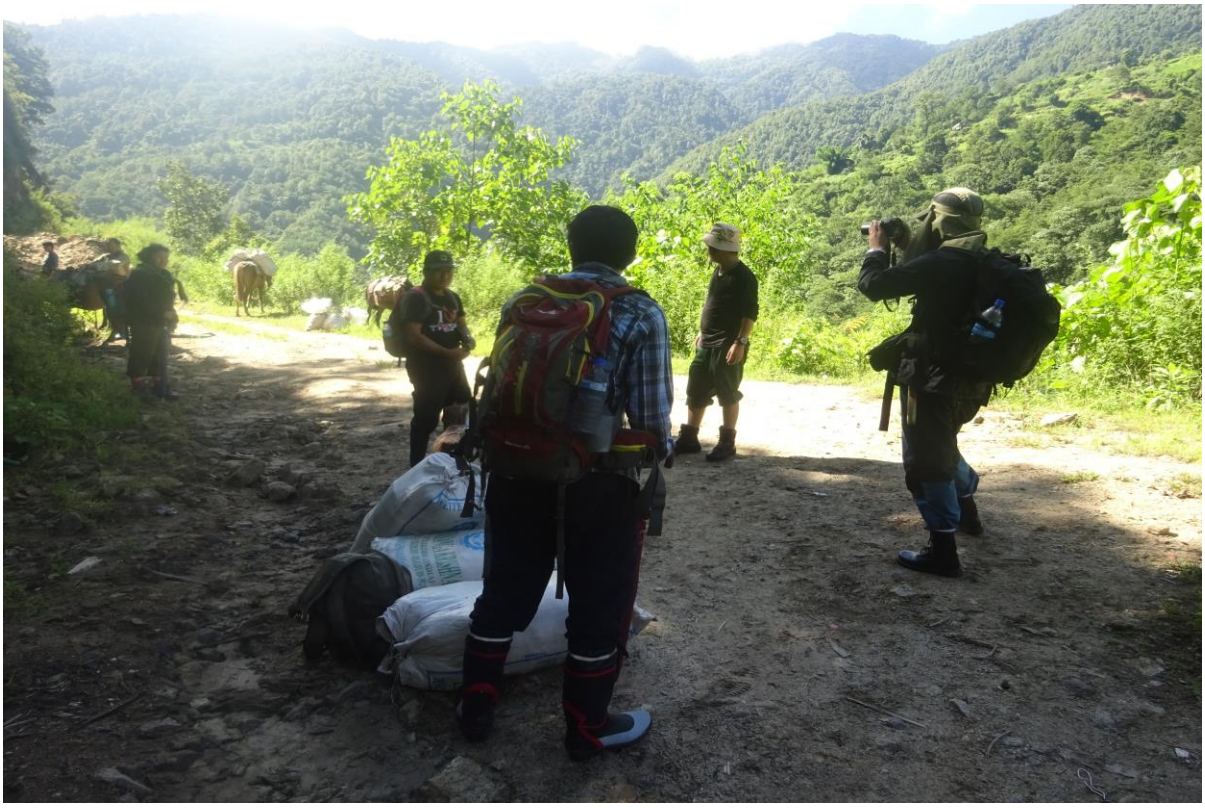


Figure 39. Preparing for journey to go for fern expedition

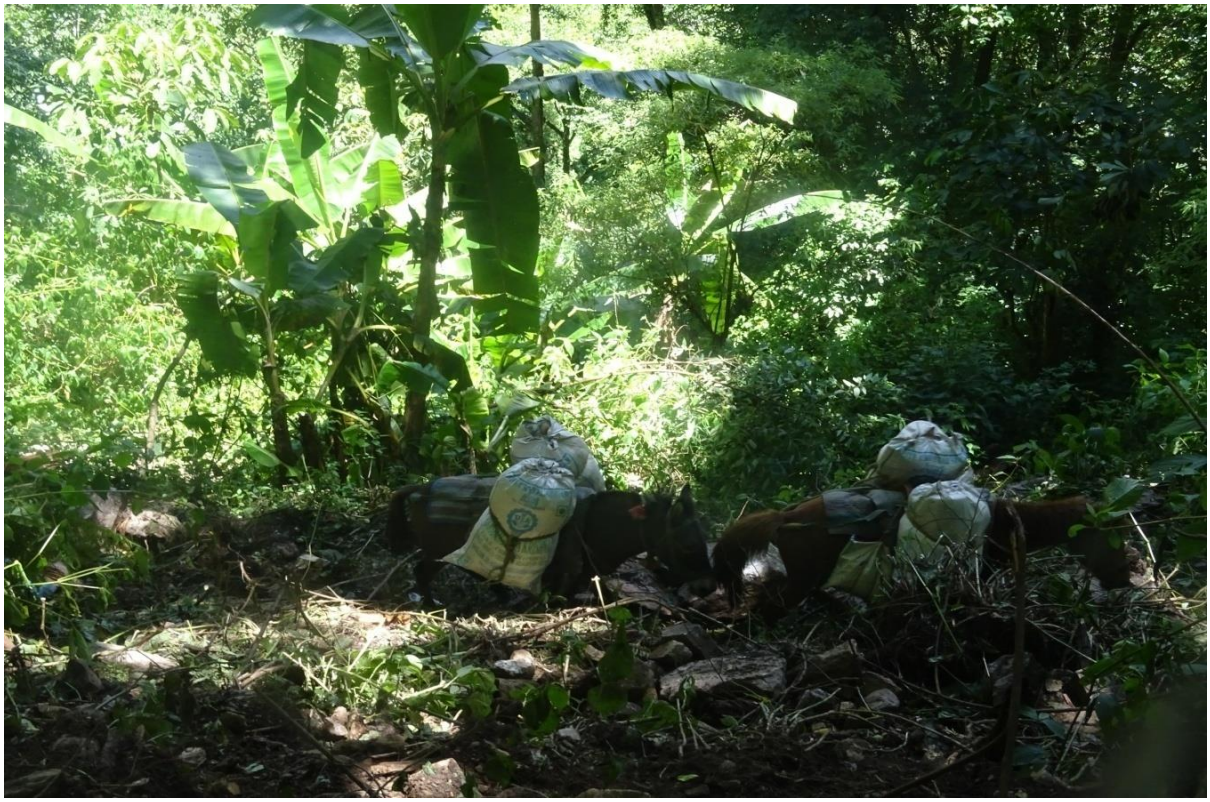
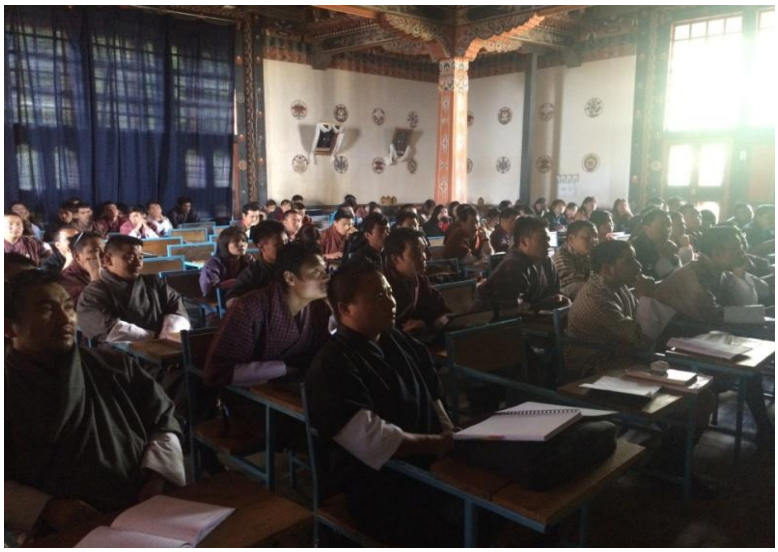


Figure 39. Difficult footpath for pony to carry luggage in rough terrain



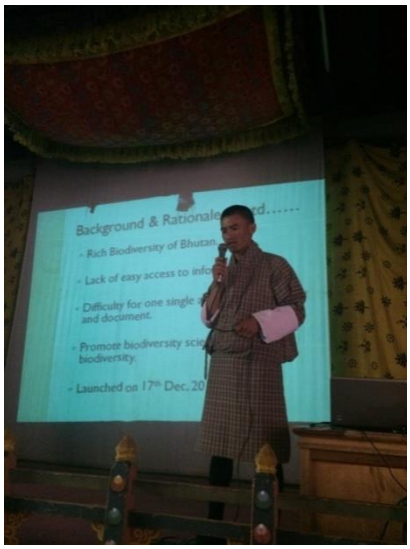
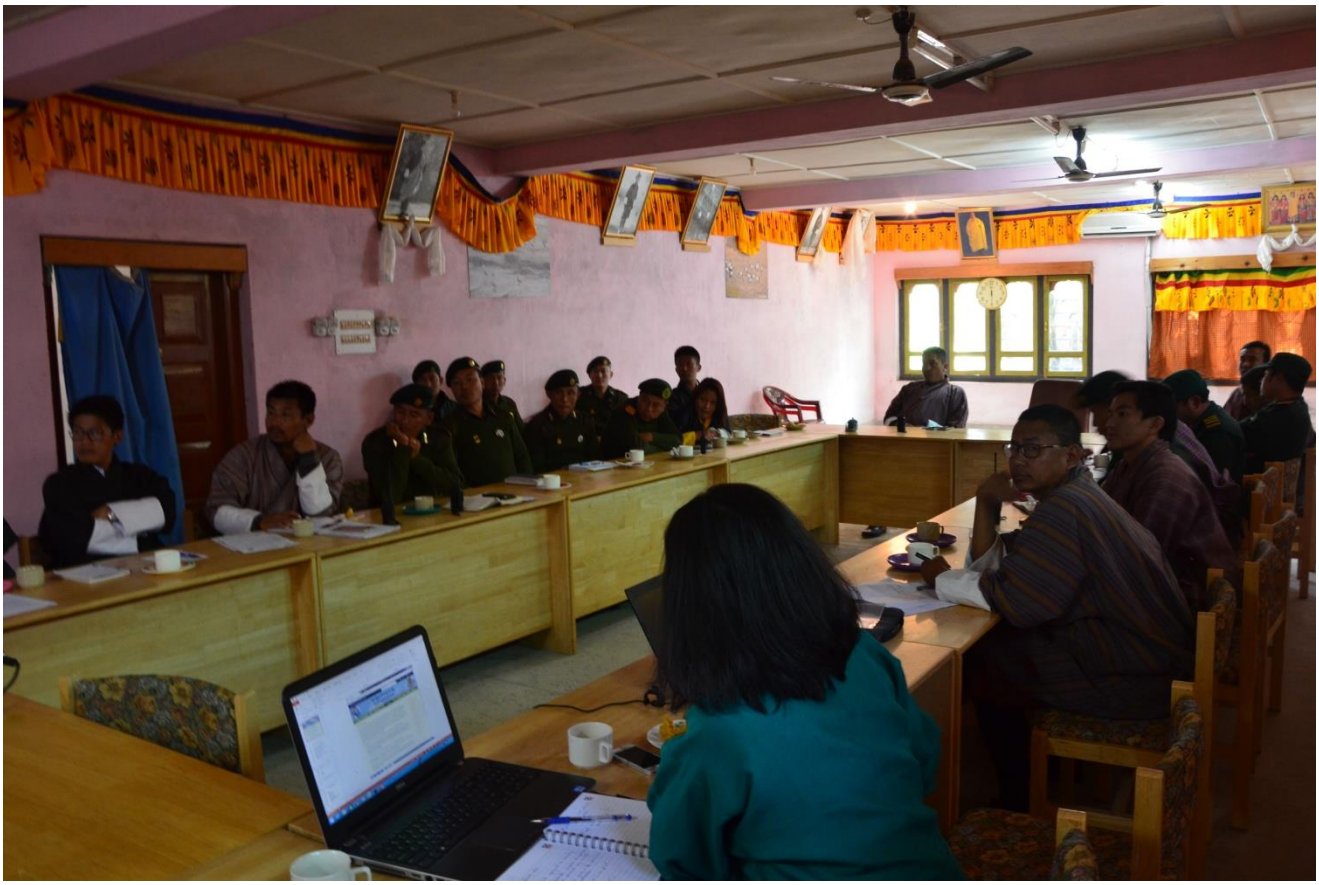
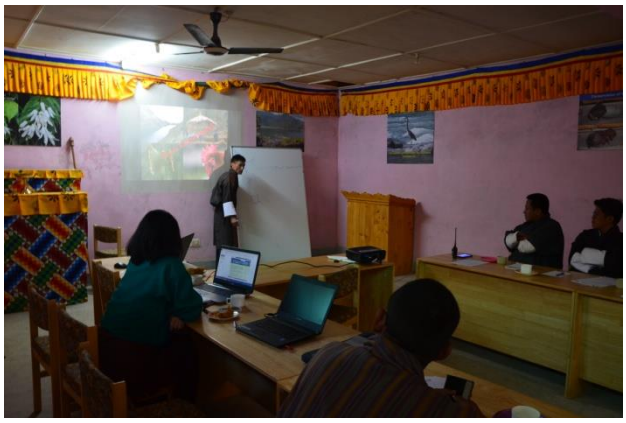
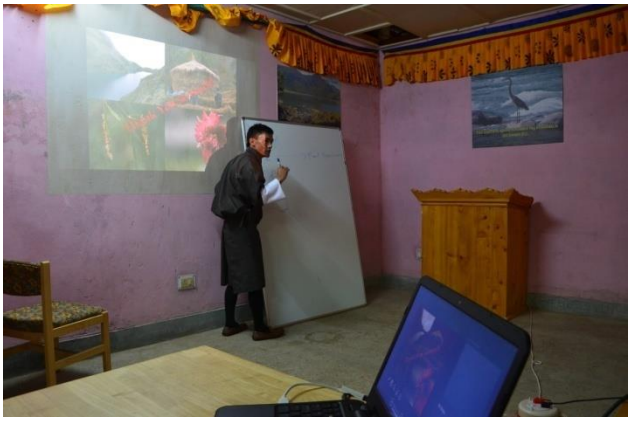


Figure 40. **Participants attainting the one day seminar**

During awareness on Pteridophytes, the main target is to make field officers understand and make them available directly to benefit the communities. There are many participants from different region where they get easy access to communities and benefit through them. This kind of seminar or presentation on Pteridophytes is first in our country and I am sure, participants have grabbed the ideas from the seminar. The seminar feedback was positive and that made me more confident to be strong mind set.







Giving awareness on Importance of Pteridophytes to extension Forester of western region.

I tried my best to give revelation on how to collect field data and herbarium specimen, so that they can give more importance on collecting fern specimen and contribute to National Herbarium and also to share the knowledge to local communities

Conclusion

I am fortunate to be able to concentrates on my work with the help from Rufford foundation providing the budget. The approach I have adopted, after getting to grip with certain difficult in making the check list of ferns in Bhutan due to un-exploration on Pteridophytes. I believe that not in wide scale approach to study on Pteridophytes will be possible but for certain extend, it will definitely bring more and additional raw data at my capacity. Bhutan being the Himalayan land-lock country, looking at the Himalayan ferns is essential to have a good knowledge of and able to describe species from fragment of the Himalaya containing west and east, south and north in list of ferns. I feel sure this should be beyond all capabilities and it would help to enlighten me about the diversity of ferns. Among the same genera that has been not yet been investigated on anything in Bhutan and will undoubtedly not to be complete in number within short period. It has to be in long term field exploration. Without the support from any donner countries, it has less scope to make formative works highly relevant and mostly adequate for the classification. With my study, I believe to attach major importance to the dissection.

During my recent field expedition, I have been aware of areas from south to north and west to east in diversity of ferns and accordingly needed further attention. Furthermore, it seems the vogue to describe a new species, perhaps in order to enhance the national level reputation. When the real situation is merely that the ferns concerned was unavailable to be identified locally. I strongly advocate an attempt to balance the situation by encouraging a very baseline monographic approach, genus by genus, instead. It would be nice to think that the exploring in general is possible and need to follow not to the extend for going into specifically for lone genera or species. In actual fact, I am well aware that due to foreign specialist having started off botanical research except Pteridophytes in Bhutan. The most important collections are conserved for Pteridophytes. I look forward to have more field exploration thereby becoming markedly complete information from every region of the country and making updated. If I am into the continuous support from Rufford Foundation, the most interesting area of all that remains inaccessible may open up again. I have covered and explored many areas where it made me and my team difficulties due to steep terrain, cliff and difficulties in penetrating in thick forest. The collection of data from field will be continuing and targeting to cover all over the region of Bhutan and find many additional species.