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Royal Government of Bhutan
Ministry of Agriculture and Forests
Department of Forests and Park Services
Forest Resources Management Division

FIELD MANUAL

NATIONAL FOREST INVENTORY OF BHUTAN

2020

FOREST RESOURCES MANAGEMENT DIVISION
DEPARTMENT OF FORESTS AND PARK SERVICES

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Foreword

Forest plays an important role in the lives and livelihood of the Bhutanese people besides contributing to our economy and maintaining ecological balance. Bhutanese are dependent on forest for everyday life for wood and non-wood forest products directly since time immemorial. The strong conservation legislations implemented under the farsighted leadership of our Monarchs coupled with, people believe system and way of life harmonious with nature, have ensured that our forest remains intact. Our Kings had foreseen the importance of the Forests and the requirement to maintain 60% of geographical area under forest cover has been reflected in National Forest Policy of Bhutan 1974.

Furthermore, our constitution mandates maintaining minimum of 60% of geographical area under forest cover for all times to come. Therefore, forest monitoring through periodic National Forest Inventory (NFI) has become paramount importance. We have also committed to remain carbon neutral in 2009 and re-affirmed our commitment in first Nationally Determined Contribution (NDC) in 2015 with support from global community.

With evolving information needs both at national and international level, the NFI is expected to provide information on carbon stock, forest area and growing stock which constitute the important features of sustainable forest management and role of forest in biodiversity, climate change, combating desertification, securing livelihoods and to efforts towards increasing food security.

Whereas we claim and take pride in being able to maintain 71% of our geographical area under forest cover, the forests are under tremendous pressure from increasing population, urban expansion, infrastructure development and more importantly the climate change. Therefore, this revised NFI field manual provides updated information on data collection methods, use of equipment, data management and data archiving methods.

I am sure this manual will be useful to my field colleagues for collecting and gathering quality data which will be useful for policy formulation and forest management interventions. I also anticipate that this manual will be useful for any interested individuals in gathering the forest resources information.

Lhendup Dorji
Director

Acronyms

BD	Bulk Density
Bum	Bumthangp
BTFEC	Bhutan Trust Fund for Environmental Conservation
CC	Carbon Content
CL	Crew Leader
CP	Cluster Plot
CWD	Coarse Woody Debris
DBH	Diameter at Breast Height
DoFPS	Department of Forests and Park Services
Dz	Dzongkha
FAO	Food and Agriculture Organization
FMU(s)	Forest Management Unit (s)
FRMD	Forest Resources Management Division
FWD	Fine Woody Debris
GI	Galvanised Iron
GPS	Global Positioning System
HD	Horizontal Distance
Kr	Kurtoep kha
Kh	Khengkha
ICBN	International Code of Botanical Nomenclature
Lh	Lhotshamkha
LUPP	Land Use Planning Project
Mg	Mangdep kha
MoAF	Ministry of Agriculture and Forests
MoE	Margin of Error
NBC	National Biodiversity Center
NCD	Nature Conservation Division
NECS	National Environment Commission Secretariat
NFI	National Forest Inventory
NFP	National Forest Policy
NSSC	National Soil Services Center
NWFP	Non-Wood Forest Produce
PC	Plot Center
PIS	Pre Investment Survey
Plot ID	Plot Identity
QAQC	Quality Assurance and Quality Control

RGoB	Royal Government of Bhutan
RP	Reference Point
RSPN	Royal Society for Protection of Nature
SD	Slope Distance
SFED	Social Forestry and Extension Division
SI	International System of Units
SPAL	Soil and Plant Analytical Laboratory
SRFL	State Reserved Forests Land
Ts	Tshanglakha
UNDP	United Nations Development Programme
USDA-FS	United States Department of Agriculture-Forest Service
WMD	Watershed Management Division
WT	Witness Tree

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Chapter 1: Overview of Forest Inventory in Bhutan

1.1 Evolution of Forest Inventory in Bhutan

The Department of Forests and Park Services (then referred to as the Department of Forestry) was established in the year 1952. Till the early 1980s, the Department was manned by Indian Foresters on deputation along with Bhutanese counterparts, given the limited national capacity at that point of time.

Then, the extent of forest area and the wealth of the forest resources were not quantified and therefore, no definite figures were available to understand the forest. It was however acknowledged that "three fourth of the country was under forests, alpine pastures, exposed rocks and barren slopes" (*PIS-North western Vol.I, Preface*). Further, forest resources then did not have much economic value and it wasn't till 1960s that the forests were valued economically when the valleys were opened up by roads and economic development began to trickle and expand.

As the importance of forests grew with the realization of its potential to contribute to the economy of the country, the Royal Government of Bhutan began inviting experts from countries like Sweden, Japan and India to appraise and ascertain the worthiness of our forest resources and all experts pointed out the need for a detailed forest survey.

This need was thus pursued as part of the Third Five Year Plan (1971-76), whereby the Pre-Investment Survey of Forest Resources of India (now referred to as the Forest Survey of India), under Ministry of Agriculture and Irrigation of the Government of India was requested by the Royal Government of Bhutan to assist Bhutan in surveying the forest resources of Bhutan.

The field work for Pre-Investment Survey (PIS) of Bhutan began in the year 1974 and continued till the December of 1979, covering a total area of 29,176.4 square kilometer. The survey was focused more towards "*assessing the availability of raw materials for wood-based industries*". The PIS generated estimates for number of stems per hectare, volume per hectare, total

growing stock, regeneration status, increment and subsequently leading to development of volume equations and volume tables. The report of the PIS proposed the potential availability of wood resources for setting up wood-based industries in Bhutan. Volume equations for 28 major timber species were developed from the PIS effort along with Forest type maps at 1: 50,000 scale for the country.

In essence, PIS was the first National Forest Inventory (NFI) in Bhutan which was followed by a number of assessments using the remote sensing technologies but no field inventory has been done since then, owing to various reasons such as lack of financial and technical capacities. The assessments based on remote sensing technologies provided forest extent and coverage but lacked the capacity to make quantitative assessments of the rich forest resources.

Besides forest cover, it is very important to understand the state of forest resources quantitatively for sustainable management to meet the demands of the human population without losing its restorative abilities necessary for a viable ecosystem. It is very important that periodic inventory and assessments are done to monitor the changes and trends in changes over time. For Bhutan, it is imperative to undertake periodic NFIs since our constitution mandates, maintaining 60% of the total geographical area under forest cover for all times to come, besides other national policy requirements (National Forest Policy, 2011 also directs undertaking periodic NFIs) and international commitments. The NFI will thus be an exhaustive and holistic inventory of forests in the country.

1.2 Current National Forest Inventory of Bhutan

NFI is the systematic collection of data and forest information for assessment and analysis.The design for the NFI was determined through two technical exercises, when the first NFI was being planned in 2009. Exercise I was the remote sensing exercise, wherein classification of land into forests and non-forests was done using Land Cover Map of Bhutan (LUPP, 1995). The forests were then classified into homogenous categories of forest types.

In Exercise II, the data of forest resource inventory plots (approximately 4500 plots of 0.05 ha) from 13 Forest Management Units (FMUs) were referred for

determining the sampling intensity required for achieving 15% Margin of Error at 90% confidence level at Gewog level. The sampling intensity was thus used to estimate the total number of cluster plots, which came to be 26919 Cluster plots at 1.2 km by 1.2 km systematic grid. However, in consideration of human resources and financial limitations, it was decided on 4 km by 4 km systematic grid, following numerous consultations with experts from within the Department of Forests and Park Services (DoFPS), the School of Forestry and Environmental Studies (FES) of Yale University and the United States Department of Agriculture-Forest Service (USDA FS). This systematic grid allows one sample location for every 160 hectares and resulted in 2424 Cluster plots covering all land cover classes as decided by the stakeholders during the Data User Consultation Workshop held in January, 2009. This framework provides reliable estimates at 10% Margin of Error for basal area at 90% confidence level at dzongkhag and greater precision at the national level.

The scope of data parameters to be collected were also discussed during the Data User Stakeholder Consultation Workshop (January, 2009), wherein, it was decided that NFI will collect data and information not limited to timber but also capture wide ranging information on Non-Wood Forest Produce (NWFP), shrubs, herbs, biomass, wildlife, biodiversity, forest health and disturbances.

1.3 Results of National Forest Inventory

Like the first NFI, the main purpose of this NFI is also to continuously provide an updated information about the state of Bhutan's forests from time to time. Therefore, the targeted outputs of the NFI are as listed:

i. Stems per hectare and total number of stems
ii. Basal area per hectare and total basal area
iii. Volume per hectare and total volume
iv. Biomass per hectare and total biomass stock
v. Carbon per hectare and total carbon stock
vi. Increment and growth of forests
vii. Regeneration status
viii. Forest stand structure
ix. Distribution of plant species
x. Biological diversity
xi. Coarse wood debris (CWD) per hectare and total CWD
xii. Cover percent of identified NWFP

xiii. Extent of bamboo coverage
xiv. Distribution of bamboos
xv. Distribution (presence/absence) of wildlife
xvi. Extent and types of forest disturbance
xvii. Land use information
xviii. Health of forests (pests and diseases)
xix. Maps - Forest cover, forest type, biomass and carbon

These data will be used for monitoring the trends of change in forests over time. The data collected can answer questions about the status and trend of forest ecosystems, distribution of plant species and their relationship to the environment, changes in forest structure and productivity resulting from disturbance, and improved prediction of forest growth and development on different sites and in response to management.

Such information and data will assist the government and policy makers in developing appropriate policy-decisions aimed at managing the forest resources sustainably. It can be used by natural resource managers and organizations for developing strategic implementation plans. Scientific community, researchers, and academia will also benefit from such data and information.

1.4 Units of Measurement

The NFI of Bhutan will use Metric System of units for measurements and estimation.

1.5 Sampling Design

The National Forest Inventory will use a systematic sampling design and will have a total of 2424 sampling plot clusters laid at 4 km by 4 km grid spread over the entire geographical area of Bhutan. Therefore, it is a land inventory with specific focus on forestry with considerable information collected for other land use and land cover parameters. This is also to allow monitoring of changes over time. This design yields sampling intensity of 0.009 % at 10 percent Margin of Error at 95 percent Confidence Interval at National Level.

1.6 Inventory Plot Design

Each Inventory Plot consisting of a cluster of 3 circular plots on an L-shaped transect spaced 50 meters apart will be laid systematically at 4 km by 4 km grid. These circular plots are referred to as Elbow Plot (L), North Plot (N) and East Plot (E) as shown in the diagram (Figure No.1)

Each circular plot will be of 12.62 m radius with an area of 0.05 hectare for collecting all data except regeneration, herbs, coarse woody debris and fine woody debris. The Elbow Plot will have an additional circular plot of 3.57 m radius within it, for collecting *Regeneration data*, whereas circular plot of 0.57 m (1 meter square) radius will be laid in North and East Plot for collecting *Herb data.*

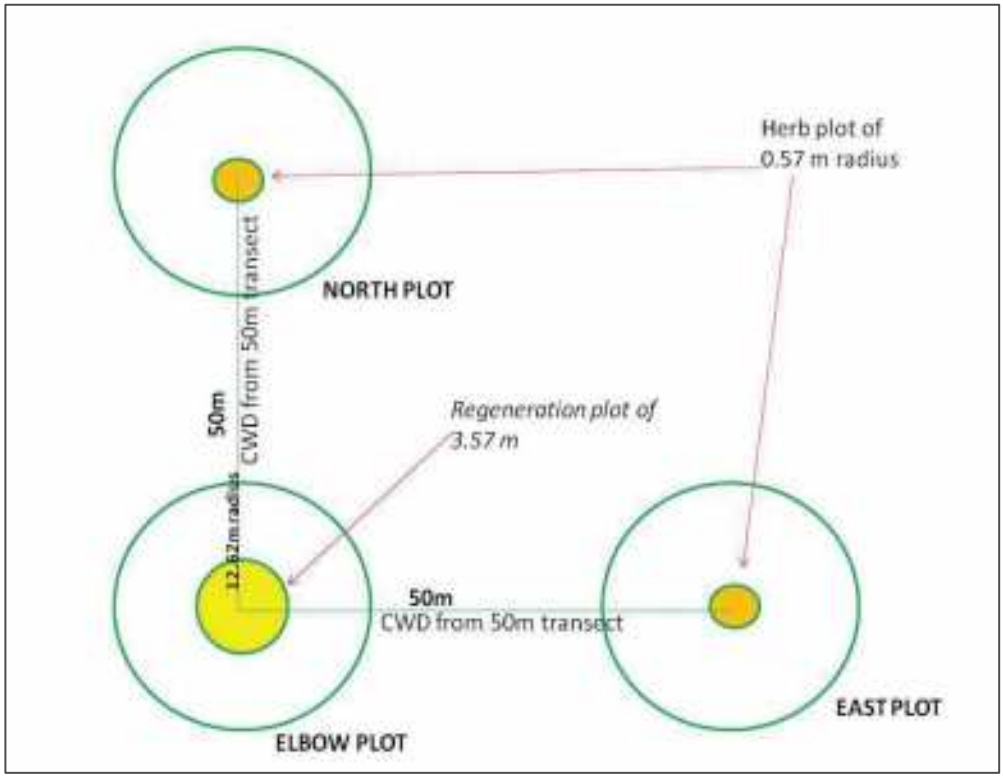


Figure 1: National Forest Inventory Cluster Plot Design

1.7 Quality Assurance and Quality Control

It is good practice to implement quality assurance and quality control for collection of scientifically sound and reliable data by adopting standard data collection methods, verification and checking for all possible errors. Therefore, NFI field crews shall be trained on interpretation and application of field protocols, proper use of field equipment and data recording to minimize the data measurement and recording error. The data managers will verify each record of data submitted by field crews and ensure that all data are checked for completeness, errors and are ready for analysis.

The following QAQC measures will be put in place at various stages of the data collection and analysis.

1. Independent crews shall be formed to perform Quality Assurance and Quality Control (QAQC) and; visit and/or re-measure at least 5-10% of the plots measured by the original crews.
2. QAQC shall be conducted by FRMD and the plots shall be selected randomly from the total accessible/measured plots using randomization tools and approaches. The QAQC team shall perform both *hot* and *cold checks* and sometimes, *blind checks*.
3. The *hot checks* are inspections conducted as part of the training process by QAQC staff to provide immediate feedback to crew about their performance, both during the training and/or during the field work on their assigned plots.
4. *Cold checks* are inspections or remeasurements of plots that have been measured by field crews by the QAQC team in absence of the original field crew but with the data collected by crews as reference. The data collected by the original field crews are then compared with the data collected by the QAQC team from the same plot, and then errors shall be corrected accordingly to improve the quality of data.
5. Depending on the need, *blind checks* can also be performed. The *blind checks* are the remeasurement of the plots measured by the original crew but without the presence of original crew and also without the access to copy of data collected by the original crew. Unlike the two previous checks (*hot* and *cold*), the data collected by the crew shall not be corrected, rather this data shall be maintained separately as a means of assessing uncertainty in measurement.

FRMD will also continuously improve the inventory process by controlling, identifying, and documenting errors and source of the variability that could be detrimental to the quality of inventory results.

Chapter 2: Preparation for Field Work

2.1 Planning and Preparation - General Preparedness

It will be the responsibility of FRMD to coordinate and oversee the overall activities of NFI. Unlike the first NFI, in the second NFI, the FRMD will guide the field offices and provide technical support to field crews. It will be a joint effort of FRMD and field offices. Therefore, FRMD will provide overall guidance in terms of informing the field offices on timeline to complete the field work and also help the field offices in sourcing funds for the field works. FRMD will identify and assign total number of plots falling within jurisdiction of each field offices, which is worked out in Implementation Modality of NFI of Bhutan. Accordingly, the field office will have to prepare work plan and execute the field work in consultation with FRMD within the given timeframe. Safety of the crew should also be the top consideration while planning and implementing the field work.

First and foremost, the Crew Leader must acquire the relevant topo maps (if needed) and shape files of the target areas. Locate the villages and human habitation that could serve as base camp sites. Identify the plots that can be reached from the villages. Identify all the approach points like roads and foot paths to the village and from the village to the target plots. Locate potential water sources, streams and rivers and mark it on the map for easy reference in the field.

Then draw a travel itinerary or day-wise program, indicating the base-camp sites, the plots to be reached from each camp and the routes to be taken. This travel itinerary must be submitted to the respective field offices and then to FRMD. It is very important that both the field offices and FRMD are informed of the start dates and expected date of return.

The Crew Leaders must identify (in consultation with crew members) their camping sites in such a manner that maximum number of sample plots can be covered from the camp site so chosen. The Crew Leader must also ensure that his crew members are fully equipped with camp and field equipment, field gears, stores and rations, and any other necessary items which might be required in the field.

Additionally, the Crew Leader is entrusted with the responsibility to ensure that any confidential documents or maps being provided to the team should be kept under his personal custody. He must ensure that these items are not passed on or shown to any un-authorized person.

Some of the other important component of preparation like logistic arrangements, safety measures and survival and field equipment are discussed separately as sub-topics in the subsequent sections.

2.1.1 Logistic Arrangements

Logistic arrangement forms an important aspect of NFI field work. While it is the responsibility of FRMD to provide overall guidance and oversee NFI field work, it is the responsibility of the field offices and NFI crew to arrange porters and ponies required during camp shifting, besides arrangement of transportation for mobility. FRMD will not be responsible for day-day activities of field crews. Nonetheless, the day-day activity and work plan of crew should be shared with FRMD to provide overall guidance and facilitate smooth coordination and implementation.

FRMD and respective field office will arrange to provide tents, camping equipment and necessary field gears as far as possible while crews shall manage food items and rations for themselves at their own cost.

2.1.2 Safety Measures

Safety of the Crew must be ensured at all times and most of the preparation and planning components discussed earlier should be observed diligently for personal safety and to avoid wasteful journeys. The Inventory Crew must observe following safety measures at all times.

- The NFI Crew, specifically the Crew Leader will always report to Field Chief Forestry Officer and perhaps the FRMD contact point too, of their whereabouts during the field work.
- For facilitating communication, the Crew will carry personal cell phones. Change in phone numbers must be conveyed to respective field chief and to FRMD for record and access whenever necessary.
- For the purpose of NFI, the NFI Crew will observe the command of the crew leaders and perform the assigned responsibilities.

- The NFI Crew will walk in groups at all time while they are in the field and be observant of any hazards
- While moving into the field from the base camp, each individual must carry the following items of survival kit to prepare for any emergency situation:
    i. Water bottle and water
    ii. Match box or lighter
    iii. Headlamp
    iv. Knife
    v. Survival kit
    vi. First aid kits
    vii. Any other item that will help surviving during emergency situation.

It is to be noted that though it is the responsibility of the Crew Leaders to ensure that their crew members maintain decorum in the camp, every individual is expected to conduct themselves in a manner appropriate of a civil servant.

2.1.3 Inspection of Equipment

It is very important that the NFI crew inspects and checks the equipment for faults beforehand. The first inspection should be done prior to moving to the field. Should they find any faults, they must rectify and correct the equipment or have it replaced before moving to field.

The crew must ensure that their equipment which require power supply are fully charged (especially Tablet, GPS, Hypsometer & metal detector) to avoid any possible disruption of works in the field. Charging of equipment should be done preferably a day–before or the night before visiting the plot. All extra batteries should be fully charged. Final inspection of equipment should be done in the morning ensuring that all the necessary equipments are carried and all the equipment are in working conditions.

Failure to check and rectify faulty equipment will lead to undesirable disruption of work, which could be avoided.

The Crew Leader must ensure that the equipments are properly stored away from excessive heat (from sun, fire etc.), rain, water and other liquid items and from damage by trampling or crushing.

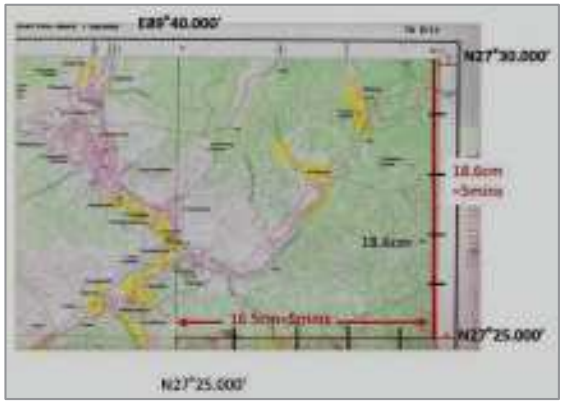
Locating Your Position on a Map.

Although for NFI field work, GPS will be used to navigate to the plots, it is a must-know for every NFI crew members to know how to read map and locate their own position on the map. For map reading, two simple fundamentals are involved;

1. Converting minutes (graticules) of topo maps into distance units (cm)
2. Plotting the minutes of GPS onto the map by converting minutes into distance units (cm)

Steps for locating your position in map:

1. Switch on GPS to find out your location coordinates i.e latitude and longitude of your current position in GPS.



2. Take out the relevant topo map of the locality.

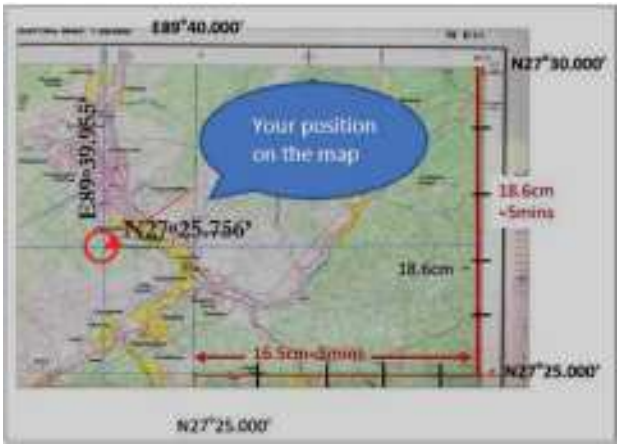
3. Measure the length (cm) between two 5 minutes graticule of latitude and then longitude.

Eg: For Longitude (E): 5 min=16.5 cm
For Latitude (N): 5 min=18.6 cm

4. Divide length by 5 to calculate the distance of one minute
One minute
For Longitude (E): 16.5/5=**3.3cm**
For Latitude (N): 18.6/5=**3.7cm**

5. If the GPS reads your position as **N27º25.756'** and **E89º39.955'** and to plot this position in map:
For latitude =0.756'x3.7=2.79=2.8 cm
For longitude = 0.955x3.3=3.15=3.2 cm

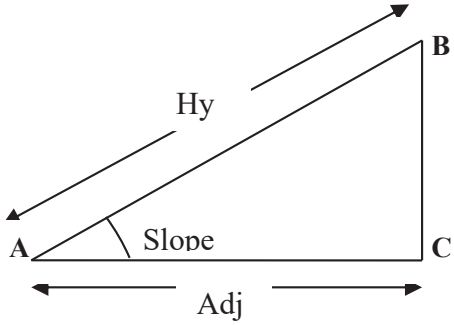
After obtaining the distances,



- Now measure 2.8 cm from N27°25.000' graticule towards North and mark a point on the map.
- Then draw a line parallel to N27°25.000' graticule passes through this point
- Then measure 3.2 cm from E89°40.000'graticule towards West and draw a line parallel to E89°40.000' passing through this point.

6. The point of intersection of above two lines is your position on map on the left.

Slope Correction for horizontal distances on slope.



Slope distances are always greater than horizontal distances, which means for laying the 50m transect from Elbow to North and Elbow to East on a sloping ground, the distances have to be corrected for slope (gradient) (Refer **Annexure II).**

The relation between slope (in degrees) and the horizontal distance is;

$$\text{Cosine of Slope} = \frac{\text{Adjacent (Adj)}}{\text{Hypotenuse (Hy)}} = \frac{\text{Horizontal Distance}}{\text{Slope Distance}}$$

But, before applying Cosine function, the degrees of slope has to be converted to radians and to convert degrees to radians, simply multiply the degrees (of slope) by factor π/180. This has been applied to develop the slope correction table for slope in degrees since the clinometers (DP6Global) to be used for NFI provides slope reading in degrees and not as "slope percent".

To get slope distance, divide the Horizontal Distance (HD) by Cosine value of the slope (in radians).

Slope (in Degrees)	Correction Factor	Horizontal Distance				
		3.57	10	12.62	20	50
		Slope Distance				
1	0.9998	3.57	10.00	12.62	20.00	50.01
2	0.9994	3.57	10.01	12.63	20.01	50.03
3	0.9986	3.57	10.01	12.64	20.03	50.07
4	0.9976	3.58	10.02	12.65	20.05	50.12
5	0.9962	3.58	10.04	12.67	20.08	50.19
6	0.9945	3.59	10.06	12.69	20.11	50.28
7	0.9926	3.60	10.08	12.71	20.15	50.38
8	0.9903	3.61	10.10	12.74	20.20	50.49
9	0.9877	3.61	10.12	12.78	20.25	50.62
10	0.9848	3.63	10.15	12.81	20.31	50.77
11	0.9816	3.64	10.19	12.86	20.37	50.93
12	0.9782	3.65	10.22	12.90	20.45	51.12
13	0.9744	3.66	10.26	12.95	20.53	51.31
14	0.9703	3.68	10.31	13.01	20.61	51.53
15	0.9660	3.70	10.35	13.06	20.70	51.76
16	0.9613	3.71	10.40	13.13	20.81	52.01
17	0.9563	3.73	10.46	13.20	20.91	52.28
18	0.9511	3.75	10.51	13.27	21.03	52.57
19	0.9456	3.78	10.58	13.35	21.15	52.88
20	0.9398	3.80	10.64	13.43	21.28	53.21
21	0.9336	3.82	10.71	13.52	21.42	53.55

For instance, if an area has a slope of 20° and the horizontal distance that we require is 12.62m, then the Slope Distance (SD) we have to travel is 13.43m. This can be obtained from slope correction table. To read SD from slope correction table, take the reading/value under particular HD column that corresponds to particular slope (in degrees).

Although reading slope value on a clinometer is fairly easy, it is very important to ensure that clinometers and measuring tapes are held correctly as illustrated below.

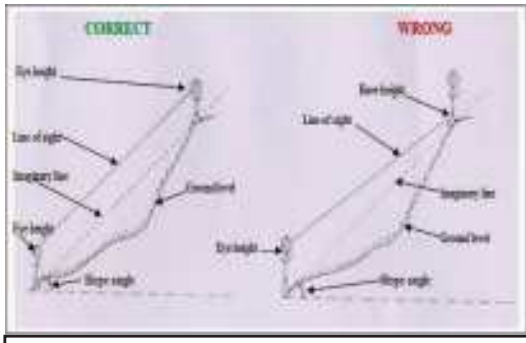


Plate 1: Aiming at "eye-height" for correct slope measurement

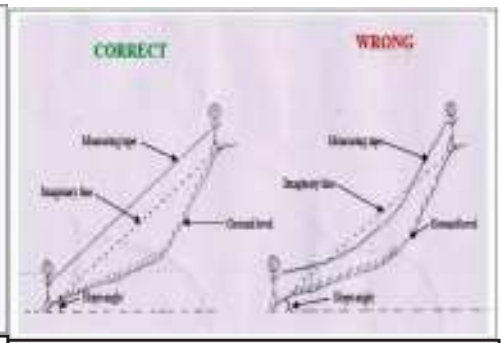


Plate 2: The measuring tape should be straight to the slope, without sagging or twisting

2.2 Navigating to Cluster Plots

With general preparation for field work completed and having decided on which Cluster Plots to be inventoried, the crew will use GPS to navigate to the targeted Cluster Plots. Each Cluster Plot will have a unique pre-assigned Plot ID (eg. CP0001) and coordinates (Latitude and longitude) using which crew can navigate and locate the cluster plots. FRMD or crew leader will have uploaded these coordinates in to the GPS and will be provided to crews, who in turn will use the GPS to navigate to the Cluster Plots for field works. The crews are also encouraged to use supplementary applications such as SW Maps & Collect Mobile to navigate to the plot.

Crew must navigate to the Elbow Plot first, complete all the necessary data collection in Elbow, and then move to North Plot. For moving to North Plot, use compass for direction and traverse 50 m towards North with slope correction.

Upon completing the North Plot, go back to Elbow Plot and then traverse towards East Plot, as done for North plot. If the transect between the Elbow and any of the two Plots (North and East) cannot be laid because of rocky cliff or water bodies, GPS may be used to navigate to these plots. In such cases, Coarse Woody Debris data cannot be collected.

2.3 Relocating, Monumenting, Referencing and Witnessing of Plot Center (PC)

There are two parts to locating the plot centre. The NFI crew will use the plot coordinates provided and uploaded in GPS to relocate the PC and establish the centre of plot by driving down Iron stake. After establishing the plot centre, take photograph of plot with SW Maps application and save by cluster plot name and plot type (e.g., if you take five photos in elbow plot of cluster plot 0001, then the photos should be named as CP0001_L1, CP0001_L2, CP0001_L3, CP0001_L4 and CP0001_L5). Relocating the plot centres of accessible plots of the first NFI is described in 2.3.1.

2.3.1 Relocating the PC

Unlike establishing PC during the first inventory and also for those inaccessible plots described above in 2.3, relocating plot centres of accessible plots during the second and subsequent inventories will be a bit tricky and challenging. The NFI crew will use GPS to navigate to the plot and nearest

point of PC. The GPS will alert by giving 'beep' sound indicating that the crew has reached PC. Once in the plot, the crew will then use metal detector to find the Galvanized Iron (GI) pipe used to monument plot centre during the first NFI. Use of SW Maps and data logger also helps in relocating the plot center.

The crew will also be provided with tree information that includes tree number, diameter, height, distance from PC and azimuth from the PC to aid relocating the PC, besides reference point (RP) information from the first NFI.

The crew must try their best to relocate the PC. After relocating the PC, the crew will then install PC tag (Stainless steel stake) with circular aluminium PC tag.

2.3.2 Establishing PC for Replacement Plots

Despite repeated attempts and the best efforts, if the crew fails to relocate the PC and find the GI pipe, the crew will re-establish a plot and PC using stainless steel stake. The failure to relocate the PC will be owing to various reasons such as faulty establishment of PC by previous crew, limited or poor satellite signals resulting in faulty readings by GPS, loss of GI pipe either through natural forces such erosion, landslide or through anthropogenic forces such as development works or purposely being removed by humans, etc.

However, the crew will establish the new PC (replacement plot) within 5 meters radius from the PC, since the crew will be provided with expected coordinates of the PC. Their GPS or Data logger will show the distance from the PC. Before establishing the replacement plot, the crew may try to relocate N or E plots and use back bearing to relocate L plot. It is encouraged to spent atleast one hour to try and relocate the last inventory plot center.

2.3.3 Referencing the PC

Referencing of the plot is done to relocate the plots in future. Referencing the plot will be done with Reference structure or feature. The reference structure or feature is going to be useful mainly for tree-less plots. It can be any permanent structure or feature which can help in re-locating the plot and plot centre in future.

For plots with trees, the reference and witness tree forms can be same, which means the same trees chosen as witness trees can be reference structure/feature

for the plot. Each plot should have a minimum of 3 reference structure, to allow triangulation methods to relocate the plot. However, exceptions can be applied under unavoidable circumstance.

2.3.4 Witnessing the PC

After relocating the PC for those plots accessed previously and laying replacement plots for those that could not be located and establishing PC for new plots (which were not accessed in the first NFI), the NFI crew shall establish Witness Trees (WT) for each PC. Witnessing of PC shall be done by fixing a square aluminum tags at the base on to the witness trees.

Figure 2: Configuration of Witness trees

A minimum of 3 trees within the plot shall be chosen as witness tree, such that they are located around the PC and that they are not located in linear position about the PC. Preferably, when these 3 WT are triangulated, it should approximately form a right-angled triangle around the PC. After choosing the WT (live tree and not dead), the WTs are tagged with witness tags. The face of the witness tags should point towards the PC. For plots with less than three trees, all trees should be recorded as witness tree.

The witness trees should be easily seen from the plot center and be roughly within the plot radius. Choose witness tree 1 that is easily identifiable on the ground and as close as possible to the plot center. Then select witness tree 2 with a trajectory to plot center which is as close to 90 degrees from the witness tree 1, witness tree 3 with a trajectory to plot center which is close 90 degrees from the witness tree 2 and follows the same pattern. The witness trees are roughly at right angle to each other, which will help for relocation of plot center by triangulation in future inventories as depicted in *Figure 2*.

2.4 Establishing Plot

After monumenting the PC with Iron Stake, the crew will establish a circular plot of 12.62 m radius around the PC. The edge of the circular plot may be

identified using the Hypsometer. The crew leader will stand at the PC and using the hypsometer or measuring tape, determine the edge of 12.62 m radius circle boundary. The plot boundary should be marked by moving in a clockwise manner.

Where the vegetation is too dense to use hypsometer to determine the edge or boundary of the circular plot, measuring tape will be used to determine the boundary of the circular plot. If measuring tapes are used, then slope correction must be done for the distance measured (refer Annexure II: Slope Correction Table) for guidance.

Within Elbow Plot, establish a subplot having 3.57 m radius with Elbow PC as the PC for this sub-plot. This subplot is called regeneration plot. After establishing regeneration plot, the regeneration data will be collected prior to collection of other data to avoid trampling of regeneration data by careful observation while collecting other data. Likewise, a subplot of radius 0.57 m will be established within North and East plot, after establishing PC for North and East, called herb plot. Herb data will be collected prior to collecting other data in North and East plots for the same reason, as for regeneration data. The plot design is shown in Figure 1.

Chapter 3: Protocols for Collecting Data

This chapter describes step-wise order and protocols for collecting data from the plots and subplots, as detailed below;

3.1 Order of Collecting and Recording Data

After establishing plot, take a a good photograph of plot. The Crew then start collecting data for *Regeneration* first, as mentioned in 2.4. After completing collection of regeneration data, the crew will collect other data parameters in the elbow plot.

Data collection will start with Elbow plot, prior to that of North and East plots. The data recording will be done on the Android based Tablet, which will have the electronic field forms loaded on to it through Collect Mobile application.

In case, the Andriod Tablet fails to function, the crew will record the measurements or data on the paper data form with a pencil. The crew leader will ensure that writing is clear, neat and legible. Over-writing will be avoided at any cost. Instead, the data recorder should cancel any wrong entry with single strike line and corrected entry written at the side. Data manager will manually enter data collected in paper forms into Collect database.

The Inventory crews are to follow the following order of data collection and recording in the Plot of any cluster:

1. Once the PC is located and established, identify the Reference Point (RP) and complete the **'Reference Point'** form.
2. Once the PC is located and established, identify the Witness Trees (WT) and complete the **'Witness Trees'** form.
3. In the Elbow plot, start the data recording **'Regeneration data'** first and in North and East, start with '**Herb data'** form.
4. Then fill in and complete **Cluster Plot** form. If the Elbow Plot is inaccessible, Cluster Plot form will be filled in North Plot, otherwise in East Plot. Likewise, for regeneration data form.
5. After that, fill in the **Plot Description'**form
6. While Plot Description Form is being completed, rest of the crew can start establishing the plot and measuring and recording the **Tree data** on a notepad.
7. Then fill in the **Tree Data** Form.

8. Upon completing the **'Tree data'** form, complete the **'Sapling Data'** form followed by **'Shrub Data'** Form.
9. Then collect data on **Wildlife** (mammal, birds and reptiles) within the 25 m radius.
10. After completing the data collection from Elbow Plot, traverse to North plot (50 m away from the Elbow Plot Center). The 50 m transect should be slope corrected horizontal distance. On this 50 m transect to North Plot, collect and record data for **Coarse Woody Debris** (CWD). CWD shall be collected for 50 m transect to East Plot as well.
11. In the elbow plot, collect the data for fine woody debris (FWD) from 4 m transect at the outer edge of transect to North and East Plot.
12. Upon completing or parallel to these data collection, two individuals will collect data on aboveground understorey carbon which entails destructively sampling and collecting shrub and herb samples; and soil samples from carbon plot. Stepwise guidance and protocol for aboveground data collection is described in the subsequent chapters.

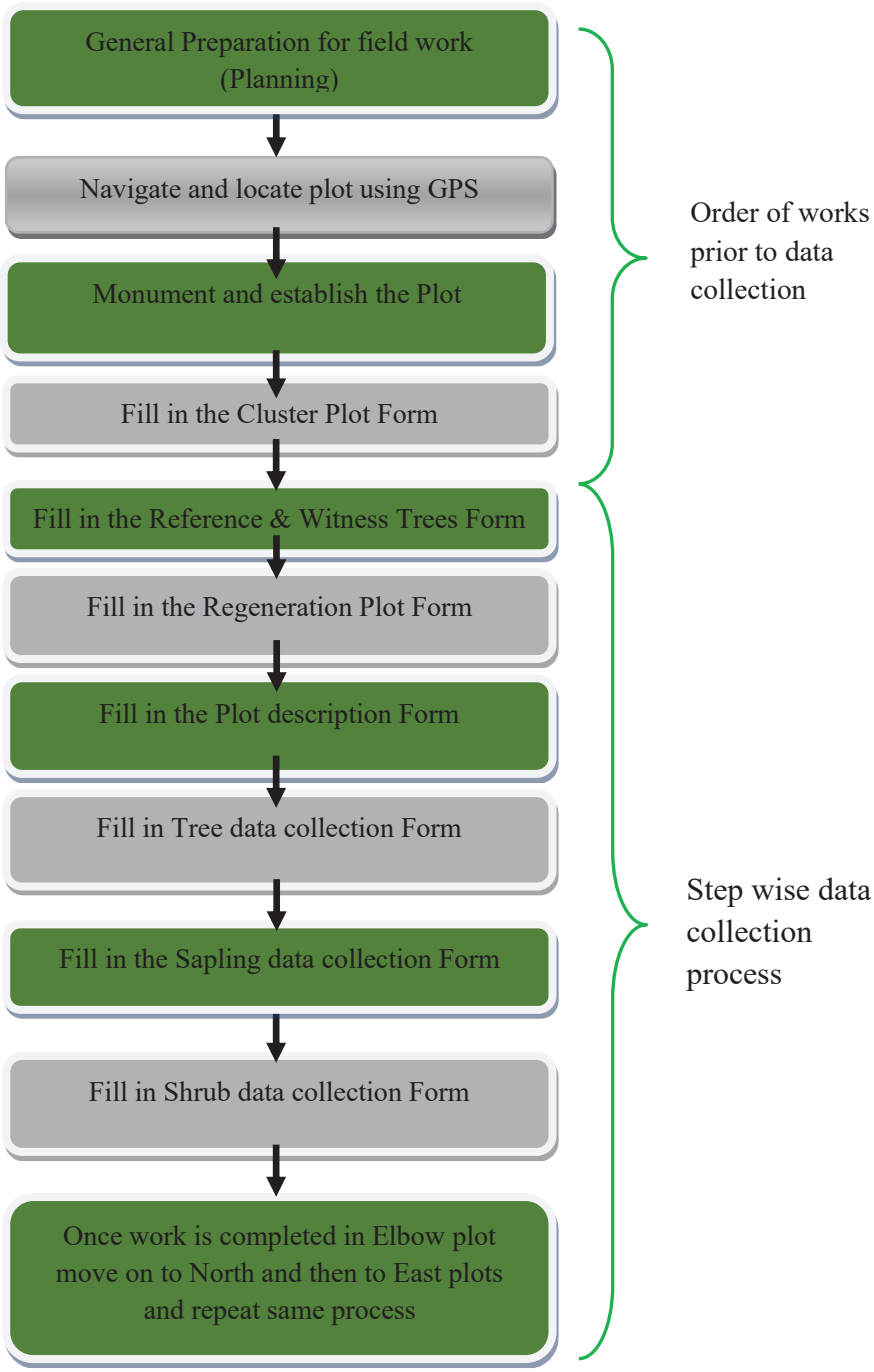


Figure 3: Flow chart illustrating the process of NFI field work

***Note**: In North and East plots, no Regeneration plot will be laid. However, Herb data will be collected in these two plots with 0.57 m radius circular plot (1 m^2).*

There are 18 data forms that need to be completed. Each of these data forms are assigned with form numbers. Form numbers will not be visible on the electronic data form. List of forms is provided in annexure I.

Sl.No	Form	Form Number
1.	Cluster Plot Form	F1/18
2.	Reference Point	F2/18
3	Witness Trees Form	F3/18
4.	Regeneration Form	F4/18
5.	Plot Description Form	F5/18
6.	Tree Data Form	F6/18
7.	Sapling Data Form	F7/18
8.	Shrub Data Form	F8/18
9.	Herb Data Form	F9/18
10.	Mammal Data Form	F10/18
11	Bird Data Form	F11/18
12	Reptile Data Form	F12/18
13	Coarse Woody Debris	F13/18
14	Fine Woody Debris	F14/18
15	Shrub Sampling Form	F15/18
16	Herb Sampling Form	F16/18
17	Litter Sampling Form	F17/18
18	Soil Sampling Form	F18/18

Copies of the Data Forms are provided as Annexures to this Manual

3.2 Instructions for Collecting and Recording Data on Field Forms (Electronic and paper)

3.2.1 Collecting and Recording Cluster plot (CP) Data

SN	Data Item	Description	Instructions
1.	CP No.	This is the unique identification number given to Cluster Plot. Eg. CP0001.	1. Select correct CP No. from the drop-down list on electronic field form or record the correct CP No, if the paper field form is used. ***Note:*** *Paper Field Forms are to be used only if data logger does not function in the field.*
2.	Date	Refers to date of day on which data is collected	Record the date by clicking on calendar icon next to the fill date.
3	Time	Refers to time of day when data for Cluster Plot is collected	Record the time by clicking on time icon next to the fill time.
4	Expected Distance	Refers to the distance between expected and current location of the CP	The distance will be automatically generated once location is recorded by clicking 'START GPS'. Repeat the prossess atleast three times before final record.
5	Location	Refers to the location of plot	1. Record the location by clicking on 'START GPS' and then after recording it, click on 'STOP GPS'. 2. Repeat atleast three times for final recording of plot location.
6	Enumerated	Refers to whether or not the cluster plot is enumerated	Record it by clicking 'Yes' if it is enumerated, 'No' if it is not. Note all accessible plots are enumerated.

7	Weather	Refers to the state of atmospheric conditions at that particular time when NFI crew carries out field work.	Based on weather conditions prevailing at that particular moment, mention whether it is; a. Sunny b. Rainy c. Cloudy d. Wind Select from the dropdown menu.
8	Altitude	Refers to the elevation from mean sea level at which the cluster plot is located. It is measured in meter.	Use the GPS to obtain altitude reading. Record altitude in meter, as it appears on GPS.
9	Crew Leader Name	Refers to name of the Crew Leader of NFI crew carrying out field work	Choose appropriately from the list as it appears on electronic form or write down in the paper form if paper field form is used. ***Note**: Names of all crew leaders will be provided as drop-down list in electronic form.*
10	Crew ID	Refers to a unique identity number assigned to each Crew	Choose and record appropriate Crew ID from the drop-down list.
11	Office Name	Refers to the name of the field office collecting the data from the cluster plot	Choose from the list of office names from the drop-down menu.
12	Dzongkhag	Refers to name of the Dzongkhag within which the Cluster Plot is located.	Choose and record appropriate name of the dzongkhag from the drop-down list on electronic field form or write down on the paper field form if it is used. ***Note**: Dzongkhag names will be provided as drop-down list in the electronic field form.*

13	Gewog	Refers to name of the gewog within which the Cluster Plot is located.	Choose and record appropriate gewog name from drop-down list on electronic form or write down gewog name on paper field form if it is used. ***Note**: Gewog names will be provided as drop-down list on electronic field form.*
14	Region	Refers to region under which the CP falls.20 Dzongkhags are placed under different regions	The region field will automatically populate once the dzongkhag is selected.
15	Accessible	Refers to if the CP was accessible or not.	Select 'Yes' if the CP was accessible, 'No' if it was not accessible.
16	CP Description	Refers to any additional plot description that Crew provides, which may be useful for future inventories	Crew may provide additional information which may aid future inventories.
17	Remarks	Any other additional information that crew might want to give.	1. Crew can provide an additional information relevant to the cluster plot, if any. 2. If elbow plot is not accessible, indicate here. 3. Nearest GPS coordinate may be recorded by manual typing.

Note: Don't start the GPS in Collect Mobile any point in time after completing data collection. Doing so will result in error at the time of data export.

3.2.2 Collecting and Recording Reference Point Form

SN	Data Item	Description	Instructions
1.	CP No.	This is the unique identification number given to Cluster Plot. e.g. CP0001	1. Select correct CP No. from the drop-down list on electronic field form or record the correct CP No., if the paper field form is used. ***Note:*** *Paper Field Forms are to be used only if the Android Tablet does not function in the field.*
2.	Plot type	Refers to one of the three plots (Elbow, East or North Plot) of cluster plot	Select correct Plot No. from the drop-down list on electronic field form or tick appropriate Plot No. if the paper field form is used.
3.	Reference structure	Refers to structure/ feature that is chosen as a Reference Point for the PC. Take a picture of reference structure and submit	1. After selecting the Reference Point, type the name of the reference point, such as rock, stream, footpath or tree, etc. 2. Short description of reference point is required.
4	DBH	If the selected reference structure is tree. Record the DBH	Measure the DBH using diameter tape and record
5	Horizontal Distance to PC	This is the horizontal distance measured between the PC and the Witness Tree.	Measure the horizontal distance using either the Hypsometer or the measuring tape (with slope correction), as convenient.And record the horizontal distancein meters (m).
6	Slope Distance to Plot Centre	This refers to the slope distance between PC and Witness Tree	Measure the slope distance using measuring tape or hypsometer and record the distance in meters (m).
7	Azimuth of RP	the angle from North	1. Measure the azimuth of the RP using compass by

		Reference Point (RP) is located, as measured from the PC.	standing at the center of the plot. 2. Record the azimuth in degrees.
8	Location	Refers to the location of the reference structure	Record the coordinate of the reference structure
9	Remarks		Record if no suitable RP are available

3.2.3 Collecting and Recording Witness tree (WT) data

SN	Data Item	Description	Instructions
1.	CP No.	This is the unique identification number given to Cluster Plot. Eg. CP0001	1. Select correct CP No. from the drop-down list on electronic field form or record the correct CP No, if the paper field form is used. ***Note:*** *Paper Field Forms are to be used only if the Android Tablet does not function in the field.*
2.	Plot Type	Refers to one of the three plots (Elbow, East or North Plot) of cluster plot	Select correct Plot No. from the drop-down list on electronic field form or tick appropriate Plot No. if the paper field form is used.
3.	Witness Tree (1, 2 &3)	Refers to tree that is chosen as a witness for the PC	After selecting the Witness Tree, drive the Witness Tag (Square aluminum tag) at the base of the tree (about 30 cm from the ground). The Witness Tag should point /face towards the PC.
4.	Species/ Scientific name	Refers to scientific or botanical name of the chosen Witness Tree. (For eg., *Pinus wallichiana*)	Provide botanical name of the Witness Tree by choosing it from the drop-down list.

5	dbh	Refers to the diameter at breast height (dbh) of the chosen Witness Tree	Measure the diameter at breast height (dbh) of the chosen witness tree using diameter tape and record the reading in centimeter (cm)
6.	Horizontal Distance to PC	This is the horizontal distance measured between the PC and the Witness Tree.	1. Measure the horizontal distance using either the Hypsometer or the measuring tape, as convenient. 2. Record the horizontal distance in meters (m).
7	Slope Distance to Plot Centre	This refers to the slope distance between PC and Witness Tree	Measure the slope distance using measuring tape and record the distance in meters (m).
8	Azimuth of WT	The angle from North at which the Witness Tree (WT) is located, as measured from the PC.	1. Measure the azimuth of WT using compass by standing at the center of the plot. 2. Record the azimuth in degrees.

***Note**: As mentioned in 2.3.4, there will be a minimum of 3 Witness Trees (WTs) per Plot. Instruction and guidance on selecting WTs are provided in the same section above. The crew will fill in 3 electronic WT forms on Andriod tablet if 3 WTs are selected, 4 times if 4 WTs are selected.*

3.2.4 Collecting and Recording Regeneration Data

Regeneration data will be collected only from the Elbow Plot, where 3.57 m radius circular plot will be laid around the PC. All tree species with diameter at breast height (DBH) less than 5 cm and located within 3.57cm subplot will be enumerated and recorded in the regeneration data form.

SN	Parameter	Description	Instructions
1.	CP No.	This is the unique identification number given to Cluster Plot. Eg. CP0001	1. Select correct CP No. from the drop-down list on electronic field form or record the correct CP No, if the

			paper field form is used. ***Note**: Paper Field Forms are to be used only if the Android Tablet does not function in the field.*
2	Date	Refers to date on which data was collected	1. Record the date by clicking on calendar icon next to it on Android tablet. 2. If paper form is used, record the date accordingly.
3.	Species /Scientific Name	Refers to scientific or botanical name which conforms to the *ICBN*	Choose appropriate botanical name as it appears against it as drop-down list.
4.	Common Name/ Local Name	"Common name" refers to the commonly used name of that tree species in English or local dialect. "Local name" means name of tree in local dialect. For NFI, the local names in following dialects will be used; Dzongkha (Dz), Tshanglha Kha (Ts), Lhotsham kha (Lh), Bumthangp (Bum), Khengkha (Kh), Trongsap (Tr) and Kurtoep (Kr).	1. The Crew may note either the common name or the local name, or both, of the tree. 2. In case of local name, Crew must specify dialect in which the local name has been given. (For *Quercus griffithii,* it is **Baenangshing** in **Tshanglha Kha,** therefore, local name must be written as **Baenangshing (Ts)**, **Ts** indicates it is in **Tshanglha Kha)**
6.	Number of established regenerations	Established seedlings are plants having height more than 2 m.	Count the number of plants having DBH less than 5 cm and of height more than 2 m within 3.57

			m sub.plot and record the number /counts
7.	Number of un-established regeneration	Un-established regeneration refers to plants which are less than 2 m height and are more than one year old.	Count the number of plants having DBH less than 5 cm and of height less than 2 m within 3.57 m sub-plot and record the number/counts.
8.	Number of recruits	Recruits are very small plants having 2-4 leaves but are current years seedling	Count the number of recruits and record the number
9.	Remarks		The Crew leader or the data recorder may add any additional information that may help in assessing regeneration status in the plot

***NOTE**: If the plants cannot be identified by either Scientific name or local name or common name, then the plant will be recorded as "UNKNOWN 1,2,3,4……" for that plot. A photo of the plant may be taken and in bracket record the photograph number (Naming protocol - Cluster Plot No_Plot type (L, N, E)_Unknown1, 2,3…., e.g First unknown plant found in East Plot of Cluster Plot 0947 will be named as CP0947_E_Unknown1.)). This will be done for trees, shrubs, herbs and saplings too. The photo of the plant should consist of shoot, leaf, flowers and whole plant where possible to aid identification. Where possible, both dorsal and ventral surface of leaves must be photographed.*

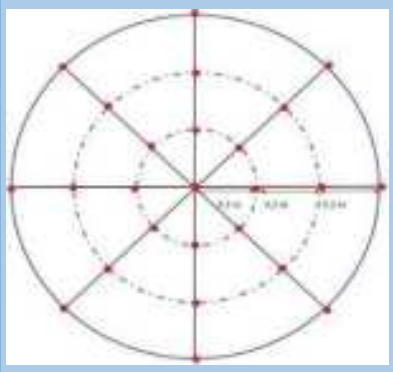
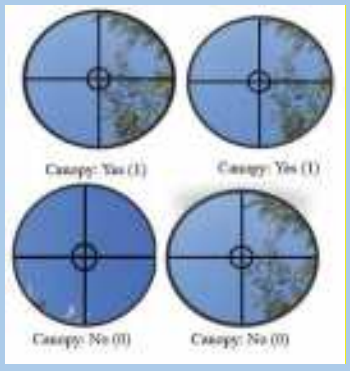
3.2.5 Collecting and Recording Plot Description data

SN	Data Item	Description/Definition	Instructions
1	CP No.	This is the unique identification number given to Cluster Plot. E.g., CP0001	Select correct CP No. from the drop-down list on electronic field form or record the correct CP No, if the paper field form is used. ***Note**: Paper Field Forms are to be used only if the Android Tablet does not function in the field.*

2	Plot name	Refers to one of the three plots (Elbow, East or North Plot) of Cluster Plot.	Select correct Plot No. from the drop-down list on electronic field form or tick appropriate Plot No. if the paper field form is used.
3	Plot Location	Refers to the location of plot	1. Record clicking the location by on 'START GPS and then after recording it, click on 'STOP GPS'. 2. Repeat atleast three times for final recording of plot location.
4	Topographic position	Refers to the position of the plot in reference to the topography and the slope. Topographic position will be classified as: 1. **Ridge top**: when plot is located on a ridge top 2. **Upper hill side**: when the plot is located in the upper one-third of the hill 2. **Middle hill side**: when the plot is located on the middle one third of the hill 3. **Lower hill side**: when the plot is located in the lower one third of the hill 4. **Flat land**: when the plot is on valley beds or vast stretch of flat area. 5. **River bed**: when the plot falls on a river (dry or otherwise)	1. Classify the position of the plot topographically by referring the definitions provided. 2. Record the appropriate topographic position by selecting from the drop-down list in the data dictionary (if electronic field form is used). 3. In case of paper field form, tick the appropriate topographic position.

		6. **River banks**: when the plot falls on the banks of river or stream. 7. **Gorge/ravine**: when the plot falls on very steep ravines.	
5	Aspect	Refers to the direction of the slope and is classified as: 1. **Northern**: When the slope is facing North 2. **North-Eastern**: When the slope is facing North East 3. **Eastern**: When the slope is facing East 4. **South-eastern**: When the slope is facing South-East 5. **Southern**: When the slope is facing South 6. **South-western**: When the slope is facing South -West 7. **North-western**: When the slope is facing North West 8. **No aspect**: When the plot falls on a flat area	1. Use a compass to determine the direction to which the slope is facing. 2. Record appropriate aspect by selecting from the drop-down list on the data dictionary in the electronic field form and tick appropriate aspect from check list in the paper field form.
6	Slope up	Slope Up describes the gradient, inclination of the up-hill slope from the PC. **Note**: Slope reading for our purpose will be done in degrees.	1. For measuring the Slope up, walk one of the crew members towards the steepest part of the up-hill side and position the member on the edge of the 12.62 m plot. 2. Take a clinometer reading to his eye height from the PC. 3. Record the reading accordingly.

7	Slope down	Slope down describes the gradient, inclination of the down-hill slope from the PC.	1. For measuring the Slope down, walk one of the crew members towards the steepest part of the down-hill side and position the member on the edge of the 12.62 m plot. 2. Take a clinometer reading to his eye height from the PC. 3. Record the reading accordingly
8	Stand height	Refers to an arithmetic mean of the height of five tallest trees in the plot. If number of records are less than 5, record average height of these trees as stand height.	1. Identify five tallest trees having DBH above 10 cm located within 12.62 m radius plot. 2. Measure the heights of the identified trees using Hypsometer or clinometers. 3. Start from North and move in clockwise direction to measure heights all five identified trees located within the plot. 4. Once the measurement of height is completed for all five trees, add the height and divide the sum by 5. The result is the *stand height*. 5. Record the result to the nearest one decimal place.

9	Canopy cover	Refers to the cover percent of tree canopy.  *Figure 4: Points for measurement on circular plot*  *Figure 5: Tally and non-tally of canopy by looking through the densitometer* If more than 50% of the black circle in the densitometer is covered it is '1' for canopy measurement.	1. Divide the plot into **eight sections** using or with imaginary lines running through North-South intersecting with East-West line, North Eastern – South Western intersecting North Western – South Eastern. 2. Using the Crown Densitometer, estimate the canopy cover percent from the following 25 positions: -Plot centre, -From the plot centre measure about 4.2 m on each line and take three measurement from all 8 directions from plot centre. Looking at the canopy cover with a GRS Densitometer, at each 4.2 m distance from plot center, record '1' if more than 50% of inner black circle is covered by canopy and '0' if no canopy is observed in 50% of the black circle (Figure 5). The canopy cover is calculated $$Canopy\ cover = \frac{Total\ 1s}{25} * 100$$

			Record the canopy closure in percentage.
	Canopy Tally	Refers to number of points where more than 50% of the black circle in the densitometer is covered by canopy and are recorded as 'Yes' or '1'.	Total number of "Yes" or "1" obervations
	Canopy Non-tally	Refers to number of points where less than 50% of the black circle in the densitometer is covered by canopy and are recorded as 'No' or '1'.	Total number of "No" or "0" obervations
10	Land Ownership	Refers to the ownership status of the land on which the plot is located. This is classified into the following categories: 1.State Reserved Forest Land (SRFL) 2.SRFL-Protected area 3.SRFL-FMU 4.SRFL-Community Forests 5. SRFL-Leased 6. Private 7. Thromde 8. Institutional 9. Don't Know	Refer the legal definition for assessing the Land ownership status of the plot and record accordingly.
11	Land Ownership	Refers to any other information related to land ownership.	Mention any additional relevant information on land ownership, as deemed fit.

<table>
<tr>
<td>12</td>
<td>Land Cover Type</td>
<td>Refers to class of land cover as classified in the Land Cover classification of IPCC 2006 and LUPP,1995, Land Use Land Map 2010, 2016 and are classified under the following categories:
<table>
<tr><th>Category</th><th>Sub-Category</th></tr>
<tr><td>Forest</td><td>1. Coniferous forests
2. Broadleaf forests
3. Coniferous plantation
4. Broadleaf plantation</td></tr>
<tr><td>Grassland</td><td>1. Meadow
2. Grassland
3. Scrub - shrubs non-rhododendrons
4. Shrubs-Rhododendron</td></tr>
<tr><td>Cropland</td><td>1. Chuzhing
2. Kamzhing
3. Mixed agriculture
4. Apple orchard
5. Citrus orchard
6. Areca nut
7. Cardamom Plantation
8. Other horticulture</td></tr>
<tr><td>Settlement</td><td>1. Urban
2. Rural
3. Industrial
4. Roads</td></tr>
<tr><td>Wetland</td><td>1. Lake
2. Reservoir
3. Marshy area
4. River</td></tr>
<tr><td>Other land</td><td>1. Impervious surface
2. Snow/glacier</td></tr>
</table>
</td>
<td>Use the technical definition provided in Annexure III for identifying the Land cover classification. Then record appropriate land cover class accordingly in the data dictionary or electronic field forms.

Land Cover Classification Code as provided in the Annexure III may be used, if paper field forms have to be used.</td>
</tr>
</table>

		3. Rocky outcrop 4. Scree 5. Landslide 6. Gully 7. Ravine 8. Moraines For Land Use definitions, refer Annexure III and Annexure IV	
13	Vegetation composition	Refers to the dominating composition of vegetation and often described by dominating tree species. The Vegetation Composition types are provided in Annexure V and appropriate type should be selected or typed	1. Study the vegetation within 25 m radius of the plot for majority species. 2. Run through the Vegetation Composition list and select the most appropriate type 3. Record accordingly
14	Forest type	Refers to Forest type as classified in the Flora of Bhutan. The characteristic feature of different forest types is provided in Annexure VI	1. Refer annexure VI to classify the forest type. 2. Select the appropriate forest type from the drop-down list in case of electronic field form and in case of paper field forms, record the Forest type Code as provided in the Annexure VI.
15	Forest Stand Structure	Refers to or defined as the "physical and temporal distribution of trees in a stand (Oliver and Larson, 1990). It basically refers to the horizontal and vertical distribution of components of a stand (Helms 1998), while for this exercise, the	Select from the drop-down list; a) even aged forest b) uneven aged forest. a) An evenaged forest is has one or two distinct age or size classes of trees; thus one or two layers of tree crowns b) An unevenaged forest has three or

		vertical distribution (even aged and un-even aged) of the stand shall be recorded.	more distinct age or size classes, thus three or more layers of trees
16	Stand Development Stage	The stand development stage is characterized by changes in stand structure and species composition and maybe classified as (Oliver and Larson,1990). 1. Open 2. Stand Initiation 3. Stand Exclusion 4. Stand re-initiation 5. Old growth	1. Refer Annexure XVI to identify the stand structure 2. Study the stand structure within 12.62 m and then record appropriately from the drop-down list for electronic forms and tick appropriately for paper forms.
17	Main Understorey type	Refers to the dominant understorey type growing within the plot. The understorey type is categorized as: 1. Moss 2. Grass 3. Herbs 4. Bamboos 5. Shrubs	1. Observe the understorey type within the plot. 2. Record the appropriate undergrowth type from the drop-down list for electronic form and tick appropriately for paper forms
18	Understorey cover percent	Refers to the area of plot (in percentage) covered by dominant understorey type.	1. Observe the understorey cover within the plot and make ocularly professional calculation. 2. Record the cover percent of the dominant understorey type in percentage.
Forest Resources			
19	Non-Wood Forest	Non-Wood Forest Produce (NWFP) for the purpose of NFI will refer to only the	1. Observe and record the NWFPs found in the 12.62 m radius plot.

	Produce (NWFP)	living plant species whose plant parts (flowers, seeds, bulbs, roots, fruits, leaves, barks, any other vegetative part or the whole plant) or its produce such as resin, katha, kutch has medicinal properties or is edible or has some utility to people as tangible goods, or has economic value. NWFP may include trees, shrubs, herbs, bamboos, grasses, creepers, reeds, orchids, canes and fungi. (This working definition is guided by Forest and Nature Conservation Rules of Bhutan, 2006 definition of NWFP) Options for listing five NWFPs are provided in the data forms along with the cover percent of each, within the 12.62 m radius of plot.	2. NWFP may be recorded by its botanical name, common name or local name or by any two nomenclatures. 3. List of NWFP should not be limited to the list provided. 4. Use field references, field guides and local knowledge to identify NWFPs. Refer Annexure XII for Traded NWFPs and Annexure VIII for Herbs.
20	Cover Percent	Refers to the cover percent of the NWFP found within the plot.	1. Observe ocularly within plot and make expert judgement of percent area of plot covered by that NWFP. 2. Record the cover percent of the identified NWFP.
21	Bamboo	Refers to evergreen perennial flowering plants of grass family Poaceae.	1. Observe ocularly for presence or absence of bamboo within the plot and 25 m around the PC. 2. If bamboos are present within the 12.62 m

			radius plot, record as "Yes", otherwise "No".
22	Scientific Name	Refers to scientific or botanical name which conforms to the *International Code of Botanical Nomenclature (ICBN)*	1. Observe within the plot and record the botanical name of the bamboo. 2. The botanical names of the bamboos found in Bhutan are provided as drop-down list in the electronic field form. 3. Refer Annexure XI: Bamboos of Bhutan. 4. If paper field form is used, record appropriate-ly from the list of Bamboo provided.
23	Bamboo cover percent	Refers to the cover percent of the bamboo in the plot	1. Observe ocularly within plot and make expert judgement of percent area of plot covered by that bamboo. 2. Record the cover percent of the identified bamboo.
24	Bamboo Regene-ration	Refer to status of bamboo regeneration within the 12.62 m radius plot, which is categorized as: 1. None 2. <10% 3. 10-20% 4. 20-50% 5. >50%	Assess the plot for bamboo regeneration and accordingly record the appropriate category.
25	Cane	Refers to perennial grasses with flexible and woody stalks for the purpose of NFI.	1. Observe ocularly for presence or absence of cane within the plot and 25 m around the PC. 2. If cane is present, record as "Yes" otherwise "No".

26	Cane Cover Percent	Refers to percent area of 12.62 m radius plot covered by cane.	1. Observe ocularly within plot and make expert judgement of percent area of plot covered by Cane. 2. Record the observation in percentage.
27	Daphne	Refers to recording the presence or absence of Daphne within the plots.	1. Observe ocularly for presence or absence of Daphne within the plot and 25 m around the PC. 2. If Daphne is present, record as "Yes", otherwise "No".
28	Daphne Cover percent	Refers to percent area of the 12.62 m radius plot covered by Daphne.	1. Observe ocularly within plot and make expert judgement of percent area of plot covered by Daphne. 2. Record the observation in percentage.
29	Snag	Refers to dead standing tree within the 12.62 m radius plot. Such trees will not have any living part at or above the DBH.	Look for snag within the plot, record "Yes" if snag is present in the plot, otherwise "No".
30	Snag count	Refers to the number of snag present in the plot.	Count the number of snag and record the count of snag accordingly in electronic form or record on paper form.
31	Fallen trees	Refers to the number of dead fallen trees (of more than 1.37 m length and diameter of more than 10 cm at the midpoint) within the 12.62 m radius plot	1. Look for fallen trees within the plot. 2. Record "Yes", if it is present, otherwise "No"

32	Fallen trees count	Refers to total number/count of fallen trees found in the plot.	Count the number of fallen trees and record and record accordingly on electronic form or paper form.
Disturbance			
33	Forest Fire	Refers to presence or absence of evidence of forest fire	1. Observe within plot for evidence of forest fire. 2. Record "Yes" if evidence is present, otherwise "No".
34	Intensity of forest fire	Refers to the severity of forest fire damage and will be classified in one of the following categories: 1. **Heavy**: Where more than 50% of the area/crop is affected by fire 2. **Moderate**: Where 10-50% of the area/crop is affected by fire 3. **Light**: Where less than 10% of the area/crop is affected by fire **4. No Fire**	1. Observe the area occularly within the plot and 25 m around the PC and assess the severity of damage as per description of each category 2. Then record the category accordingly from the drop-down list in the electronic form or tick appropriately for the paper form.
35	Type of forest fire	Refers to type of forest fire and is classified as one of the following categories: 1. **Underground fire**: fire spreading under the surface through roots or any other underground means. 2. **Surface fire**: Fire spreading through ground cover, vegetation and litters without reaching the tree canopies	1. Classify the type of forest fire that had affected the area, as per definition provided 2. Then record the appropriate category from the drop-down list in the electronic form or tick appropriately for paper forms.

		3. **Crown fire**: Fire spreading through the canopies of woody vegetation 4. **Not Sure/not known**: If the nature of forest fire cannot be ascertained 5. **Not applicable**: When no fire incidence is evident	
36	Grazing	Refers to presence or absence of evidence of grazing.	1. Observe ocularly for evidence of presence or absence of grazing within the plot and 25 m around the PC. 2. Then record as; a. **Yes**: When there are signs of grazing, presence of livestock or sighting of cattle or dung, etc. b. **No**: When there is no evidence of grazing. c. **Not sure**: When you are not sure
37	Intensity of grazing	Refers to the severity of grazing and will be classified as: 1. Low 2. Moderate 3. Severe 4. No grazing	1. Observe ocularly for evidence of severity of grazing within the plot and 50 m around the PC. 2. Then make expert judgement and record the extent of grazing class from the drop-down list for electronic form or tick appropriately on the paper form.
38	Timber extracti-on	Refers to evidence of timber being extracted from the plot.	1. Observe for evidence of timber extraction within the plot and 25 m around PC.

			2. Record as "Yes" if there is evidence of extraction, otherwise "No".
39	Type of Timber Extraction	Refers to type of timber extraction in the plot and will be categorized in one of the following: 1. Clear felling: Felling of all trees in the area 2. Selective felling: Felling of trees selectively/few trees felled 3. Group felling: Felling of trees in group/patch 4. No felling	1. Observe and record the observation by selecting the type of timber extraction appropriately from drop-down list for electronic form or tick appropriate type of timber extraction on the paper form
40	Mining	Refers to evidence of presence or absence of mining in the plot	1. Observe ocularly in the plot for evidence of presence or absence of mining in the plot and 25 m around the PC. 2. Record "Yes" if there is presence of mining, otherwise "No".
41	Type of Mining	Refers to type of mining and will be categorized as: 1.Yes, Surface collection 2. Yes, quarry 3. None	Observe ocularly within plot and 50 m around the PC; and record your observation as; a. Yes, surface collection b. Yes, quarry
42	Transmission lines	Refers to the transmission wires running over-head and/or existence of transmission poles.	If the transmission line runs over the plot or presence of electric poles within plot or boundary,

			then it will be recorded as "Yes", otherwise "No".
43	Garbage	Refers to presence or absence of garbage and will be categorized as: 1. Food wrappers 2. PET bottles 3. Construction wastes 4. All of above 5. None	1. Observe within the plot for evidence of any garbage/wastes. 2. Record the observation under any one of the relevant categories by selecting from the drop-down list for electronic form or tick appropriately on the paper form
Forest Health			
44	Pest and disease	Refers to presence or absence of evidence of pest and diseases	Observe ocularly with plot and around 25 m from the PC and record "Yes" if evidence of disease and pests is observed, otherwise "No".
45	Mistle toe	Mistletoe is an obligate hemiparasitic plant that grows attached to and penetrating within branches of trees. Can be identified on trees by the presence of "witches' broom"	If mistletoes are observed on the plot itself or within 25 m from the PC, record as "Yes, mistletoe", otherwise as "No"
46	Dieback Fir	Fir dieback is a condition observed in Fir, where the following symptoms are observed: 1. Top-dying/shedding of needles 2. Thinning crown	If fir dieback is observed on the plot itself or within 25 m from the PC, record as "Yes", otherwise "No".

47	Bark Beetle	Refers to occurrence of Bark Beetle infection in the forest stand. The visible symptoms of bark beetle infections are: 1. Discoloration of needles from green to yellow and eventually from red to brown 2. Tiny holes in the bark of the infected trees	If you observe the symptoms of Bark Beetle infection in the area, record as "Yes", else "No".
48	Others	Refers to any other information not captured.	If other pests and diseases are observed, record as observed.
Litter, Humus and Fuel bed			
49	Litter Depth Value	Refers to the depth of litter on the forest floor, measured in centimeters. Litter can be defined as the surface layer of the forest floor consisting of freshly fallen leaves, needles, twigs, stems, bark, and fruits. The decomposition would have just begun in this layer.	1. Measure the Litter depth at three random points in the plot, using a measuring scale. 2. Record the average value to the nearest decimal in centimeters.
50	Humus depth Value	Humus is the layer just below the litter and comprises of highly decomposed organic matter. There will be no discernible plant parts.	1. Measure the Humus depth at three random points in the plot, using a measuring scale. 2. Record the average value to the nearest decimal in centimeters.
51.	Fuel bed	The accumulated mass of dead, woody material on the surface of the forest floor.	1. Measure the fuel depth at three random points in the plot.

	Depth Value	It begins at the top of the duff/humus layer, and includes litter, fine and coarse wood debris and dead woody shrubs.	2. Record the average value to the nearest decimal in centimeters.
52	Litter Cover percent	Refers to the coverage of the litter measured as a percentage of the total area of the plot.	Record the cover percent of litter in the 12.62 m radius plot.
53	Bare soil cover percent	The extent of plot area that is not covered by litter and is indicated as the percentage of total area.	Record the bare soil cover percent in the 12.62 m radius plot.
Soil			
54.	Stoniness	Refers to cover percent of stones in the 12.62 m radius plot area. The stoniness of the plot area may be classified as: 1. None 2. Rare, <10 percent 3. Few, 10-20 percent 4. Common, 20-30 percent 5. Many, 30-60 percent 6. Abundant, >60 percent	1. Walk around the plot and assess the area for stoniness. 2. Record your observations by selecting the most appropriate category from the drop-down list on the electronic form or tick appropriately on paper form
55	Soil drainage	The drainage capacity of the soil is observed and classified as under: 1. **Poorly drained**: Water removed slowly; soil remains wet with water table near the surface for considerable part of the time.	1. Observe ocularly in the plot. 2. Select and record the most appropriate soil drainage category based on the definition provided.

		2. **Imperfectly drained**: Water removed slowly; soil remains wet for significant part of the year; mottles present within 75 cm of the soil. 3. **Moderately drained**: Water removed somewhat slowly and soil remains wet for small part of the time. Mottles observed below 75cm. 4. **Well drained**: Water removed rapidly. No mottles	
56	Top soil moisture	Refers to the moisture content of the top soil at the time of data collection and classified as: 1. Dry 2. Slightly moist 3. Moist 4. Wet 5. Water-logged.	Select and record the most appropriate category of top soil moisture from the drop-down list on electronic form or tick appropriately on the paper form.
57	Top soil colour	Refers to the colour of the soil and classified as: 1. Blackish 2. Reddish 3. Yellowish 4. Brownish 5. Others	Select and record the most appropriate top soil color from the drop-down list on electronic form or tick appropriately on paper form.
58	Top soil texture	Refers to assessment of the soil texture, which will be classified as: 1. Sand 2. Sandy loam 3. Loam	1. Feel the soil particles and assess the texture as instructed in the field guide provided in Annexure XVII 2. Record your observation.

		4. Silty Loam 5. Silt 6. Clay loam 7. Clay Refer to the Rough guide provided in Annexure XVII to determine the soil texture	
59	Gully Evidence	Gullies are vast gaps, crevices created by erosion of soil on hillside by running waters.	If gullies are observed within the plot or 25 m around the plot, record as 'Yes', otherwise, 'No' from the drop-down list on electronic form or tick appropriately on paper form.
60	Erosion Evidence	Evidence of any form of displacement of the upper layer of soil by water, air or any external forces.	Check for evidence of erosion and record "Yes" if it is present, otherwise "No" from the drop-down list on electronic form or tick appropriately on paper form
Water Bodies			
61	Stream	Stream refers to any flow of water in a channel or bed, as a brook, rivulet or small river.	If there is a stream within the plot or 25 m around the plot, record as "Yes", otherwise "No".
62	River	A large natural stream of water following in a channel to a sea, a lake or to another river.	If there is a river within the plot or 25 m around the plot, record as "Yes", otherwise "No".

63	Wetland/ Marshy area	Refers to any inundated /waterlogged area or areas with ponds.	If the plot area or area within 25 m radius from the PC, shows waterlogged/swampy conditions, then record as "Yes" else "No"
64	Lakes	A lake is a body of relatively still fresh or salt water of considerable size, localized in a basin, which is surrounded by land apart from a river, stream, or other form of moving water that serves to feed or drain lake. (Source:*en.wikipedia.org/wiki/Lake)*. Lakes can be Alpine lake, Sub-alpine lakes, Glacier lakes, Supra Glacial lake, Supra snow lake or Tsho.	If there is lake (irrespective of the category) within the plot or within 25 m radius from the PC, record as "Yes" else "No".
65	Glacier	A glacier is a large persistent body of ice that forms where the accumulation of snow exceeds its ablation (melting and sublimation) over many years, often centuries. (At least 0.1 km² in area and 50 m thick). (*Source:http://en.wikipedia.org/wiki/Glacier*) This will be relevant for Cluster plots falling in the high altitudes only.	If there is glacier within the plot or 25 m around the PC, record "Yes", otherwise "No" from the drop-down list on electronic form or tick appropriately on paper form.
Site Value			

66	Natural Trail facility	Refers to any approach path (footpath, road) to the plot, within the plot or within 25 m radius from the PC.	Record observation appropriately "Yes" or "No" from the drop-down list on electronic form or tick on the paper form.
67	Scenic	Refers to aesthetic value of the site.	Record "Yes" or "No" based on your own observation/ judgment from the drop-down list on electronic form or tick appropriately on paper from
68.	Visitor Evidence	Any evidence of human visiting the area in and around 25 m of the plot. For this, consult with the local guide accompanying the crew.	Observe and record observation as: 1. Yes, Local 2. Yes, Foreigner 3. Yes, Religious 4. None evident
69	Site value	Refers to any value attached to the location by people and will be classified as: 1. Yes, cultural 2. Yes, historical 3. Yes, religious 4. None	Observe and record the appropriate category from the drop-down list on electronic form or tick on the paper form, as; 1. Yes, Cultural 1. Yes, Historical 2. Yes, Religious 3. None
70.	Site name	Name of the site	Record the name of the site, if it has one.
71	Remarks	Any other useful remarks or information related to site that crews want to provide.	For e.g., if there is marshy land under the forest area, the area shall be classified as forest. However, it

			shall be mentioned in the "Remarks", that the forest land falls on the marshy land

3.2.6 Tree Data

Tree is a woody perennial with a single main stem, or, in the case of coppice, with several stems, having a more or less definite crown (FAO 2005). Tree data is collected from all three plots of the cluster; Elbow, North and East plots. For NFI, any woody perennial that meet the above definition of tree and has DBH of 10 cm and above (both live and dead); and falls within 12.62 m are considered tree, and relevant data should be collected.

Note: The same tree data collection Form is used for all three plots; Elbow, North and East.

SN	Parameter	Description	Instructions
1	CP No.	This is the unique identification number given to Cluster Plot. Eg. CP0001	1. Select correct CP No. from the drop-down list on electronic field form or record the correct CP No., if the paper field form is used. ***Note**: Paper Forms are to be used only if the Android Tablet does not function in the field.*
2	Plot Name	Refers to one of the three plots (Elbow, East or North Plot) of cluster plot	1. Choose appropriate plot name as it appears against it as drop-down list, on electronic form. 2. If paper forms have been used, tick the relevant plot from the three options provided.
3	Tree Location	Refers to the coordinate of the tree	Take a coordinate reading from the data logger/ Collect Mobile

4	Scientific Name	Refers to scientific or botanical name which conforms to the *International Code of Botanical Nomenclature (ICBN)*	1. Choose appropriate Botanical Name as it appears against it as drop-down list on electronic form. 2. If the name of the plant is not in the list, then provision for typing the botanical name is also provided. 3. If Paper forms have been used, record accordingly. 4. Tree names are provided in Annexure VII
5	Common Name/ Local Name	"Common name" herein is referred to the commonly used name of a tree in English. "Local name" means name of tree in local dialect. For NFI, the Local Names in following dialects will be used; Dzongkha (Dz), Tshanglha kha (Ts), Lhotsham kha (Lh), Bumthangp (Bum), Khengkha (Kh), Mangdep kha (Mg) and Kurtoep kha (Kr).	1. The Crew may note either the common name or the local name of the plant. 2. In case of local name, specify dialect in which the local name has been given. (For *Quercus griffithii,* it is **Baenangshing** in **Tshanglhakha,** therefore, local name must be written as **Baenangshing (Ts)**, **Ts** indicates it is in **Tshanglha kha)**
6	Tree tag No.	Refers to the pre-printed tree Tag no. assigned to a particular tree (ranges from 1 to 60000).	Type manually or select from the dropdown list
7	Witness Tree	Refers to whether or not this particular tree has	If this tree has been already recorded as WT, record as "Yes", otherwise "No".

		been recorded as a Witness Tree (WT) for PC.	
8	Tree Distance Horizontal	Refers to the horizontal distance of the tree from the PC	1. Measure the distance of the tree from the PC using Hypsometer. 2. In dense forest where use of Hypsometer may not be possible, measure the distance using measuring tape. 3. This distance must be recorded to one decimal place in meter (m)
9	Tree Distance Slope	Refers to the slope distance of the tree from the PC	1. Measure the distance of the tree from the PC using Hypsometer. 2. In dense forest, where use of Hypsometer may not be possible, measure the distance using measuring tape. 3. This distance must be recorded to one decimal place in meter (m)
10	Azimuth	Refers to the angle from North at which the tree is located, as measured from PC	1. Measure the Azimuth of a tree using compass by standing at the center of the plot 2. Record the Azimuth in Degrees to one decimal place.

11	DBH	Refers to Diameter measured at Breast Height. It is defined as a method of dendrometric measurements wherein the diameter is measured at Breast Height which is 1.37 m height from the ground.	1. Measure the DBH and record accordingly. 2. Record DBH in centimeter (cm) to one decimal place. *Note: Standard Rules for measuring DBH is given as Annexure XVIII.*
12	Total Height	Refers to the height of a tree which is the length of tree from Ground till Tip.	1. Measure the height of tree using Hypsometer. 2. Measure the height by standing on uphill side of the tree on a slope. 3. Record the height in meters (m) to once decimal place.
13	Bole Height	The distance between ground level and crown point *(the position of the first crown forming living or dead branch)* is defined as Bole Height.	1. Measure the bole height using hypsometer. 2. Record the bole height in meter to one decimal place. ***Note**: The measurement should be taken by standing on uphill side of the tree on a slope.*
14	Crown Length	The vertical measurement of crown from the tip of the crown to the point, half way between lowest green branch forming green crown all around and the lowest green branch on the bole is Crown Length.	1. Measure the crown length of tree using Hypsometer. 2. Record the crown length in meter to one decimal place. ***Note**: The measurement should be taken by standing on uphill side of the tree on a slope.*

15	Crown Position	This refers to the position of crown of a tree in relation to the adjacent trees. It is categorized as; a. **Dominant Trees**: Trees which form the upper most leaf canopy and have their leading shoots free. These trees are called best trees. b. **Dominated Trees**: Trees which do not form part of the upper most leaf canopy but leading shoots of which are definitely not over-topped by neighboring trees. Their height is about 3/4 of the tallest tree which falls within the plot. c. **Suppressed Trees**: Trees which reach only about 1/2 to 5/8 of the height of the best trees, with their shoots over-topped by the neighboring trees. d. **Solitary Trees**: Trees which stand scattered or stand individually.	Observe ocularly and select the appropriate category of crown position of tree from the drop-down list on electronic form or tick appropriately on paper form.
16	Condition of Tree	Refers to state of the tree. The condition of the tree will be categorized as: 1. **Healthy**: Tree is free of disease or abnormality and damage. 2. **Diseased**: Tree is infected with pests and diseases. 3. **Abnormal and Damaged**: Tree is	Observe and record the condition of tree by choosing the appropriate category from the drop-down option on the electronic form or tick appropriate category on paper form.

		moribund, damaged or hollowed, etc. 4. **Dead**: Dead standing tree	
17	Bark Thickness	Refers to thickness or amount of bark around a tree from outer surface till cambium/wood of a tree.	1. Measure the Bark thickness using Bark gauge. 2. Measure the bark thickness at DBH. 3. Press Bark gauge against bark until wood is reached and read the scale to determine bark thickness. 4. Record the bark thickness in centimeter to one decimal place.
18	Core Taken	Refers to whether or not the tree is cored. Tree Cores will be used for estimating the age of the tree and; also, to study and understand the growth of trees. If selected for coring, two cores will be taken from one tree. Coring technique is provided separately. Only one tree per diameter class will be cored. However, if a plot has less than 5 trees, all trees may be cored.	1. If the tree is selected for coring and the tree core is taken, record as "Yes" otherwise "No". 2. Segregate the trees into diameter-class of 10 cm interval (eg.10-20, 20-30…) 3. Select one tree each from each diameter class for coring. 4. Core the tree using increment borer. 5. Bring the core back to laboratory for analysis. ***Note**: Use of increment borer is provided separately.*
19	Total rings of core 1	Refers to the number of rings in the core 1	Count the number of rings and record accordingly.
20	Length of core 1	Refers to length of the core 1 taken.	Measure the length of core with ruler and record the length in centimeter (cm).
21	Total rings of core 2	Refers to the number of rings in the core 2	Count the number of rings and record accordingly.

22	Length of core 2	Refers to length of the core 2 taken.	Measure the length of core with ruler and record the length in centimeter (cm).
23	Remarks	Any useful remarks related to this particular tree.	Crews may or may not provide remarks. e.g all tree recorded in the plot are less than 30cm diameter, 20m height and it's a pure stand

***Note**: Not all trees falling within the plots will be cored. Only one tree per diameter class will be cored and diameter classes will be 10-20, 20-30 and so on.*

3.2 7 Sapling Data

All tree species having DBH 5 cm and more but less than 10 cm will be identified as Sapling. Sapling data will be collected from 12.62 m radius plot of all three plots (Elbow, North and East).

SN	Data Items	Description/Definition	Instructions
1	CP No.	This is the unique identification number given to Cluster Plot. Eg. CP0001	1. Select correct CP No. from the drop-down list on electronic field form or record the correct CP No., if the paper field form is used. ***Note**: Paper Field Forms are to be used only if the Android Tablet does not function in the field.*
2	Plot Name	Refers to one of the three plots (Elbow, East or North Plot) of cluster plot	Select and record correct Plot No. from the drop-down list on electronic field form or tick appropriate Plot No. if the paper field form is used.
4	Scientific Name	Refers to scientific or botanical name which conforms to the *International Code of Botanical Nomenclature (ICBN).*	1. Choose appropriate Botanical Name as it appears against it as drop-down list on electronic form. 2. If the name of the plant is not in the list, then provision for typing the botanical name is also provided.

			3. If Paper forms have been used, record accordingly. 4. Use tree list from Annexure VII .
5	Common Name/ Local Name	"Common name" herein is referred to the commonly used name of a tree in English. "Local name" means name of tree in local dialect. For NFI, the Local Names in following dialects will be used; Dzongkha (Dz), Tshanglha kha (Ts), Lhotsham (Lh), Bumthangp (Bum), Khengkha (Kh), Trongsap (Tr) and Kurtoep (Kr).	1. The Crew may note either the common name or the local name of the plant. 2. In case of local name, Crew must must specify dialect in which the local name has been given. (For *Quercus griffithii,* it is **Baenangshing** in **Tshanglha kha,** therefore, local name must be written as **Baenangshing (Ts)**, **Ts** indicates it is in **Tshanglha kha).**
6	Number of individuals	Refers to the number of saplings of that particular species found within a plot.	1. Count the number of saplings of one species and record the observation. ***Note**: If there are more than one species, open same electronic field form (electronic form) and fill it up as being done for first species.* 2. For paper field forms, write the species name and record the number accordingly.
7	Sapling average diameter at breast height (dbh)	Refers to average diameter at breast height of the saplings recorded in that particular plot	1. Measure diameter at breast height of all the saplings recorded in that particular plot and average them. 2. Record the average diameter in centimeter to one decimal place.

8	Layer height	Refers to the average height of sapling in meters	Record the average height of the sapling in meters
9	Cover percent	Refers to the percentage of the plot area that is covered by sapling.	Ocularly estimate as to the extent of coverage of sapling within 12.62 m plot and record it in terms of percentage.
10	Remarks	Any useful remarks related to the sapling	Crews may or may not provide remarks.

3.2.8 Shrub Data

Shrub is a single or multi-stem woody perennial plant, generally more than 0.5 m and less than 5 m high at maturity without a definite crown. For NFI, shrub data will be collected from all three 12.62 m plots; Elbow, North and East.

***Note**: Same data collection form will be used for all three plots*

SN	Data Items	Description	Instructions
1	CP No.	This is the unique identification number given to Cluster Plot. Eg. CP0001	1. Select correct CP No. from the drop-down list on electronic field form or record the correct CP No., if the paper field form is used. ***Note**: Paper Field Forms are to be used only if the Android Tablet does not function in the field.*
2	Plot Name	Refers to one of the three plots (Elbow, East or North Plot) of cluster plot	Select and record correct Plot No. from the drop-down list on electronic field form or tick appropriate Plot No. if the paper field form is used.
3	Scientific or botanical name	Refers to scientific or botanical name which conforms to the *International Code of Botanical Nomenclature (ICBN).*	1. Choose appropriate Botanical Name as it appears against it as drop-down list on electronic form. Refer Annexure VIII 2. If the name of the plant is not in the list, then provision for typing the

			botanical name is also provided. 3. If Paper forms have been used, record accordingly.
4	Common Name/ Local Name	"Common name" herein is referred to the commonly used name of a shrub in English. "Local name" refers to name of tree in local dialect.	1. The Crew can note either the common name or the local name of the plant. ***Note**: In case of local name, Crew must specify dialect in which the local name has been given. (For Berberis aristata, it is **Kerpa zoo** in **Tshanglha kha,** therefore, local name must be written as **Kerpa zoo (Ts)**, **Ts** indicates it is in **Tshanglha Kha)***
5	No. of individuals	No. of shrubs of parti-cular species	Count the number of individuals of particular species of shrub and record
6	Layer height	The average height of the shrub in meters	Record the average height of the shrub in meters
7	Cover percent	Cover percent of shrub within 12.62 m radius plot.	Ocularly estimate as to the extent of coverage of shrub within 12.62 m plot and record it in terms of percentage.
8	Remarks	Any useful remarks related to the shrubs	Crews may or may not provide remarks.

3.2.9 Herb Data

For NFI, Herb is any soft-stemmed plant with height equal to or less than 1 meter. The herb data will be collected from 1 m^2 plot (radius 0.57 m) which will be laid in North and East plots. NFI Crew must FIRST collect herb data (like regeneration data in Elbow plot) in North and East plots to avoid trampling of herbs.

SN	Data Items	Description	Instructions
1	CP No.	This is the unique identification number	1. Select correct CP No. from the drop-down list on

		given to Cluster Plot. Eg. CP0001	electronic field form or record the correct CP No, if the paper field form is used. ***Note**: Paper Field Forms are to be used only if the Android Tablet does not function in the field.*
2	Plot Name	Refers to one of the two plots (East or North Plot) of cluster plot	1. Select and record correct Plot No. from the drop-down list on electronic field form or tick appropriate Plot No. if the paper field form is used. 2. If paper field forms have been used, tick the relevant plot from the two options provided.
3	Scientific or botanical name	Refers to scientific or botanical name which conforms to the *International Code of Botanical Nomenclature (ICBN).*	1. Choose appropriate Botanical Name as it appears in drop-down list on electronic form. 2. If the name of the plant is not in the list, then provision for typing the botanical name is also provided. 3. If Paper forms have been used, record accordingly. Annexure IX
4	Common Name/ Local Name	"Common name" herein is referred to the commonly used name of herb in English. "Local name" means name of tree in local dialect. For NFI, the Local Names in following dialects will be used; Dzongkha (Dz), Tshanglha Kha (Ts), Lhotsham kha (Lh),	1. The Crew can note either the common name or the local name of the plant. In case of local name, Crew must specify dialect in which the local name has been given. (For *Houttuynia cordata,* it is **Mombaring** in **Tshanglha Kha,** therefore, local name must be written as **Mombaring (Ts)**, **Ts**

		Bumthangp (Bum), Khengkha (Kh), Trongsap (Tr) and Kurtoep (Kr).	indicates it is in **Tshanglha Kha)**
5	Number of individuals	Refers to number of individuals of a particular herb present in the subplot.	1. Count the number of individuals of a particular species of herb and record the number accordingly. 2. Likewise, record number of individuals of rest of the species of herb found in the subplot.
6	Cover percent	Refers to area of 0.57 m radius subplot, covered by herb	Ocularly estimate as to the extent of coverage of herb within 0.57 m plot and record it in terms of percentage.
7	Layer height	Refers to the average height of the herb in meters found within the subplot.	Record the average height of the herb in meters
8	Remarks		The Crew Leader or the data recorder may add any additional information on herbs found within the plot.

3.2.10 Wildlife Data

The National Forest Inventory will also collect some information on wildlife from the three Plots: Elbow, North and East Plot. Wildlife field forms will collect data on Mammals, Birds and Reptiles separately as described.

Mammal data:

SN	Data Item	Description	Instruction
1	CP No.	This is the unique identification number given to Cluster Plot. Eg. CP0001	1. Select correct CP No. from the drop-down list on electronic field form or record the correct CP No., if

			the paper field form is used. ***Note**: Paper Field Forms are to be used only if the Android Tablet does not function in the field.*
2	Plot name	Refers to one of the three plots (Elbow, East or North Plot) of cluster plot. Refer Annexure XIII for names of mammals of Bhutan	Select and record correct Plot No. from the drop-down list on electronic field form or tick appropriate Plot No. if the paper field form is used.
3	Mammal Sighting	Refers to whether or not mammal was sighted, either through direct or indirect evidence, within 25 m around from the PC.	Record "Yes" if mammal was sighted, else "No", from the drop-down list on electronic field form or tick appropriately on the paper field form.
4	Mammal sighted	Refers to identity of the particular mammal that has been sighted or identified. The list of mammals is provided in Annexure XIII	1. Select from the drop-down list and record the mammal sighted or identified from the evidence on electronic field form or write down on the paper field form. 2. Select "None" if no mammal is observed.
5	Species identity	Refers to the level of confidence on the identification of mammal by crew and can be categorized as: 1. **Certain**: when one is very sure that the identification is correct	Depending on the level of confidence on the identification, choose and record from the drop-down list on electronic field form or record on the paper field form.

		2. **Doubtful**: When one is not very confident about the identification 3. **Not relevant:** when no mammal is observed.	
6	Evidence Type	Refers to the type of evidence using which mammal is identified. The categories are: 1. Direct sighting 2. Sound/calls 3. Dung/Pellets/Scats 4. Skeleton/Cadaver 5. Horns/Antlers 6. Footprints/pugmarks 7. Tracks/Paths 8. Burrow/Den 9. Browsing 10. Debarking 11. Fraying 12. Digging 13. Not relevant	1. Select the appropriate evidence type and record. 2. **Not relevant** should be selected when there are no mammals sighted or observed in the 25 m radius.
7	Gender	Refers to the gender of the mammal sighted	1. If gender can be determined, record as determined. 2. If gender cannot be determined, then record as "Not known".
8	Group size	Refers to the number of individuals of the same species sighted or observed.	1. Record the number of individuals of same species sighted (as identified from direct sighting) 2. It may not be possible to determine the number from indirect evidences, so record as "approximate size".

9	Remarks	Refers to any other relevant information to be added by the crew.	The Crew Leader or the data recorder may add any additional information on mammal

Bird Data:

SN	Data Item	Description	Instruction
1	CP No.	This is the unique identification number given to Cluster Plot. Eg. CP0001	1. Select correct CP No. from the drop-down list on electronic field form or record the correct CP No., if the paper field form is used. ***Note**: Field Forms are to be used only if the Android Tablet does not function in the field.*
2	Plot name	Refers to one of the three plots (Elbow, East or North Plot) of cluster plot	Select and record correct Plot No. from the drop-down list on electronic field form or tick appropriate Plot No. if the paper field form is used.
3	Bird sighting	Refers to whether or not bird was sighted, either through direct or indirect evidence, within 25 m around from the PC.	Record "Yes" if bird was sighted, else "No", from the drop-down list on electronic field form or tick appropriately on the paper field form.
4	Bird sighted	Refers to identity of the particular bird that has been sighted or identified. The list of birds will be provided in Annexure XIV	1. Select from the drop-down list and record the bird sighted or identified from the evidence on electronic field form or write down on the paper field form. 2. Select "None" if no bird is observed.
5	Species identity	Refers to the level of confidence on	1. Depending on the level of confidence on the identification of bird,

		identification of bird by crew and can be categorized as: 1. **Certain**: when one is very sure that the identification is correct 2. **Doubtful**: When one is not very confident about the identification 3. **Not relevant**: When no birds have been sighted	choose and record from the drop-down list on electronic field form or record on the paper field form.
6	Evidence Type	Refers to the type of evidence using which the bird is identified. The categories are: 1. Direct sighting 2. Sound/calls 3. Droppings 4. Eggs 5. Skeleton/Cadaver 6. Feathers 7. Footprints 8. Tracks/Paths 9. Nests/Burrows 10. Not relevant	1. Select the appropriate evidence type based on which the bird has been identified and record. 2. "Not relevant" should be selected when there are no birds sighted or observed in the 25 m radius from the PC.
7	Gender	Refers to the gender of the bird sighted	1. If gender can be determined, record as determined. 2. If gender cannot be determined, then record as "Not known".
8	Group size	Refers to the number of individuals of the same species sighted or observed.	1. Record the number of individuals of same species sighted (as identified from direct sighting) 2. It may not be possible to determine the number from indirect evidences, so record "approximate size".

9	Remarks	Refers to any relevant information on bird that crew provides.	The Crew Leader or the data recorder shall add any additional information on birds.

Reptile Data:

SN	Data Item	Description	Instruction
1	CP No.	This is the unique identification number given to Cluster Plot. Eg. CP0001	1. Select correct CP No. from the drop-down list on electronic field form or record the correct CP No., if the paper field form is used. ***Note**: Paper Field Forms are to be used only if the Android Tablet does not function in the field.*
2	Plot name	Refers to one of the three plots (Elbow, East or North Plot) of cluster plot	Select and record correct Plot No. from the drop-down list on electronic field form or tick appropriate Plot No. if the paper field form is used.
3	Reptiles sighting	Refers to whether or not reptile was sighted, either through direct or indirect evidence, within 25 m around from the PC.	Record "Yes" if bird was sighted, else "No", from the drop-down list on electronic field form or tick appropriately on the paper field form.
4	Reptiles sighted	Refers to identity of the particular bird that has been sighted or identified. The list of reptiles will be provided in Annexure XV.	1. Select and record the reptile from the drop-down list on electronic field form or record on the paper field form. 2. Select "None" if no reptile is observed.

5	Species identity	Refers to the level of confidence on the identification of reptiles by the crew and can be categorized as: 1. Certain: when one is very sure that the identification is correct 2. Doubtful: When one is not very confident about the identification 3. Not relevant	1. Depending on the level of confidence on identification, choose and record from the drop-down list on electronic field form or record on paper field form.
6	Evidence Type	Refers to the type of evidence using which the reptile is identified. The categories are: 1. Direct sighting 2. Sound/calls 3. Dung 4. Skin 5. Skeleton/Cadaver 6. Footprints/pugmarks 7. Tracks/Paths 8. Burrow 9. Den 10. Not relevant	1. Select the appropriate evidence type and record by selecting from the drop-down list on electronic field form or selecting relevant evidence type on paper field form. 2. "Not relevant" should be selected when there are no reptiles sighted or observed within the 25 m radius.
7	Gender	Refers to the gender of the reptile sighted.	1. If gender can be determined, record as determined. 2. If gender cannot be determined, then record as "Not known".
8	Group size	Refers to the number of individuals of the same species sighted or observed.	1. Record the number of individuals of same species sighted (as identified from direct sighting) 2. It may not be possible to determine the number from indirect evidences, so record "approximate" size

9	Remarks	Refers to any other relevant information provided by crew.	The Crew Leader or the data recorder shall add any additional information on reptiles

3.2.11 Coarse Woody Debris Data

Once the work (data collection) is completed in Elbow Plot, the Crew will move to North Plot making a transect of 50 m to collect data from North Plot. Similarly, upon completion of the data collection in the North Plot, the Crew will move back to Elbow Plot and from the Elbow Plot make a 50 m transect to East Plot. Coarse Woody Debris data will be collected from these two 50 m transects (Elbow to North and Elbow to East).

All down and dead tree bole, large branches and other woody pieces that are severed from their original source of growth will be considered as Coarse Woody Debris (CWD). **CWD will not include standing dead trees, stumps, separated barks, non woody pieces, roots or the part of the bole below the root collar** (Waddell, 2002). Woody debris of more than 10 cm diameter at the point of intersection with transect will be sampled. Not all CWD will be measured but only those, which meet the following criteria will be tallied for measurement:

a. The central longitudinal axis of CWD must intersect with transect
b. Must have minimum 10 cm diameter at point of intersect with transect
c. Piece length is at least 1m or greater.
d. Piece is not decayed to the point of having no structural integrity

If a woody debris of 10 cm minimum diameter is found along the transect but does not intersect with the transect, the CWD will be ignored. Any CWD less than 1 m will also be ignored even if it intersects the transect (Refer to Figure 6)[1]

In case of CWD, where the main bole as well as the branches intersect with the transect and if the intersecting segments has more than 10 cm at the point of intersection, then the segments will be considered as separate pieces (Refer to Figure 7)

1. [1] Illustration source: Waddell, Karen L. (2002), *Sampling coarse woody debris for multiple attributes inextensive resource inventories, Ecological Indicators*

In case of forked trees, the forked segment with largest diameter will be considered as the main bole and therefore the length will be measured from tip of the fork to the end of the log. For the smaller segment (having smaller diameter), it will be recorded as the second piece and the length will be measured from the fork tip to the point where this piece separates as a fork.

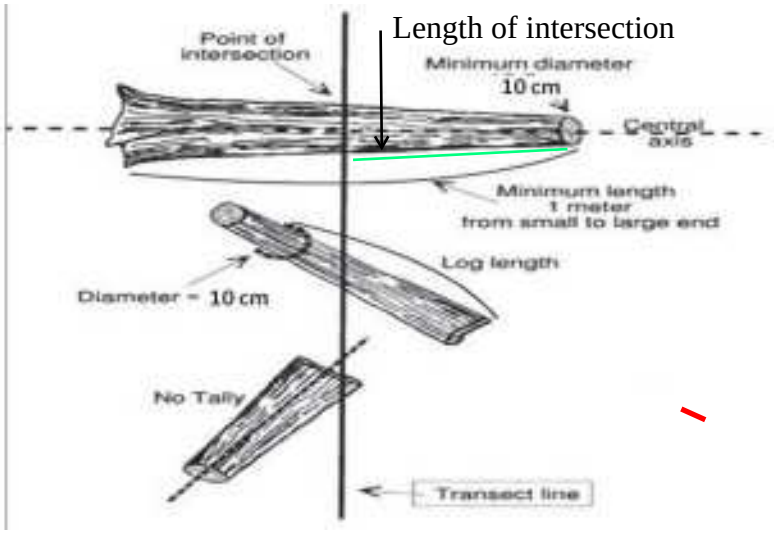


Figure 6: Conditions for tally of CWD for measurement

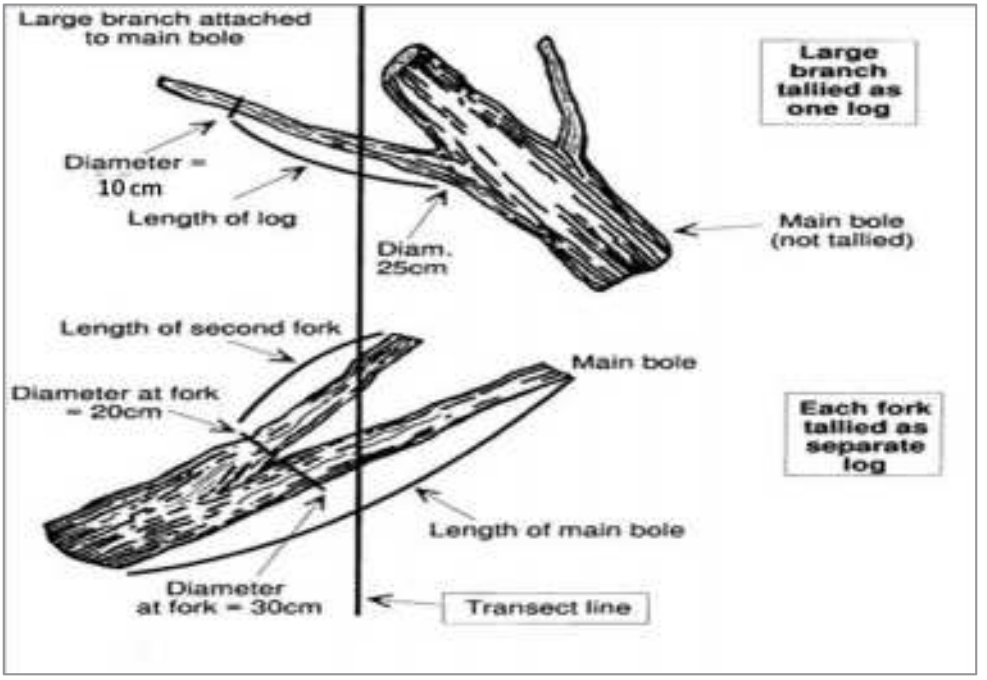


Figure 7: Measurement of forked and branched CWD

For every tallied CWD piece and segments, the following data and measurements will be recorded:

SN	Data Item	Description	Instruction
1.	CP No.	This is the unique identification number given to Cluster Plot. Eg. CP0001	1. Select correct CP No. from the drop-down list on electronic field form or record the correct CP No., if the paper field form is used. ***Note**: Paper Field Forms are to be used only if the Android Tablet does not function in the field.*
2.	Plot Name	Refers to one of the two plots (East or North Plot) of cluster plot to which transect is moving.	Select and record correct Plot No. from the drop-down list on electronic field form or tick appropriate Plot No. if the paper field form is used.
3.	CWD Scientific or Botanical name	Refers to scientific or botanical name which conforms to the *International Code of Botanical Nomenclature (ICBN)*	1. If the CWD can be identified, record the botanical name of the tallied piece or else record it by common name or local name. 2. List of botanical names will appear as drop-down list on electronic field form. But on the paper field form, record manually.
4.	Diameter large end	Refers to the diameter of the CWD at large end.	Record the diameter of large end in centimeters to nearest one decimal place.
5.	Diameter intersection	Refers to the diameter of the CWD at point of intersection with transect.	Record the diameter of CWD at the point of intersection in centimeters to nearest one decimal place.
6.	Diameter small end	Refers to the diameter of the CWD at small end.	Record the diameter of small end of CWD in centimeters to nearest one decimal place.

7.	Length of intersection	Refers to the length of CWD from the small end side to the point of intersection	Record the length in meters to nearest one decimal place
8	CWD length	Refers to the total length of the CWD	Record the length in meters to nearest one decimal place.
9	CWD width	Refers to the perpendicular distance covered by the CWD to the transect. Refer Figure 8 for guidance.	Record the width of CWD in meters to nearest one decimal place.
10	Decay Class	Refers to the stage of decay of dead fallen wood	Record the class 1 to 5 from the drop menu based on the definitions provided below.

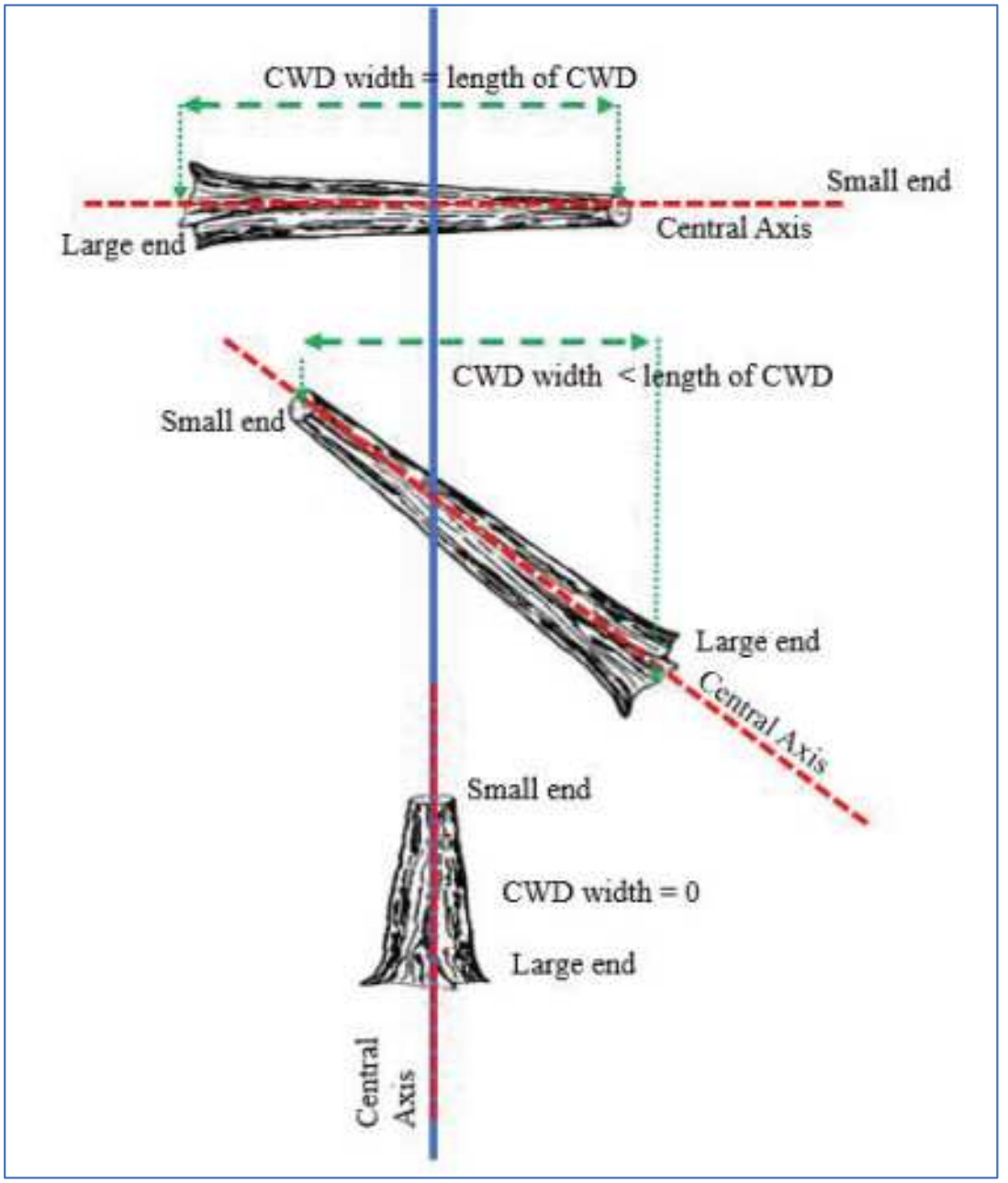


Figure 8: Measuring the width of CWD

Guidelines for decay class

Decay Class	Structural integrity	Texture	Color of Wood	Presence of Invading Roots	Branches
1	Sound, freshly fallen, intact logs	Intact, no rots, conks of stem decay absent	Original color	Absent	If branches are present, fine twigs are still attached and have tight bark
2	Sound	Mostly intact, sapwood partly soft (starting to decay) but can't be pulled apart by hand	Original color	Absent	If branches are present, many fine twigs are gone and reamining fine twigs have peeling bark
3	Heartwood sound, piece supports its own weight	Hard. Large pieces, sapwood can be pulled apart by hand or sapwood absent	Reddish brown or original color	Sapwood only	Branch stubs will not pull out
4	Heart wood rotten, piece does not support its own weight, but maintains its shape	Soft, small blocky pieces, a metal pin can be pushed into heartwood	Reddish or light brown	Throughout	Branch stubs will pull out
5	None, piece no longer maintains its shape, it spreads out on ground	Soft, powdery when dry	Red-brown to dark brown	Throughout	Branch stubs and pitch pockets have usually rotted down

Chapter 4: Fine Woody Debris Sampling

Fine Woody Debris (FWD) is defined here as those woody litters comprising the down and dead tree bole, branches and other woody pieces severed from original source of growth; and has diameter of 1 cm -10 cm. FWD data will be collected only if FWD intersects two 4 m transects located within the Elbow plot at each cluster site.

4.1 Design of Transact

Two transects of 4 m is laid at the outer ends of the two 12.62 m radius of the Elbow plot of NFI.

4.2 Data Recording

1. Lay two 4 m transects, located towards outer end of Elbow plot (as depicted in Figure 9).
2. Record the botanical name of FWD encountered along the transect if possible.
3. Whether or not FWD data will be collected is defined by diameter at intersection, wherein the diameter of FWD at intersection must be less than 10 cm to be considered FWD.
4. Follow the protocols for measurement of diameter of large end, diameter of intersection and diameter at small end; and length of intersection and total length of fine woody debris, as defined for Coarse Woody Debris (CWD).
5. Also measure width of FWD as in case of CWD.

Note: Cones, bark, wood fragments are not included typically in FWD.

SN	Data Item	Description	Instruction
1.	CP No.	This is the unique identification number given to Cluster Plot. Eg. CP0001	1. Select correct CP No. from the drop-down list on electronic field form or record the correct CP No., if the paper field form is used. ***Note**: Paper Field Forms are to be used only if the Android Tablet does not function in the field.*

2.	Plot Name	Refers to one of the two plots (East or North Plot) of cluster plot to which transect is moving.	Select and record correct Plot No. from the drop-down list on electronic field form or tick appropriate Plot No. if the paper field form is used.
3.	FWD Scientific or Botanical name	Refers to scientific or botanical name which conforms to the *International Code of Botanical Nomenclature (ICBN)*	1. If the FWD can be identified, record the botanical name of the tallied piece or else record it by common name or local name. 2. List of botanical names will appear as drop-down list on electronic field form. But on the paper field form, record manually.
4.	Diameter large end	Refers to the diameter of the FWD at large end.	Record the diameter of large end in centimeters to nearest one decimal place.
5.	Diameter intersection	Refers to the diameter of the FWD at point of intersection with transect.	Record the diameter of FWD at the point of intersection in centimeters to nearest one decimal place.
6.	Diameter small end	Refers to the diameter of the FWD at small end.	Record the diameter of small end of FWD in centimeters to nearest one decimal place.
7.	Length of intersection	Refers to the length of FWD from the small end side to the point of intersection	Record the length in meters to nearest one decimal place
8	FWD length	Refers to the total length of the FWD	Record the length in meters to nearest one decimal place.
9	FWD width	Refers to the perpendicular distance covered by the FWD to the transect.	Record the width of FWD in meters to nearest one decimal place.

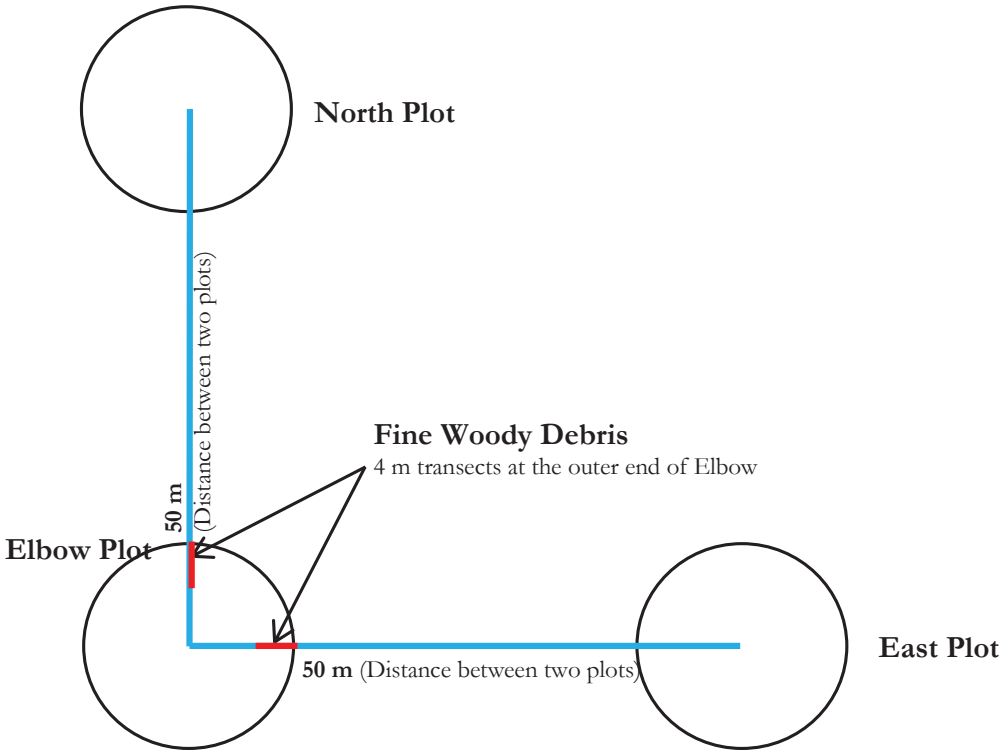


Figure 9: Fine woody debris transect

Chapter 5: Aboveground Shrub, Herb, Litter and Soil Carbon Sampling

Data and samples of Shrubs, Herbs, Organic Surface Litters and Soil shall be collected for the laboratory analysis of carbon content following the methodology developed and adopted during the first NFI. The step-by-step instructions to collect the data and samples is detailed out in the subsequent chapters.

5.1 General Equipment and Supplies

Following are some of the general equipment and supplies required for the field work;

1. Global Positioning System (GPS) - for locating NFI plot and collecting data
2. Compass - for direction
3. Clinometer - for slope assessment
4. 50-meter measuring tape - for distance measurement
5. Knife - for multipurpose use

Equipment specific to each carbon pool are listed separately in the relevant chapters.

***Note**: The Field crews may suggest and add equipment as needed to improve efficiency of the field work.*

5.3 Plot Design for Shrub, Herb, Litter and Soil Carbon

The carbon plots will be laid 20 meters south-west of Elbow plot of NFI (as depicted in Figure 10 & 11). The plots will be positioned so as to minimize any disturbance from sampling done in this plot that may affect any future tree growth in North, East and Elbow overstorey plots in each cluster site.

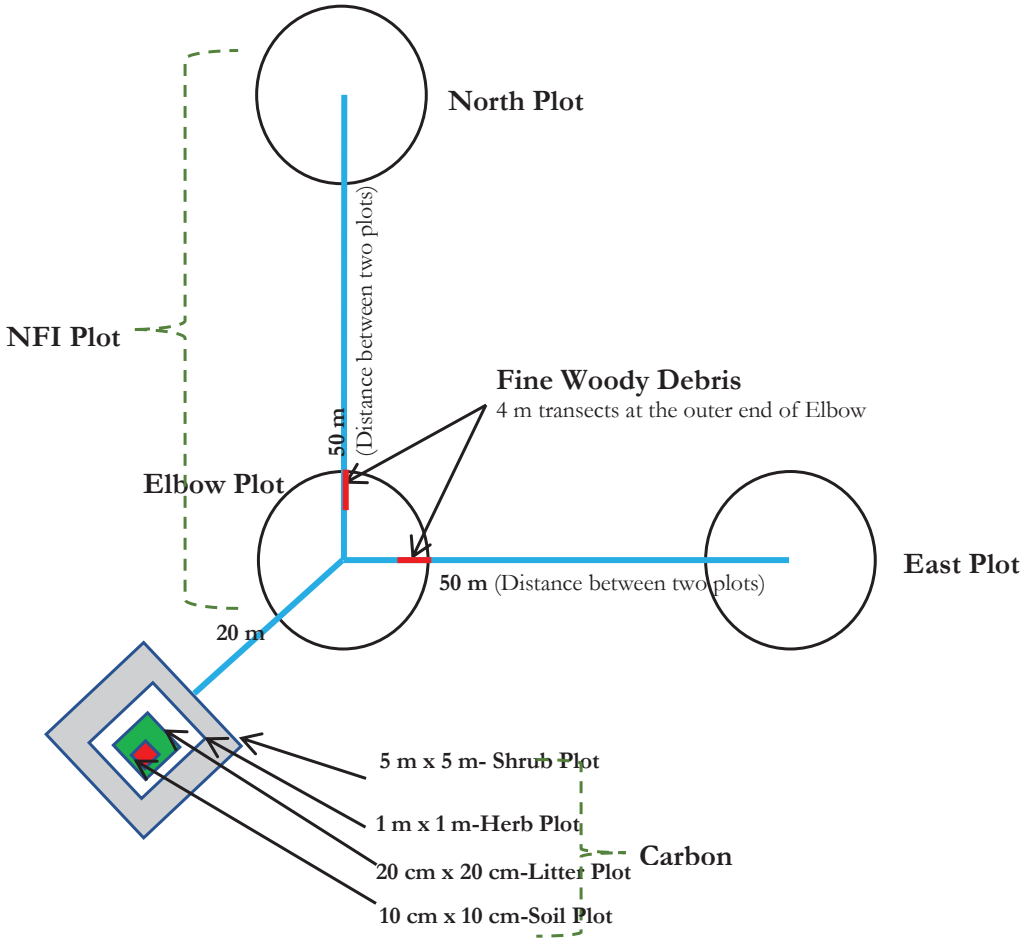


Figure 10: Schematic arrangement of the plost for assessment of carbon stock

A 5 m x 5 m plot will be laid 20 m away towards the South-west of plot centre of the Elbow plot to collect data and samples for shrubs. Subsequently, a 1 m x 1 m plot will randomly be laid within 5 m x 5 m shrub plot to collect samples and data for Herbs.

The surface organic litter data and samples will be collected from 20 cm x 20 cm plot which will be randomly placed within herb plot. Once the surface organic litter sample is collected, the same plot will be used for collecting soil sample. Soil samples will be collected by excavation method up to a depth of 30 cm pit using 10 cm x 10 cm x 10 cm soil frame.

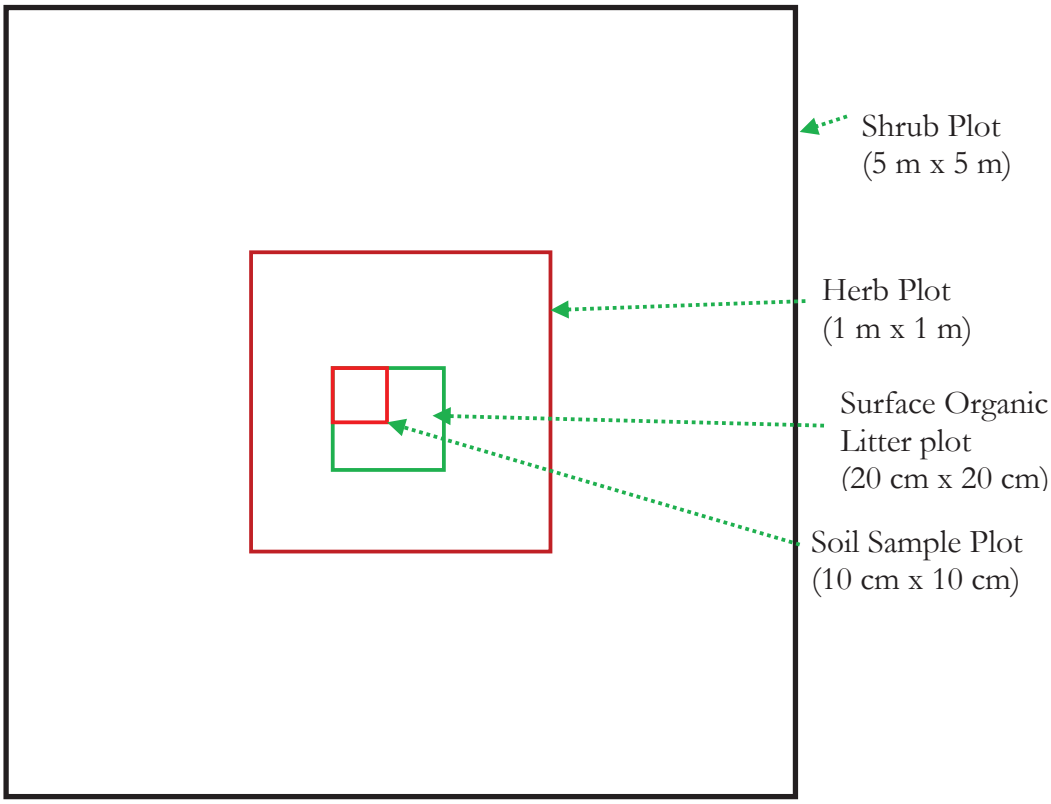


Figure 11: Plot Desigin for shrub, herb, litter and soil sampling

Chapter 6: Shrub Sampling

6.1 Equipment and Supplies

The equipment and supplies needed for sampling shrubs in the field are:

1. Weighing balance-for weighing shrub samples
2. Pruning shears- for cutting shrubs
3. Rite-in-Rain notebooks- for recording data
4. Calipers- for measuring tree seedling diameters
5. Labeling pens - for labelling samples
6. 0.5 Mechanical pencils- for recording data
7. Flagging Tapes- for demarcating boundaries
8. Tarpaulin with grommet- for collecting and weighing samples
9. Stitched Muslin bags (40 cm x 60 cm)- for transporting shrub samples
10. Polyester bags- for transporting samples
11. Ropes- for tying and weighing the tarpaulin containing samples and for suspending a scale from the rope to weigh larger masses, as may be necessary.

6.2 Sample Plot Design

Lay a 5 m x 5 m Shrub plot 20 m South-West from Elbow plot center of NFI Cluster plot (Azimuth of 225º).

- Locate the NFI Elbow plot center using Global Positioning System (GPS).
- Move 20 meters away towards South -West direction from elbow plot center at 225º azimuth and mark the point with stick.
- Take fore bearing and back bearing of 315º NW and 135º SE respectively to establish a 5 m x 5 m dimension plot. Move 2.5 m in both directions and demarcate plot boundary with flagging tapes.
- Then, move 5 meters away towards South -West direction from both the end/plot boundary at 225º azimuth and demarcate plot boundary with flagging tapes.
- Use compass for direction, clinometer for slope correction and measuring tape for to measure distance.

6.3 Shrub Sample

1. Shrub is a single or multi-stem woody perennial plant, generally more than 0.5 m and less than 5 m high at maturity without a definite crown.

2. Any tree species of diameter less than 5 cm present in the 5 m x 5 m shrub plot will be sampled as shrubs.

6.4 Data Collection

a. Sampling

1. Once plot is established, record the following general information in the field form (either paper field form or electronic field form):

No	Data items	Description/Definition	Instruction
1	CP No.	Refers to unique identification number given to Cluster Plot. Eg. CP0001	1. Select correct CP No. from dropdown list (in electronic form). 2. If paper form is used, record the correct CP No.
2	Dzongkhag	Refers to name of the Dzongkhag in which the cluster plot is located.	1. Select correct name of the Dzongkhag from dropdown list (in electronic form). 2. If paper form is used, record the correct name of the Dzongkhag.
3	Gewog	Refers to name of the Gewog in which the cluster plot is located.	1. Select correct name of the Gewog from dropdown list (in electronic form). 2. If paper form is used, record the correct name of the Geog.
4	Crew Leader	Refers to name of the Leader of crew collecting the data.	1. Select correct name of the Crew Leader from dropdown list (in electronic form). 2. If paper form is used, record the correct name of the Crew Leader.
5	Date of Collection	Refers to the date on which data is collected.	Record the date

6	Scientific or Botanical name	Refers to the scientific name of the shrub which conforms to the *International Code of Botanical Nomenclature* (ICBN)	Identify and record the botanical name of the shrub species observed within the 5 m x 5 m plot.
7	Cover percent	Refers to percentage of plot area (5 m x 5 m) covered by shrub.	1. Ocularly estimate the extent of coverage of shrub within 5 m x 5 m plot and express it in terms of percentage. 2. Record the percentage figure.
8	Shrub height	Refers to the predominant height of the shrub in the plot	1. Measure the height of the shrubs and record predominant height as shrub height. 2. Record the shrub height in meters.

***Note**: The recording of information on species, cover percent and height will be repeated for all shrub species found within the plot. This is important for site characterization. Unknown species may be indicated as "Unknown 1", "Unknown 2", etc. However, for NFI field work, the steps 6 through 8 in the table above will not be followed, since shrubs diversity and cover percent information have been collected in Shrub Form. Instead, crew will collect shrub samples as follows.*

2. After filling the data form above, harvest all the shrubs at ground level (causing minimal damage to herbs and litter) falling within the 5 m x 5 m plot. Whether or not the shrub falls IN or OUT of the plot is determined by position of the base or root of the plant, i.e., if the base of the plant is inside the 5 m x 5 m plot boundary, it is considered IN, but if the base is outside the plot boundary, it is considered OUT even if shrub is partially or fully leaning inside the plot boundary.
3. Place all the harvested shrubs in a tarpaulin or a bag of known weight (or tie together by rope).
4. Weigh the collected samples (making sure that mass of tarpaulins or bags or ropes are accounted for).

5. Record the wet weight of the collected shrubs in kilograms (kg) to one decimal place.
6. If the total wet weight of the shrub sample weighs **equal to or less than 2 kilograms**, bring the entire shrub sample back to the laboratory for analysis. Then record the percentage of samples taken as **100%.**

Data Items	Description	Instruction
Total wet weight of the shrub sample	This refers to the gross wet weight of the shrub sample being collected from 5 m x 5 m plot.	1. Weigh the entire shrub sample 2. Subtract the weights of tarpaulin or rope or bags, used for measuring shrub sample. 3. Record the wet weight in kilograms (kg) to nearest one decimal place. 4. Example: 2.5 Kilograms (kgs)

If the wet shrub sample weighs **more than 2 kilograms**, then subsample the shrub. However, minimum weight of the shrub sample must be **2 kilograms** and then accordingly record the percentage of subsample taken from total shrub sample. For instance, if the total wet weight of shrub is 8 kilograms, a minimum of 2 kilograms of shrub sample is required to be brought to laboratory for analysis. Here, the percentage of shrub sample being subsampled is 25%. That is

Total wet weight of shrub sample	=	8 kgs
Minimum weight of subsample	=	2 kgs
Therefore, per cent subsampled	=	(2/8) x 100 = 25%

b. Subsampling

For subsampling, follow the protocols mentioned below;

1. Remove a representative subsample from harvested shrub sample (that represents the various plant tissues in that sample in an approximate weight-proportional manner). That is, if shrub species A, B and C exist in about 60, 30, and 10 % biomass or volume ratios; then take subsample of 60% of A (including stems, branches and leaves of A),

30 % of B (including stems, branches and leaves of B), and 10% of C (including stems, branches and leaves of C) of the shrub samples. However, in a highly productive site, even this might be too large a subsample to be brought back to laboratory. In that case, further subsampling is recommended. Then take 6% of A, 3% of B and 1% of C of subsample in weight-proportional manner.

2. Weigh the subsample (making sure that mass of tarpaulins or bags or ropes are accounted for).
3. Record the wet weight of the subsample in the field form.

Data Items	Descriptions/Definition	Instructions
Weight of Subsample of shrubs	Refers to the wet weight of the subsample.	1. Weigh the subsampled samples 2. Record the weight of the subsample in kilogram (kg) to nearest one decimal place.
Percentage of Subsample	Refers to the percentage of subsamples taken from the total gross wet weight of the samples.	Record the percentage of subsample taken

c. Labeling and bagging

1. Carefully, bag the Subsample of shrubs in muslin bag of 40 cm x 60 cm dimension.
2. It is very important to ensure that the bagged samples are labeled properly and correctly.
   For shrubs, follow this standard labeling format: SHRUBS_CPNo. (eg. SHRUBS_CP0001). CPNo. stands for the four-digit cluster plot number unique for each cluster plot of NFI.
3. Additional information stating the date of collection and Collector's ID may be added on the label.
4. Then bag the subsample of shrubs contained in muslin bag, in the polyester sack(s).
5. The polyester sack(s) should have CPNo, Date, and Crew ID.

d. Transfer and processing of samples

1. Carry the bagged samples to the base camp and store in cool dry tent or a place till it is possible to hand over the sample for laboratory analysis.
2. This representative sample will then be oven dried in the laboratory and moisture determined to calculate dry mass per area of total shrub wet weight found in that 5 m x 5 m shrub plot.

Chapter 7: Herb Sampling

7.1 Equipment and Supplies

The following equipment and supplies are required for sampling herbs;

1. Weighing balance-for weighing herb samples
2. Pruning shears- for cutting herbs
3. Rite-in-Rain notebooks – for recording data
4. Labeling pens – for labelling samples
5. 0.5 Mechanical pencils- for recording data
6. Flagging Tapes- for demarcating boundaries
7. Tarpaulin with grommet- for collecting and weighing samples
8. Stitched Muslin bags (30 cm x 40 cm)- for transporting herb samples
9. Polyester bags- for transporting samples
10. Ropes- for tying and weighing the tarpaulin containing samples and for suspending a scale from the rope to weigh larger masses, as may be necessary.

7.2 Sample Plot Design

Lay a 1 m x 1 m Herb plot *randomly* within the 5 m x 5 m shrub plot.

1. After collecting shrubs samples, *randomly*, lay a 1 m x 1 m plot within shrub plot. However, it should be laid in such a way that it is *representative* of entire 5 m x 5 m plot.
2. Correct the slope with slope correction table given in Annexure II.
3. Demarcate the plot boundary with flagging tape.

7.3 Herb Sample

1. Herb is any soft-stem plant with height equal to or less than 1 m.

7.4 Data Collection

a. Sampling

1. Once the herb plot is established, record the following general information in the field form (either paper field form or electronic field form):

No	Data items	Description	Instruction
1	CP No.	Refers to unique identification number	1. Select correct CP No. from dropdown list (in electronic form).

		given to the Cluster Plot. Example: CP0001	2. If paper form is used, record the correct CPNo.
2	Dzongkhag	Name of the Dzongkhag in which the cluster plot is located.	1. Select correct name of the Dzongkhag from dropdown list (in electronic form). 2. If paper form is used, record the correct name of the Dzongkhag.
3	Gewog	Name of the Gewog in which the cluster plot is located.	1. Select correct name of the Gewog from dropdown list (in electronic form). 2. If paper form is used, record the correct name of the Gewog.
4	Crew Leader	Name of the Leader of crew collecting the data.	Record name of Crew Leader.
5	Date of Collection	Refers to the date on which data is collected.	Record the date.
6	Scientific or botanical name	Refers to the scientific name of the Herb which conforms to the *International Code of Botanical Nomenclature* (ICBN)	Identify and record the botanical name of the Herb species observed within the 1 m x 1 m plot
7	Cover percent	Refers to percentage of plot area (1 m x 1 m) covered by Herb.	Occularly estimate the extent of coverage of Herb within 1 m x 1 m plot and express it in terms of percentage.
8	Herb height	Refers to the predominant height of the Herb in the plot	Measure the height of the Herbs and record predominant height in meters to one decimal place.

***NOTE**: The recording of information on species, cover percent and height will be repeated for all major herb species found within the plot. This is important for site characterization. Unknown species may be indicated as "Unknown 1", "Unknown 2" etc. For herbs too, steps 6 through 8 in the table above will not be followed for NFI field work. Instead, crew will collect the herb samples as follows.*

2. Then clip all grasses and herbs to ground level (causing least disturbance and compaction to the surface litter or the soil as they will also need to be sampled).
3. Place the clipped samples in a tarpaulin or a bag of known weight (or tie with ropes).
4. Weigh the herb sample (making sure that mass of tarpaulins or bags or ropes are accounted for).
5. Record the wet weight of the clipped herbs in kilograms (kg) closest to two decimal points.

No	Data Items	Description	Instruction
1	Total wet weight of the Herb sample	This refers to the gross wet weight of the Herb sample being collected from 1 m x 1 m plot.	1. Weigh the entire Herb sample 2. Subtract the weights of tarpaulin or rope or bags, used for measuring Herb sample. 3. Record the wet weight in kilograms (kg) to nearest one decimal places. 4. Example: 2.5 Kilograms (kgs)

***Note**: Identification of herbs may be useful in the future to determine any species ranges shifts due to climatic variability and change which may have management implications down the road as forested ecosystem components change.*

b. Subsampling

1. If herb sample from the 1 m x 1m is small and can be brought in its entirety, bring the entire sample to laboratory.
2. Then record the wet weight of the entire sample and also record the percentage of sample taken as "100%".

But, if the sample is too large logistically (**more than 2 kilograms**) to transport to the laboratory, then large herb sample should be subsampled;

1. Remove representative herb tissues (subsample) from the total herb sample.
2. Place the subsample in a tarpaulin or bag of known weights (or tie with ropes).
3. Weigh the subsample (making sure that mass of tarpaulins or bags or ropes are accounted for).
4. Record wet weight in kilograms closest to two decimal points.
5. Bag the subsample for transport.

No	Data Items	Descriptions/Definition	Instructions
1	Weight of Subsample of herb	Refers to the wet weight of the subsample.	1. Weigh the subsampled samples 2. Record the weight of the subsample in kilogram (kg) to nearest one decimal places.
2	Percentage of Subsample	Refers to the percentage of subsamples taken from the total gross wet weight of the samples.	Record the percentage of subsample taken

***Note**: Generally, for Herb, it is expected that subsampling may not be required because in most sites, the weight of the herb samples will not exceed 2 kilograms. If at all there is need for subsampling, the percentage of subsample taken must be clearly reflected.*

c. Labeling and bagging

1. Carefully, bag the subsample of herbs in muslin bag (30 cm x 40 cm)
2. It is very important to ensure that the bagged samples are labeled properly and correctly.

   For herbs, follow this standard labeling format: HERBS_CPNo. (eg. HERBS_CP0001). CPNo. stands for the four-digit cluster plot number unique for each cluster plot of NFI.
3. Additional information stating the date of collection and Collector's ID may be added on the label.
4. Then bag the subsample of herbs contained in muslin bag, in the polyester sack.
5. The polyester sack should have CP No., Date, and Crew ID.

d. Transfer and processing of samples

1. Carry the bagged samples to the base camp and store in cool dry tent or place till it is possible to hand over the sample for laboratory analysis.
2. This representative sample will then be oven dried in the laboratory and moisture determined to calculate dry mass per area of total wet weight of herbs found in that 1 m x 1 m herb plot.

Chapter 8: Litter Sampling

8.1 Equipment and supplies

The following equipment and supplies are necessary for surface organic litter sample collection, namely;

1. 20 cm by 20 cm steel frame- for demarcating plot
2. Ziploc bag- for collecting litter sample
3. Tray-for collecting litter sample
4. Small trowel - for collecting litter sample
5. Pruning shears - for cutting through smaller roots
6. Saw-for cutting bigger roots
7. Battery operated digital balance - for weighing samples
8. Indelible ink markers- for marking the litter samples
9. Polyester sacks- for transporting the litter samples

8.2 Sample Plot Design

1. Randomly lay a 20 cm x 20 cm plot within 1 m x 1 m herb plot for collecting soil and litter samples.
2. Once herb sampling is completed, carefully place the frame within 1 m x 1 m plot that is representative of whole area.

8.3 Organic Litter Sample

1. For the purpose of carbon assessment (in this manual), the surface organic litter is defined as surficial organic detritus having diameter less than 1 centimeter, which are un-decomposed or partially decomposed that can be readily identified as plant leaves, twigs, etc.

8.4 Litter Sampling and Data Recording

a. Sampling

1. Carefully place 20 cm x 20 cm frame randomly within 1 m x 1 m herb plot.
2. Press and drive down the frame manually until it drives in about 2-3 cm depth. Do not compress the organic sample being extracted or the surrounding organic material until an uncompressed depth (*i.e an average of 4 depths of litter measured, one on each side of the square sampling area from top of litter down to the top of mineral soil ensuring no organics are left on the mineral soil surface*) is measured.

3. Collect the entire surface litter sample in a volumetric procedure so that both mass and volume can be determined from the sample collected.
4. Using inward scooping motions, carefully remove the entire litter within the confines of the sampling frame. Discard all woody debris including pine cones, large pieces of bark and wood greater than 1 cm in diameter and also discard any rocks or pebbles encountered.
5. Once all litters are completely collected, measure the depth of litter. Record the readings in centimeter (cm) to **nearest two decimal places.**

No	Data Items	Descriptions/Definition	Instructions
1	CP No.	Refers to the unique identification number given to the Cluster Plot. Example: CP0001	1. Select correct CP No. from dropdown list (in electronic form). 2. If paper form is used, record the correct CP No.
2	Dzongkhag	Name of the Dzongkhag in which the cluster plot falls.	1. Select correct name of the Dzongkhag from drop-down list (in electronic form). 2. If paper form is used, record the correct name of the Dzongkhag.
3	Gewog	Name of the Gewog in which the cluster plot is located.	1. Select correct name of the Gewog from dropdown list (in electronic form). 2. If paper form is used, record the correct name of the Geog.
4	Crew Leader	Name of the Leader of crew collecting the data.	Record name of Crew Leader.
5	Date of Collection	Refers to the date on which data is collected.	Record the date.
6	Depth of Litter	Refers to the distance between the surface of the surficial organic	1. Starting from one side of the frame, using scale, measure from top of litter down to the top of

		litter and the top of the mineral soil.	mineral soil ensuring no organics are left on the mineral soil surface. 2. Similarly, repeat from the remaining three sides. 3. Take average of four readings. 4. Record the average reading to nearest one decimals place in centimeter. This is the depth of litter.

b. Labeling and bagging

1. Carefully, bag the litter sample in ziploc bag.
2. It is very important to ensure that the bagged samples are labeled properly and correctly.

   For litter, follow this standard labeling format: LITTER_CPNo. (eg. LITTER_CP0001). CPNo. stands for the four-digit cluster plot number unique for each cluster plot.
3. Additional information stating the date of collection and Collector's ID may be added on the label.
4. Then put the ziploc bag with litter sample in the polyester sack containing shrubs and herbs samples.
5. Polyester sack(s) should have CP No., Date, and Crew ID.

***Note**: This sample does not need to be weighed in the field as the whole sample will be oven-dried for mass determination in laboratory by area and depth.*

Mineral soil samples are collected for 0-10 cm, 10-20 cm and 20-30 cm depths of soil pit using 10 cm x 10 cm dimension sampling frame.

Chapter 9: Mineral Soil Sampling

9.1 Mineral Soil Horizon (for 0-10 cm, 10-20 cm and 20-30 cm depths)

The soil samples are collected from 10 cm x 10 cm soil sampling frame for Bulk Density and Soil Carbon content analysis.

9.2 Equipment and Supplies

The following equipment and supplies are necessary for soil sampling, namely;

1. 10 cm by 10 cm steel frame- for soil sampling
2. Small trowel- for collecting soil sample
3. Tray-for collecting soil sample
4. Pruning shears- for cutting through smaller roots
5. Saw- for cutting through bigger roots
6. Battery operated digital balance- for weighing soil samples

9.3 Sample Plot Design

Place 10 cm x 10 cm steel frame within the 20 cm x 20 cm frame laid for surface litter carbon determination. The soil sampling has to be done only after surface organic litter is completely collected.

- ✓ Place 10 cm x 10 cm frame in the north-west quadrant of the 20 cm x 20 cm frame.

  ***Cautionary Note**: However, if the plot falls on a rock or stream or water, then shift the plot but within 20 cm x 20 cm frame and collect the samples.*
- ✓ Carefully drive the frame about 2-3 cm depth manually.

9.4 Soil Sampling and Data Recording

a. Sampling

1. Ensure that surface organic litter is collected completely.
2. Using inward scooping motion, carefully excavate soil with the help of a small trowel.
3. Excavation is done in a volumetric procedure, up to 10 cm depth. Do not throw away rocks if encountered.

   For rocky, sandy and/or wet soils, follow instruction as defined in **9.5 Working with Problem Soils.**
4. For plot falling in steep terrain, measure 10 cm depth from the center of the plot. The readings on uphill side will be slightly greater than 10

cm whereas the reading for downhill side will be slightly less than 10 cm but average should be 10 cm.

5. Cut the overlapping roots encountered, using pruning shear or saw from inner surface of the frame.
6. Every scooped soil should be put in the tray
7. Divide the excavated sample into two halves; one for Bulk Density (BD) and other for soil Carbon Content (CC) analysis.
8. Weigh and record the wet weights of the two samples

No	Data Items	Descriptions	Instructions
1	CP No.	Refers to unique identification number given to the Cluster Plot. Example: CP0001	1. Select correct CP No. from dropdown list (in electronic form). 2. If paper form is used, record the correct CP No.
2	Dzongkhag	Name of the Dzongkhag in which the cluster plot is located.	1. Select correct name of the Dzongkhag from dropdown list (in electronic form). 2. If paper form is used, record the correct name of the Dzongkhag.
3	Gewog	Name of the Gewog in which the cluster plot falls.	1. Select correct name of the Gewog from dropdown list (in electronic form). 2. If paper form is used, record the correct name of the Geog.
4	Crew Leader	Name of the Leader of crew collecting the data.	Record name of Crew Leader.
5	Date of Collection	Refers to the date on which data is collected.	Record the date.
6	Wet weight of sample for Bulk Density analysis	Refers to the wet weight of the soils sample taken from 10 cm x 10 cm soil frame for analyzing Bulk Density.	1. Weigh the wet weight of soil sample for BD 2. Record the weight in kilograms (kg) to the nearest one decimal places

7	Soil Layer	Refers to the layer (0-10, 10-20 or 20-30 cm depth) from which sample for BD analysis is collected.	1. Choose 0-10 cm, 10 -20 cm and 20 - 30 cm if the sample has been collected from 0 – 10 cm layer, 10-20 cm layer and 20 – 30 cm layer respectively.
8	Wet weight of sample for Carbon Content analysis	Refers to the wet weight of the soils sample taken from 10 cm x 10 cm soil frame for analyzing Carbon Content.	1. Weigh the other half of the soil sample for CC 2. Record the weight in Kilogram (kg) to the nearest one decimal place.
9	Soil Layer	Refers to the layer (0-10, 10-20 or 20-30 cm depth) from which sample for CC analysis is collected.	1. Choose 0-10 cm, 10 -20 cm and 20 - 30 cm if the sample has been collected from 0 – 10 cm layer, 10-20 cm layer and 20 – 30 cm layer respectively.

b. Labeling and bagging

1. Carefully, bag the soil samples (BD sample and CC samples) into two separate ziploc bags.
2. It is very important to ensure that the bagged samples are labeled properly and correctly.
3. For Bulk Density, follow this standard labeling format: BD_Layer No_CPNo. (eg. BD_1_CP0001). BD_1 stands for Bulk Density for layer 1 (i.e 0-10cm depth) and CPNo. stands for the four-digit cluster plot number unique for each cluster plot.
4. For Carbon Content, follow this standard labeling format: CC_Layer No_CPNo. (eg. CC_1_CP0001). CC_1 stands for Carbon Content for layer 1 (i.e 0-10cm depth) and CPNo. stands for the four-digit cluster plot number unique for each cluster plot.
5. Additional information stating the date of collection and Collector's ID may be added on the label.
6. Then bag these ziploc bags with BD and CC samples into the polyester sack(s) (containing shrubs herbs and litter samples of same plot).
7. Polyester sack(s) should have CPNo, Date, and Crew ID.

Once sampling for 0-10 cm depth is completed, repeat the process for 10-20 cm and 20-30 cm depths of soil pit.

Note: *Always remember to refill the pits after excavating soil and litter samples, before moving on to next plot.*

9.5 Working with Problem Soils

1. **Rocky soils**-One common problem when collecting the soil sample in rocky soils is that larger rocks may extend partially inside and outside your 10 cm x 10 cm x 10 cm volume. In this case you only want to know the mass and volume of the rock inside your excavated hole but not that part of the rock that is outside your volume. If this occurs try to find another rock from outside your excavated volume that is a close match to the rock volume that extends into your excavated area. Then throw away the larger rock but retain the matched-volume rock and place it in with the rest of the excavated sample. Again, this is an estimate and will induce an error but there is not much choice.
2. **Sandy soils**-The other common problem exists when sampling sandy soils. As you are collecting from inside your 10 cm x 10 cm quadrat, the sides of the excavated hole may collapse. This will induce an error by decreasing your ability to accurately measure the excavated volume. In this case, try to insert some kind of walls in the excavated hole to stop the sides from collapsing.
3. **Wetland soils**-If plot falls in wetland soil, drive in the sampling frame completely into the soil. Then dig out and remove soil from outside of the frame to the bottom of the frame. Now, drive in the smaller soil frame (10 cm x 10 cm) completely in and excavate soil completely for 0-10 cm depth.
   For 10-20 cm and 20-30 cm depths, repeat the process, as being done for 0-10 cm depth.

   Division of samples for bulk density and carbon analysis is done, as is defined in **9.4.a7** for normal soil sampling.

Chapter 10: Sample Preparation and Laboratory Analysis

10.1 Number of Samples

The protocols for sample analysis in the laboratories for both Understorey (shrubs, herbs and litter) and Soil carbon pools are developed by Soil and Plant Analytical Laboratory and is described in detail in this manual.

For the purpose of field work, it is to be remembered that the following number of samples should be collected from each plot;

1. One Shrub sample (minimum 2 kgs from productive sites and entire samples if the sites have less than 2 kgs samples)
2. One Herb sample (entire samples are to be brought back to laboratory except if the site has samples more than 2 kgs)
3. One Litter sample (Entire samples is to be brought back to laboratory)
4. Six Samples (3 for Bulk Density and 3 for Carbon Content analysis)

In total, 9 numbers of samples will be collected and brought back to laboratory from each carbon plots for analysis.

10.2 Sample Status

While it is required to bring samples from every plot, it is foreseen that it may not always be possible to get samples from the all plots, given various difficulties in the field. In the event, it is not feasible to obtain samples; the crews are advised to record whether or not the sample has been collected from a sampling plot. If sample has not been collected, record the reasons as;

a. Shrub:
    1. Not sampled: No Shrub present
    2. Not sampled: Too dangerous
    3. Not sampled: Other reasons (list reason)

b. Herb
    1. Not sampled: No Herb present
    2. Not sampled: Too dangerous
    3. Not sampled: Other reasons (list reason)

c. Litter

1. Not sampled: No litter present
2. Not sampled: Waterlogged/Water
3. Not sampled: Too dangerous
4. Not sampled: Other reasons (list reason)

Chapter 11: Data Management

This chapter defines roles and responsibilities of field crew and data managers both at field offices as well as FRMD. It also provides step-wise flow of data from the data collection in the field to transferring the data from the field (by field crews) to field offices and then to sending to FRMD (by Field Data Managers) and upto data cleansing (Data Managers at FRMD) and analysis at FRMD (by Data Analysts).

The job of Inventory crew is not limited to collecting the data from the sample plots assigned to them alone. Rather, the data management is also very much an important part of the NFI Crew's responsibilities. Data management will involve transferring of data from Android Tablet to Laptop provided to the crew and to Database Management Systems maintained at Headquarters of Field Offices.

The NFI crew will collect NFI data using Android Tablet which has Collect Mobile installed in it. Collect Mobile is an android based application which allows fast, intuitive and flexible data collection from the field. It has features such as geo-location through embedded GPS, on-the-fly validation to improve data quality, handling of large lists of species or other attributes and processes inputs and calculates attributes for quality control in the field.

The data is collected in a survey form or NFI field form designed and developed in Open Foris Collect. The Collect is an easy-to-use solution for managing complex field survey data. It provides a fast, easy, flexible way to set up a survey with a user-friendly interface. It handles a multiple data types and complex validation rules, all in a multilanguage environment. Collect is installed on Laptops, where the survey or field forms are designed, exported and then uploaded or imported on the Android Tablet using Collect Mobile, installed on it. **Note**: *Use of Collect is provided in Bhutan NFI Open Foris Collect User Manual, 2018.*

11.1 Data Flow and Management

The data flow and management will be as reflected in the Table below. The table also shows responsibility assigned against each task.

SN	Task	Responsibility
1	Collecting data using Android Tablet that has Collect Mobile installed.	NFI Crew in the Field
2	Exporting data from Android Tablet	NFI Crew in the Field
3	Uploading data on Google Drive and storing a copy on laptops	NFI Crew in the Field
4	Sending the data to data center via email or share file via google drive	NFI Crew in the Field
5	Downloading or opening shared file from email or google drive and maintaining a copy of the data in PC hard drive	NFI data manager at Field Offices
6	Uploading or importing data into Collect	NFI Data Manager from Field Offices
7	Verifying whether all data shared by field crew are imported into Collect	NFI Data Manager at Field Offices
8	Exporting NFI data in correct format and .csv format and storing in a folder called raw_data	NFI Data Manager at Field Offices
9	Informing Crew leader for any missing data	NFI Data Manager from Field Offices
10	Submitting a copy of back-up data of step 5 and 8 to FRMD for record	NFI Data Manager from Field Offices
11	Performing data cleansing in Collect	NFI Data Manager at Field Offices
12	Exporting cleansed data in Collect and .csv format and storing in PC or Database system as cleaned data	NFI data Manager at Field Offices
13	Submitting a copy of cleansed data both in Collect and .csv format to FRMD via email or google drive	NFI data manager from Field Offices
14	Downloading the data submitted by field office and storing in PC hard drive or Work Station.	NFI Data Manager at FRMD

15	Uploading or Importing data into Collect	NFI Data Manager at FRMD
16	Verifying whether all data are imported properly	NFI Data Manager at FRMD
17	Performing further data cleaning	NFI Data Manager at FRMD
18	Exporting cleansed data in collect and .csv format and storing in PC or Work Station as cleaned data	NFI Data Manager at FRMD
19	Exporting data as Collect format for data analysis in Calc	NFI Data Manager at FRMD
20	Analyzing the data and generating estimates or NFI results.	FRMD

11.2 Exporting the Data from Android Tablet

This section is the responsibility of the field crews. After completing the data collection from the plot, the field crew will have to export the data and send it to the Data Managers at their respective offices. Steps to follow in exporting the data from Android tablet are;

a. After completing to data collection, go back to COLLECT Data Entry page

b. Then click on *three-dots icon*, at the top right corner of the COLLECT Data Entry page as shown on the right (Figure 12).

Figure 12: Collect Data Entry Page

c. On clicking the *three-dots icon* at the top right corner, the Figure 13 opens. Then click on *Export* to export the data.

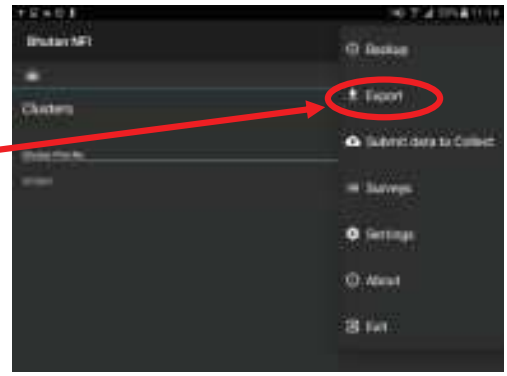


Figure 13: Data entry page with export option

d. After that check [✓] *Exclude image files*, if you have taken pictures using tablet but you want it to be exported along with the data. Then click on *EXPORT* (Figure 14).

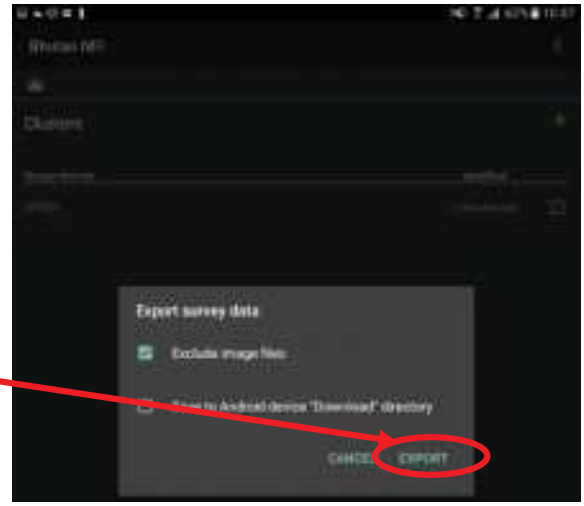


Figure 14: Specifying export option

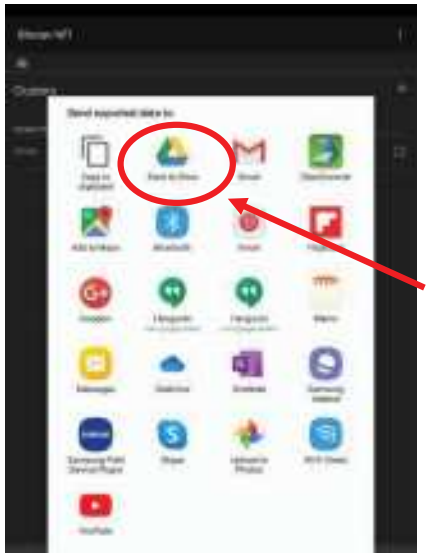


Figure 15: Screen with export directory

e. On clicking *EXPORT* option, then the screen with options to store or send the data opens. Select *Save to Drive* since we have created Google drive to send/receive NFI data (Figure 15).

f. Then screen with default document title (Bhutan_2019-09-13) is opened automatically which has to be changed (Figure 16).

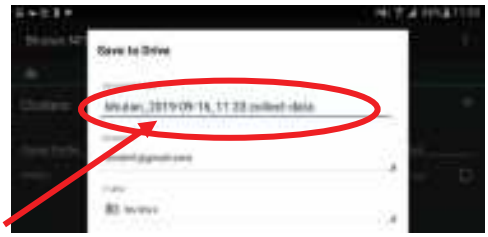


Figure 16: Default document title

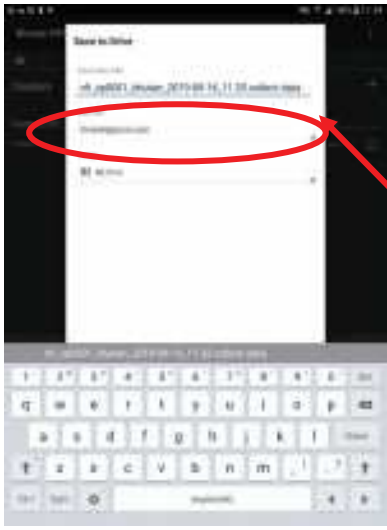


Figure 17: Editing the file name

g. Change the document title by adding nfi_cp_number in front of the default document title (Figure 17).

***Note**: The **nfi_cp_number** should be in LOWER CASE since COLLECT requires the file names to be in lower case to import the data into it.*

Here, since the data being exported is from the plot CP0001, we provide the document title as nfi_cp0001_bhutan_2019-09-16_11.08.collect-data.

The '_bhutan_2019-09-16_11.33.collect.data' indicates the data was transferred on 16th September, 2019 at 11:33AM.

h. Then click on ***done*** (Figure 17).

i. Then click on ***Save*** to save the data on frmd.nfi google drive

j. After the file has been successfully saved in google drive using the gmail account created for each office, the data managers can access the data to download and import the data into COLLECT.

11.3 Downloading Data from Google Drive

Once the field staff uploads the data in the google drive, the data managers of the respective offices can access the data and download the data and import the data into COLLECT (Figure 18).

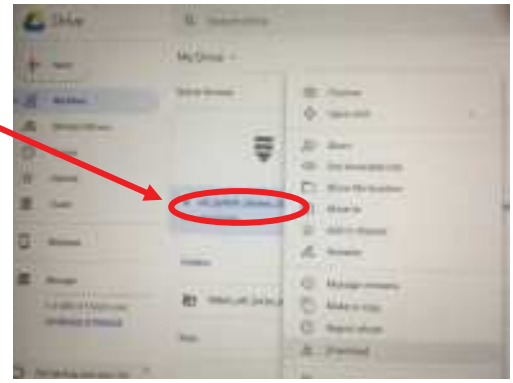


Figure 18: Downloading the data from google drive

Name of Office	Office Name Code	User Name
DFO, Bumthang	BuFD	bumthangdivisionnfi@gmail.com
DFO, Gedu	GeFD	gedudivisionnfi@gmail.com
DFO, Dagana	DaFD	daganadivisionnfi@gmail.com
DFO, Mongar	MoFD	mongardivisionnfi@gmail.com
DFO, Paro	PaFD	parodivisionnfi@gmail.com
DFO, Pemagatshel	PGFD	pemagatsheldivisionnfi@gmail.com
DFO, Samdrup Jongkhar	SJFD	sjongkhardivnfi@gmail.com
DFO, Samtse	SaFD	samtsedivisionnfi@gmail.com
DFO, Sarpang	SrFD	sarpangdivisionnfi@gmail.com
DFO, Thimphu	ThFD	thimphudivisionnfi@gmail.com
DFO, Trashigang	TGFD	trashigangdivisionnfi@gmail.com
DFO, Tsirang	TsFD	tsirangdivisionnfi@gmail.com
DFO, Wangdue	WPFD	wangduedivisionnfi2@gmail.com
DFO, Zhemgang	ZhFD	zhemgangdivisionnfi@gmail.com
Bumdeling Wildlife Sanctuary	BWS	bwsnfi2@gmail.com
Jigme Dorji National Park	JDNP	jdnpnfi@gmail.com
Jigme Singye Wangchuck National Park	JSWNP	jswnpnfi@gmail.com
Jomotshangkha Wildlife Sanctuary	JWS	jwsnfi@gmail.com
Phipsoo Wildlife Sanctuary	PWS	pwsnfi@gmail.com
Royal Manas National Park	RMNP	rmnpnfi@gmail.com
Sakteng Wildlife Sanctuary	SWS	swsnfi@gmail.com
Phrumsengla National Park	PNP	pnpnfi2@gmail.com
Jigme Khesar Strict Nature Reserve	JKSNR	jksnrnfi@gmail.com
Wangchuck Centennial National Park	WCNP	wcnpnfi1@gmail.com

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ANNEXURES

Annexure I: Field Forms

Sl.No	Form	Form Number
1	Cluster Plot Form	F1/18
2	Reference Point Form	F2/18
3	Witness Tree Form	F3/18
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7	Sapling Data Form	F7/18
8	Shrub Data Form	F8/18
9	Herb Data Form	F9/18
10	Mammal Data Form	F10/18
11	Bird Data Form	F11/18
12	Reptile Data Form	F12/18
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14	Fine Woody Debris Form	F14/18
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NATIONAL FOREST INVENTORY FIELD FORM
Cluster Plot Form

F1/18

Department of Forests and Park Services
Forest Resources Management Division

1. **CP No** ☐ ☐ ☐ ☐
2. **Date** / /
3. **Time** /
4. **Weather** Sunny ☐ Rainy ☐ Cloudy ☐ Windy ☐
5. **Location** Y= X=
6. **Enumerated** **Yes** ☐ **No** ☐
7. **Altitude (m)**
8. **Crew Leader Name**
9. **Crew ID:**

8. Office Name:

9. Gewog

10. Dzongkhag

11. Accessible a. Yes ☐ b. No ☐

12. CP Description:

13. CP Remark. ……

NATIONAL FOREST INVENTORY FIELD FORM
Reference Point Form

F2/18

Department of Forests and Park Services
Forest Resources Management Division

1. **CP No** ☐ ☐ ☐ ☐

2. **Plot Name** **Elbow** ☐ **North** ☐ **East** ☐

3. **Reference Point 1** ☐

   DBH ☐ cm Horizontal Distance to PC ☐ m Slope Distance to PC ☐ m Azimuth ☐

4. **Reference Point 2** ☐

   DBH ☐ cm Horizontal Distance to PC ☐ m Slope Distance to PC ☐ m Azimuth ☐

5. **Reference Point 1** ☐

   DBH ☐ cm Horizontal Distance to PC ☐ m Slope Distance to PC ☐ m Azimuth ☐

6. **Locaion** **Y=** ☐ **X=** ☐

7. **Remarks**: ……

NATIONAL FOREST INVENTORY FIELD FORM
Witness Trees' Form

F3/18

Department of Forests and Park Services
Forest Resources Management Division

1. **CP No** ☐ ☐ ☐ ☐

2. **Plot Name** **Elbow** ☐ **North** ☐ **East** ☐

3. **Witness Tree 1** ☐

   DBH ☐ cm Horizontal Distance to PC ☐ m Slope Distance to PC ☐ m Azimuth ☐

4. **Witness Tree 2** ☐

   DBH ☐ cm Horizontal Distance to PC ☐ m Slope Distance to PC ☐ m Azimuth ☐

5. **Witness Tree 3** ☐

   DBH ☐ cm Horizontal Distance to PC ☐ m Slope Distance to PC ☐ m Azimuth ☐

6. **Remarks**: .....

NATIONAL FOREST INVENTORY FIELD FORM
Regeneration Form (Within r < 3.57 m)

F4/18

Department of Forests and Park Services
Forest Resources Management Division

1. **CP No** ☐ ☐ ☐ ☐

2. **Date** ☐ / / ☐

SN	Scientific name	Local Name	No of Established	No of Un-established	No of Recruits	Remarks

NATIONAL FOREST INVENTORY FIELD FORM
Plot Description Form

F5/18

Department of Forests and Park Services
Forest Resources Management Division

1. **CP No** ☐ ☐ ☐ ☐
2. **Plot Name** Elbow ☐ North ☐ East ☐ (Tick the appropriate plot)
3. **Date** / /
4. **Time** / hrs
5. **Location** **Y** **X**

6. **Topographic position** (Tick appropriately)

i. Ridge top ☐ ii. Upper side hill ☐ iii. Middle side hill ☐ iv. Lower side hill ☐

v. Flat land ☐ vi. River bed ☐ vii. Gorge/Ravine ☐

7. **Aspect**

i. Northern ☐ ii. North-eastern ☐ iii. Eastern ☐ iv. South-eastern ☐

v. Southern ☐ vi. South-western ☐ vii. Western ☐ viii. North-western ☐

ix. No aspect ☐

8. Slope (Slope should be in degrees)

i. Slope up ☐ ii. Slope down ☐

9. Stand description

i. Stand height ☐ m iia. Canopy tally iib. Canopy non-tally ☐ iic Canopy closure ☐

10. Land Ownership

i. SRFL ☐ ii. SRFL-PA ☐ iii. SRFL-FMU ☐ iv. SRFL-CF ☐ v. SRFL-Leased ☐

vi. Private ☐ vii. Thromde ☐ viii. Thromde ☐ ix. Institutional ☐ x. Don't know ☐

11. Land ownership note .....

12. Land Cover Type ☐ (Refer manual and enter appropriate land cover code)

13. Vegetation composition ☐ (Refer manual and enter appropriate vegetation composition code)

14. Forest type ☐ (Refer manual and enter appropriate forest type code)

15. Forest stand structure i. Even-aged stand ☐ ii. Uneven-aged stand ☐

16. Forest stand development stage

i. Open ☐ ii. Stand initiation ☐ iii. Stand exclusion ☐ iv. Stand re-init ☐

v. Old growth ☐

17. Main understory type (Tick appropriately)

i. Moss ☐ ii. Grass ☐ iii. Herbs ☐ iv. Bamboo ☐ v. Shrubs ☐ vi. Others ☐

18. Understory percent (Tick appropriately)

i. None ☐ ii. < 2 % ☐ iii. 2 – 10% ☐ iv. 10 - 40% ☐ v. > 40 % ☐

19. Forest Resources

a. Non-wood forest produce (NWFP)

NWFP 1 ☐ (*Mention name of NWFP*)

Cover percent ☐

NWFP 2 ☐ (*Mention name of NWFP*)

Cover percent ☐

NWFP 3 ☐ (*Mention name of NWFP*)

Cover percent ☐

NWFP 4 ☐ (*Mention name of NWFP*)

Cover percent ☐

NWFP 5 ☐ (*Mention name of NWFP*)

Cover percent ☐

b. **Bamboo** a. Yes ☐ b. No ☐ (*Tick against Yes, if the Bamboo is found, and No, if it is not found*)

1. **Bamboo scientific name** ☐
2. **Bamboo cover percent** ☐
3. **Bamboo regeneration** ☐ ☐ ☐ ☐ ☐

i. None ii. <10% iii. 10-20% iv. 20-50% v. > 50%

c. **Cane** a. Yes ☐ b. No ☐ (*Tick against Yes, if the Cane is found, and No, if it is not found*)

1. Cane cover percent ☐

d. **Daphne** a. Yes ☐ b. No ☐ (*Tick against Yes, if the Daphne is found, and No, if it is not found*)

1. Daphne cover percent ☐

20. Snag **a.** Yes ☐ b. No ☐

21. Snag Count ☐

22. Fallen Tree **a.** Yes ☐ b. No ☐

23. Fallen Tree Count ☐

24. Disturbance

a. **Forest fire** a. Yes ☐ b. No ☐ (Tick against Yes, if there is evidence of fire, No if there is no evidence)

1. Intensity of forest fire

i. Heavy fire ☐ ii. Moderate fire ☐ iii. Light fire ☐ iv. No fire ☐

2. Type of forest fire

i. Ground fire ☐ ii. Surface fire ☐ iii. Crown fire ☐ iv. Not sure ☐ v. Not applicable ☐

b. **Grazing** a. Yes ☐ b. No ☐ (Tick against Yes, if there is evidence of grazing, No if there is no evidence)

1. Intensity of grazing

i. Low ☐ ii. Moderate ☐ iii. Severe ☐ iv. No grazing ☐

☐ ☐

c. **Timber extraction** a. Yes b. No (Tick against Yes, if there is evidence of timber extraction, No if there is no evidence)

1. Type of timber extraction

i. Clear felling ☐ ii. Selective felling ☐ iii. Group felling ☐ iv. Others ☐ v. No felling ☐

d. **Mining** a. Yes ☐ b. No ☐ (Tick against Yes, if there is evidence of mining, No if there is no evidence)

1. Type of mining

i. Surface collection ☐ ii. Quarry ☐ iii. None ☐ iv. Don't know ☐

e. **Transmission line** a. Yes ☐ b. No ☐ (Tick against Yes, if there is transmission line, No if there is no evidence)

f. **Garbage**

i. Food wrappers ☐ ii. PET bottles ☐ iii. Construction wastes ☐ iv. All of above ☐ v. None ☐

25. Forest Health

a. Pest & Disease a. Yes ☐ b. No ☐

b. Mistletoe a. Yes ☐ b. No ☐

c. Dieback fir a. Yes ☐ b. No ☐

d. Bark beetle a. Yes ☐ b. No ☐

e. Others a. Yes ☐ b. No ☐

26. Litter, Humus and fuel bed

a. Litter depth value ☐ (in cm)

b. Humus depth value ☐ (in cm)

c. Fuel bed depth value ☐ (in cm)

d. Litter cover percent ☐ (in %)

e. Bare soil cover percent ☐ (in %)

27. Soil

a. Stoniness

i. None ☐ ii. Rare, < 10% ☐ iii. Few, 10-20% ☐ iv. Common, 20-30% ☐

v. Many, 20-30% ☐ vi. Abundant, >60% ☐

b. Soil drainage

i. Poorly drained ☐ ii. Moderately drained ☐ iii. Well drained ☐

c. Top soil moisture

i. Dry ☐ ii. Slightly moist ☐ iii. Moist ☐ iv. Wet ☐ v. Water-logged ☐

d. Top soil colour

i. Blackish ☐ ii. Reddish ☐ iii.Yellowish ☐ iv. Brownish ☐ v. Others ☐

e. Top soil texture

i. Sand ☐ ii. Sandy loam ☐ iii. Loam ☐ iv. Silt loam ☐

v. Silt ☐ vi. Clay loam ☐ vii. Clay ☐

f. **Gully evidence** a. Yes ☐ b. No ☐

g. **Erosion evidence** a. Yes ☐ b. No ☐

28. Water bodies

a. Stream a. Yes ☐ b. No ☐

b. River a. Yes ☐ b. No ☐

c. Wetland a. Yes ☐ b. No ☐

d. Lakes a. Yes ☐ b. No ☐

e. Glacier a. Yes ☐ b. No ☐

29. Site Value

a. Natural trail facility a. Yes ☐ b. No ☐

b. Scenic a. Yes ☐ b. No ☐

c. Visitor evidence
i. Yes, Local ☐ ii. Foreign Tourist ☐ iii. Yes, Both ☐ iv. Yes, Religious ☐ v. None evident ☐

d. Site Value
i. Yes, Cultural ☐ ii. Yes, historical ☐ iii. Yes, Religious ☐ iv. None ☐ v. None evident ☐

e. Site Name ☐

f. Remarks: .....

NATIONAL FOREST INVENTORY FIELD FORM

F6/18

Tree Data Form

Department of Forests and Park Services

Forest Resources Management Division

1. **CP No** ☐ ☐ ☐ ☐

2. **Plot Name** Elbow ☐ North ☐ East ☐ (Tick the appropriate plot)

3. **Date** / / 4. **Time** / hrs

Tree Data Form (*>10 cm DBH*)

SN	Location		Scientific name	Local name	Tree tag No	Witness Tree	Distance Horizontal (m)	Distance Slope (m)	Azimuth (degree)	DBH (cm)	Height (m)	Bole height (m)	Crown length (m)	Crown position	Condition of Tree		Bark thickness (cm)	Core Taken		Core 1		Core 2	
	Lat	Lon													Live	Dead		Yes	No	Ring No	Ring Length	Ring No	Ring Length

Crown position

SN	Crown position	code
1	Dominant	D1
2	Dominated	D2
3	Suppressed	S1
4	Solitary	S2

NATIONAL FOREST INVENTORY FIELD FORM
Sapling Data Form

Department of Forests and Park Services
Forest Resources Management Division

F7/18

1. **CP No** ☐ ☐ ☐ ☐
2. **Plot Name** Elbow ☐ North ☐ East ☐ (Tick the appropriate plot)
3. **Date** / / 4. **Time** / hrs

Sapling Data Form (*Tree species of DBH >5 cm and <10 cm*)

SN	Scientific name	Local name		Number of individuals (Nos)		Layer height (m)		Cover percent (%)		Average diameter (cm)

F8/18

NATIONAL FOREST INVENTORY FIELD FORM
Shrub Data Form

Department of Forests and Park Services
Forest Resources Management Division

1. **CP No** ☐ ☐ ☐ ☐
2. **Plot Name** Elbow ☐ North ☐ East ☐ (Tick the appropriate plot)
3. **Date** / / 4. **Time** / hrs

Shrubs Data Form (*Woody plant of less than 5 m height*)

SN	Scientific name	Local name	No. of individuals		Layer height (m)		Cover percent (%)

NATIONAL FOREST INVENTORY FIELD FORM
Herbs Data Form
Department of Forests and Park Services
Forest Resources Management Division

F9/18

1. **CP No** ☐☐☐☐
2. **Plot Name** Elbow ☐ North ☐ East ☐ (Tick the appropriate plot)
3. **Date** / / 4. **Time** / hrs

Herbs Data Form (*Data collected from only North and East plots (within r=0.57 m plot)*)

SN	Scientific name	Local name		Layer height (m)		Cover percent (%)		Number of individuals (Nos)		Remarks

NATIONAL FOREST INVENTORY FIELD FORM
Wildlife (mammal) Data Form

F10/18

Department of Forests and Park Services
Forest Resources Management Division

1. **CP No** ☐☐☐☐

2. **Plot Name** Elbow ☐ North ☐ East ☐ (Tick the appropriate plot)

3. **Date** / / 4. **Time** / hrs

Wildlife (mammal) Data Form (*Data to be collected from all three plots*)
(within 25 m around PC)

SN	Scientific name	Local name	Species Identity		Wildlife Evidence (*Enter code*)	Gender (*Tick appropriately*)			Group size	Remarks
			Certain	Doubtful		Male	Female	Not known		

SN	Wildlife evidence (Mammal)	Code	SN	Wildlife evidence	Code
1	Direct sighting	ME1	8	Burrow/Den	ME8
2	Sound/calls	ME2	9	Browsing	ME9
3	Dung/Pellets/Scats	ME3	10	Debarking	ME10
4	Skeleton/Cadaver	ME4	11	Fraying	ME11
5	Horns/Antlers	ME5	12	Digging	ME12
6	Footprints/Pugmarks	ME6	13	Not relevant	ME13
7	Tracks/Paths	ME7			

NATIONAL FOREST INVENTORY FIELD FORM
Wildlife (Bird) Data Form

Department of Forests and Park Services
Forest Resources Management Division

F11/18

1. **CP No** ☐ ☐ ☐ ☐

2. **Plot Name** Elbow ☐ North ☐ East ☐ (Tick the appropriate plot)

3. **Date** / / 4. **Time** / hrs

Wildlife (Bird) Data Form (*Data to be collected from all three plots*)
(within 25 m around PC)

SN	Scientific name	Local name	Species Identity		Wildlife Evidence (*Enter code*)	Gender (*Tick appropriately*)			Group size	Remarks
			Certain	Doubtful		Male	Female	Not known		

SN	Wildlife evidence (Bird)	Code		SN	Wildlife evidence	Code
1	Direct sighting	BE1		6	Feathers	BE6
2	Sound/calls	BE2		7	Footprints	BE7
3	Droppings	BE3		8	Tracks/Paths	BE8
4	Eggs	BE4		9	Nest/Burrows	BE9
5	Skeleton/Cadaver	BE5		10	Not relevant	BE10

NATIONAL FOREST INVENTORY FIELD FORM

Wildlife (Reptile) Data Form

F12/18

Department of Forests and Park Services
Forest Resources Management Division

1. **CP No** ☐ ☐ ☐ ☐

2. **Plot Name** Elbow ☐ North ☐ East ☐ (Tick the appropriate plot)

3. **Date** / / 4. **Time** / hrs

Wildlife (Reptile) Data Form (*Data to be collected from all three plots*)
(within 25 m around PC)

SN	Scientific name	Local name	Species Identity		Wildlife Evidence (*Enter code*)	Gender (*Tick appropriately*)			Group size	Remarks
			Certain	Doubtful		Male	Female	Not known		

SN	Wildlife evidence (Reptile)	Code	SN	Wildlife evidence	Code
1	Direct sighting	RE1	5	Skin	RE5
2	Sound/calls	RE2	6	Tracks/Paths	RE6
3	Eggs	RE3	7	Nests/Burrows	RE7
4	Skeleton	RE4	8	Not relevant	RE8

NATIONAL FOREST INVENTORY FIELD FORM
Coarse Woody Debris Data Form

F13/18

Department of Forests and Park Services
Forest Resources Management Division

1. **CP No** ☐ ☐ ☐ ☐

2. **Plot Name** Elbow ☐ North ☐ East ☐ (Tick the appropriate plot)

3. **Date** / / 4. **Time** / hrs

Coarse Woody Debris Data Form (*Data to be collected from 50 m transects between plots*)

SN	Scientific name	Dia. Large end (cm)	Dia. Intersection (cm)	Dia. Small end (cm)	Length Intersection (m)	CWD Length (m)	CWD Width (m)	Decay Class

NATIONAL FOREST INVENTORY FIELD FORM
Carbon Data Form
FINE WOODY DEBRIS SAMPLING

F14/18

Department of Forests and Park Services
Forest Resources Management Division

1. **CP No** ☐ ☐ ☐ ☐
2. **To Plot Name** North ☐ East ☐ (Tick the appropriate plot)
3. **Date** / / 4. **Time** / hrs

Fine Woody Debris Data Form (*Data to be collected from 4 m transects located at outer end of Elbow plot*)

SN	Scientific name	Dia. Large end (cm)	Dia. Intersection (cm)	Dia. Small end (cm)	Length Intersection (m)	FWD Length (m)	FWDWidth (m)

NATIONAL FOREST INVENTORY FIELD FORM
Carbon Data Form
SHRUB SAMPLING
Department of Forests and Park Services
Forest Resources Management Division

F15/18

1. **CP No** ☐☐☐☐
2. **Dzongkhag** _____ (*Mention name of the dzongkhag in which the plot is located*)
3. **Gewog** _____ (*Mention name of the gewog in which the plot is located*)
4. **Crew Leader** _____ (*Mention name of the Crew Leader collecting the data*)
5. **Date** / / (*Mention the date on which data is collected*)

Shrubs Sampling Data Form *(Sample and data to be collected from 5m x 5 m shrub plot)*

SN	Scientific name	No. of individuals	Cover percent (%)	Shrubs height (m)

Need not fill up this table if the information has been collected in Shrub Data Form

6. Total wet weight of the shrub sample _____ (*Includes total weight of all shrubs sampled irrespective of species*)
7. Wet weight of the shrub sub-sample _____ (*The wet weight of the subsampled shrubs*)
8. Percentage of subsample taken _____ (*Percentage of wet weight subsampled from the total wet weight*)

NATIONAL FOREST INVENTORY FIELD FORM
Carbon Data Form
HERBS SAMPLING

F16/18

Department of Forests and Park Services
Forest Resources Management Division

1. **CP No** ☐☐☐☐
2. **Dzongkhag** _____ (*Mention name of the dzongkhag in which the plot is located*)
3. **Gewog** _____ (*Mention name of the gewog in which the plot is located*)
4. **Crew Leader** _____ (*Mention name of the Crew Leader collecting the data*)
5. **Date** / / (*Mention the date on which data is collected*)

Herbs Sampling Data Form *(Sample and data to be collected from 1m x 1 m herbs plot)*

SN	Scientific name	No. of individuals	Cover percent (%)	Herbs height (m)

Need not fill up this table if the information has been collected in Herb Data Form

6. Total wet weight of the herbs sample _____ (*Includes total weight of all herbs sampled irrespective of species*)
7. Wet weight of the herbs sub-sample _____ (*The wet weight of the subsampled herbs*)
8. Percentage of subsample taken _____ (*Percentage of wet weight subsampled from the total wet weight*)

NATIONAL FOREST INVENTORY FIELD FORM
Carbon Data Form
LITTER SAMPLING *(Litter plot -20 cm x 20 cm)*

Department of Forests and Park Services
Forest Resources Management Division

F17/18

1. **CP No** ☐ ☐ ☐ ☐
2. **Dzongkhag** ☐ (*Mention name of the dzongkhag in which the plot is located*)
3. **Gewog** ☐ (*Mention name of the gewog in which the plot is located*)
4. **Crew Leader** ☐ (*Mention name of the Crew Leader collecting the data*)
5. **Date** ☐ / / (*Mention the date on which data is collected*)
6. **Depth of litter** ☐ cm (*Measure depth from all four sides of plot*)
7. **Litter wet weight** ☐ kg

Note : For litter all the samples are collected, bagged and brought to the laboratory to obtain dry weight)

F18/18

NATIONAL FOREST INVENTORY FIELD FORM
Carbon Data Form
SOIL SAMPLING

Department of Forests and Park Services
Forest Resources Management Division

1. **CP No** ☐ ☐ ☐ ☐
2. **Dzongkhag** ________ (*Mention name of the dzongkhag in which the plot is located*)
3. **Gewog** ________ (*Mention name of the gewog in which the plot is located*)
4. **Crew Leader** ________ (*Mention name of the Crew Leader collecting the data*)
5. **Date**   /   / (*Mention the date on which data is collected*)

Soil Sampling Data Form *(Sample and data to be collected from 10 cm x 10 cm soil plot)*

SN	Soil Layer	Weight of sample for Bulk Density (BD) (in kgs)	Weight of sample for Carbon Content (in kgs)
1	0 – 10 cm		
2	10 – 20 cm		
3	20 – 30 cm		

Annexure II: Slope Correction Table

Slope (in Degrees)	Horizontal Distance(m)				
	3.57	10	12.62	20	50
	Slope Distance(m)				
1	3.57	10.00	12.62	20.00	50.01
2	3.57	10.01	12.63	20.01	50.03
3	3.57	10.01	12.64	20.03	50.07
4	3.58	10.02	12.65	20.05	50.12
5	3.58	10.04	12.67	20.08	50.19
6	3.59	10.06	12.69	20.11	50.28
7	3.60	10.08	12.71	20.15	50.38
8	3.61	10.10	12.74	20.20	50.49
9	3.61	10.12	12.78	20.25	50.62
10	3.63	10.15	12.81	20.31	50.77
11	3.64	10.19	12.86	20.37	50.93
12	3.65	10.22	12.90	20.45	51.12
13	3.66	10.26	12.95	20.53	51.31
14	3.68	10.31	13.01	20.61	51.53
15	3.70	10.35	13.06	20.70	51.76
16	3.71	10.40	13.13	20.81	52.01
17	3.73	10.46	13.20	20.91	52.28
18	3.75	10.51	13.27	21.03	52.57
19	3.78	10.58	13.35	21.15	52.88
20	3.80	10.64	13.43	21.28	53.21
21	3.82	10.71	13.52	21.42	53.55
22	3.85	10.78	13.61	21.57	53.92
23	3.88	10.86	13.71	21.73	54.31
24	3.91	10.95	13.81	21.89	54.73
25	3.94	11.03	13.92	22.07	55.16
26	3.97	11.12	14.04	22.25	55.62
27	4.01	11.22	14.16	22.44	56.11
28	4.04	11.32	14.29	22.65	56.62
29	4.08	11.43	14.43	22.86	57.16
30	4.12	11.55	14.57	23.09	57.73
31	4.16	11.66	14.72	23.33	58.32
32	4.21	11.79	14.88	23.58	58.95
33	4.26	11.92	15.04	23.84	59.61
34	4.31	12.06	15.22	24.12	60.30
35	4.36	12.21	15.40	24.41	61.03
36	4.41	12.36	15.60	24.72	61.79
37	4.47	12.52	15.80	25.04	62.59
38	4.53	12.69	16.01	25.37	63.43
39	4.59	12.86	16.23	25.73	64.32
40	4.66	13.05	16.47	26.10	65.25
41	4.73	13.25	16.72	26.49	66.23
42	4.80	13.45	16.98	26.90	67.26
43	4.88	13.67	17.25	27.34	68.34
44	4.96	13.90	17.54	27.79	69.48
45	5.05	14.14	17.84	28.27	70.68
46	5.14	14.39	18.16	28.78	71.95
47	5.23	14.66	18.50	29.31	73.28
48	5.33	14.94	18.85	29.88	74.69
49	5.44	15.23	19.23	30.47	76.17
50	5.55	15.55	19.62	31.10	77.75
51	5.67	15.88	20.04	31.76	79.41
52	5.80	16.23	20.49	32.47	81.17
53	5.93	16.61	20.96	33.21	83.03

54	6.07	17.00	21.46	34.00	85.01
55	6.22	17.42	21.99	34.84	87.11
56	6.38	17.87	22.55	35.74	89.35
57	6.55	18.35	23.15	36.69	91.73
58	6.73	18.86	23.80	37.71	94.28
59	6.93	19.40	24.48	38.80	97.00
60	7.13	19.98	25.22	39.96	99.91
61	7.36	20.61	26.01	41.21	103.03
62	7.60	21.28	26.85	42.56	106.39
63	7.86	22.00	27.77	44.01	110.01
64	8.13	22.79	28.76	45.57	113.93
65	8.44	23.63	29.82	47.27	118.16
66	8.77	24.55	30.99	49.11	122.77
67	9.12	25.56	32.25	51.11	127.79
68	9.52	26.65	33.64	53.31	133.27
69	9.95	27.86	35.16	55.72	139.30
70	10.42	29.19	36.84	58.38	145.94
71	10.95	30.66	38.69	61.32	153.30
72	11.53	32.30	40.76	64.59	161.49
73	12.18	34.13	43.07	68.26	170.65
74	12.92	36.20	45.68	72.39	180.98
75	13.76	38.54	48.64	77.08	192.71
76	14.72	41.22	52.03	82.45	206.12
77	15.82	44.32	55.94	88.65	221.62
78	17.12	47.94	60.50	95.88	239.71
79	18.64	52.22	65.90	104.44	261.10
80	20.48	57.36	72.39	114.71	286.79
90	4483.08	12557.66	15847.77	25115.32	62788.30

Annexure III: Major Land Use and Land Cover Classes, Definitions and Code

Major land category	Definition	Code
Forest land	Land with tree or woody vegetation spanning more than 0.5 hectares with tree higher than 5 meter in height and a canopy cover of more than 10 percent. Do not include land that is predominantly under agriculture or urban landuse or orchards	FL
Cropland	All arable and tillage land, and agro-forestry systems where vegetation falls below the thresholds used for the forest land category.	CL
Grassland	All **rangelands and pasture land** that is not considered as cropland. It also includes systems with vegetation that fall below the threshold used in the forest land category and are not expected to exceed, without human intervention, the threshold used in the forest land category.	GL
Wetlands	All land that is covered or saturated by water for all or part of the year (e.g., peatland) and that does not fall into the forest land, cropland, grassland or settlements categories.	WL
Settlements	All developed land, including transportation infrastructure and human settlements of any size, unless they are already included under other categories.	SL
Other land	Any land that is not included as part of above five land categories, such as bare soil, rock, ice, and all unmanaged land areas is considered as other land	OL

Annexure IV: Land Use and Land Cover Classes Sub-Categories, Definitions and Code

S/N	Land Use Type	Definition	Code
1	Coniferous forests	Forest in which more than 75 percent of tree cover consists of coniferous (Fir, Spruce, Pine) species.	**FC**
2	Broadleaf forests	Forest in which more than 75 percent of tree cover consists of broadleaf and hardwood species.	**FB**
3	Coniferous /plantation	Plantations of more than 75 percent coniferous species	**FPc**
4	Broadleaf plantation	Plantations of more than 75 percent broadleaf species	**FPb**
5	Scrub (rhododendron) forests	Forest areas characterized by less than 10 percent tree cover; or where vegetations are stunted or dwarfed. Mainly dominated by rhododendron species.	**FSR**
6	Scrub (non-rhododendron) forests	Areas characterized by less than 10 percent tree cover; or where vegetations are stunted or dwarfed. Dominated by species other than rhododendron.	**FSnR**
7	Meadow	Open areas of predominantly grassy vegetation cover and herbaceous plants.	**MDW**
8	Chuzhing	Irrigated, bench terraced and land cultivated mainly for rice	**AW**
9	Kamzhing	Rainfed, cultivated land which may be terraced or unterraced.	**AD**

10	Apple orchard	Self explanatory	**HOa**
11	Citrus orchard	Self explanatory	**Hoc**
12	Areca nut	Self explanatory	**HPa**
13	Cardamom Plantation	Self explanatory	**HPc**
14	Other horticulture		**HPo**
15	Urban	Towns and areas of habitation (near houses but besides roads or other concrete surfaces).	**UR**
16	Rural	Areas of habitation in villages (near houses, footpaths, or areas which are not forest, or meadows or agricultural fields)	**RU**
17	Road	National Highways, Dzongkhag Roads, Thromde Roads, Farm Roads, Access Roads, Forest Roads.	**RO**
18	Industrial Area	Area identified or earmarked for production of industrial goods and services.	**Ia**
19	Impervious surface	Man-made surfaces like roads, concretes, pavements	**IMP**
20	Snow/glacier	Only those areas which appear to remain permanently under snow or glacier should be identified as one.	**OS**
21	Rocky outcrop	Areas of rocky outcrop and rocky barren lands, sometimes associated with sparse trees/scrub cover	**OR**
22	Scree	**Scree**, or **talus**, is accumulation of broken rock fragments at the base of crags, mountain cliffs, or valley shoulders.	**OScr**
23	Lake	A **lake** is a body of relatively still fresh or salt water of considerable size, localized in a basin, which is surrounded by land apart from a river, stream, or other form of moving water that serves to feed or drain the lake. (Source:*en.wikipedia.org/wiki/Lake)*. Lakes can be Alpine lake, Sub-alpine lakes, Glacier lakes, Supra Glacial lake, Supra snow lake or Tsho.	**Olk**
24	Reservoir	Any water body held within man-made structure.	**Ores**
25	River	Refers to perennial flow of water and the river beds.	**Orv**
26	Marshy area	Poorly drained or waterlogged areas of permanent swamp or marsh	**OM**
27	Landslide	Areas in which there is clear evidence of erosion	**OL**
28	Gully	Gullies are vast gaps, crevices created by erosion of soil on hillside by running waters.	**OG**
29	Moraines	Refers to a mass of rocks and sediments carried down and deposited by a glacier typically as ridges at its edges or extremity	**OU**
	Note: *The Land Use Classes have been derived from the LUPP, 1995 definitions of Land Use/Land Cover Classes and categories. Additional Land use Classes have been added based on the field experiences.*		

Annexure V: Vegetation Composition Type and Code

VEGETATION COMPOSITION (as per Land Use code combination in Forestry Services Division, Laumans, P. *Guidelines for Forest Management Inventory Field work*,1994)

CODE	VEGETATION COMPOSITION
Ac	*Acer* sp.
Ac-Be	*Acer* sp./*Betula* sp.
Ac-Oc	*Acer* sp./*Populus ciliate*
Ac-Qs	*Acer* sp./*Quercus semecarpifolia*
Al	*Alnus nepalensis*
Be	*Betula* sp.
Bk	Temporarily unstocked/Blank
Bl	Low bamboo
Bl(Nc)	Low bamboo with sparse Mixed coniferous
Bl(Nf)	Low bamboo with sparse tree cover
Bt	Tall bamboo
Ch	*Schima wallichii*, Chilaune
Cu	Agriculture/Cultivation
Cy	*Cypress* sp.
Ex	*Exbucklandia populnea*
Fi	Fir
Fi(Be)	Fir with minor *Betula* sp.
Fi(He)	Fir with minor *Hemlock*
Fi-Ac	Fir/*Acer* sp.
Fi-Ar	Fir/*Prunus* sp.
Fi-Be	Fir/*Betula* sp.
Fi-He	Fir/Hemlock
Fi-Ju	Fir/*Juniper* sp.
Fi-La	Fir/Larch
Fi-Rh	Fir/*Rhododendron* sp.
Fi-Sp	Fir/Spruce
Ga	Alpine grassland
Ga(Fi)	Alpine Grassland with sparse Fir
Ga(Ju)	Alpine Grassland with sparse Juniper sp.
Ga(Sp)	Alpine Grassland with sparse Spruce
Gr	Grassland
Gr(Nf)	Grassland with sparse tree cover
Gr(Pb)	Grassland with sparse Blue Pine
Gr(Pc)	Grassland with sparse Chir Pine
Gr(Sp)	Grassland with sparse Spruce
He	Hemlock
He(Be)	Hemlock with minor *Betula* sp.
He(Fi)	Hemlock with minor Fir
He(Pb)	Hemlock with minor Blue Pine
He(Sp)	Hemlock with minor Spruce
He-Ac	Hemlock/*Acer* sp.
He-Ar	Hemlock/*Prunus* sp.
He-Be	Hemlock/*Betula* sp.
He-La	Hemlock/Larch
He-Nb	Hemlock/broadleaved
He-Pb	Hemlock/Blue Pine

He-Qs	Hemlock/*Quercus semecarpifolia*
Ju	*Juniper* sp.
Ka	*Castanopsis* sp., Katus
Ka-Qu	*Castanopsis* sp./*Quercus* sp.
La	Larch
La-Qs	Larch/*Quercus semecarpifolia*
Ma	*Macaranga* sp.
Nb	Mixed broadleaved
Nc	Mixed coniferous
Nc-Nb	Mixed coniferous/Mixed broadleaved
Oc	*Populus ciliata*
Oc-Nc	*Populus ciliata*/Mixed coniferous
Oc-Qs	*Populus ciliata*/Quercus semecarpifolia
Or	*Populus rotundifolia*
Pb	Blue Pine
Pb-He	Blue Pine/Hemlock
Pb-He(Sp)	Blue Pine/Hemlock with minor Spruce
Pb-Nb	Blue Pine/Mixed broadleaved
Pb-Oc	Blue Pine/*Populus ciliata*
Pb-Or	Blue Pine/*Populus rotundifolia*
Pb-Qg	Blue Pine/*Quercus griffithii*
Pb-Qs	Blue Pine/*Quercus semecarpifolia*
Pb-Qu	Blue Pine/*Quercus* sp.
Pb-Rh	Blue Pine/*Rhododendron* sp.
Pc	Chir Pine
Pc-Nb	Chir Pine/Mixed broadleaved
Pl	Forest plantation
Qg	*Quercus griffithii*
Qg-Nc	*Quercus griffithii*/Mixed coniferous
Qg-Qs	*Quercus griffithii*/*Quercus semecarpifolia*
Qg-Rh	*Quercus griffithii*/Rhododendron sp.
Qn	*Quercus lanata*
Qs	*Quercus semecarpifolia*
Qs-Nc	*Quercus semecarpifolia*/Mixed coniferous
Qu	*Quercus* sp.
Qu-Nc	*Quercus* sp./Mixed coniferous
Rh	*Rhododendron* sp.
Ro	Rocky outcrops and barren land
Ro(Nf)	Barren land with sparse tree cover
Ro(Pb)	Barren land with sparse Blue Pine
Ro(Pc)	Barren land with sparse Chir Pine
Sa	Alpine shrubland
Sa(Fi)	Alpine shrubland with sparse Fir
Sc	Shrubland
Sc(Nf)	Shrubland with sparse tree cover
Sc(Pb)	Shrubland with sparse Blue pine
Sc(Pc)	Shrubland with sparse Chir Pine
Se	Settlements
Sp	Spruce
Sp-Ac	Spruce/*Acer* sp.
Sp-He	Spruce/Hemlock
Sp-Nb	Spruce/Mixed broadleaved

Sp-Oc	Spruce/*Populus ciliata*
Sp-Pb	Spruce/Blue Pine
Sp-Qs	Spruce/*Quercus semecarpifolia*
Wa	Lakes and rivers
Ye	Yew
Ye-Oc	*Taxus baccata/Populus ciliata*
Fi-He(Ju)	Fir/Hemlock with minor Juniper
Nb-He	Mixed broadleaf/Hemlock
Nb-Pb	Mixed broadleaf/*Blue Pine*
Nb-Pc	Mixed broadleaf/Chir Pine
Nb-Qu	Mixed broadleaf/*Quercus* sp.
He-Fi	Hemlock/Fir
He-Fi(Sp)	Hemlock/Fir with minor Spruce
He-Pb(Qu)	Hemlock/Blue Pine with minor *Quercus* sp.
Ju-He	Juniper/Hemlock
Pb-Pc	Blue Pine/Chir Pine
Pb-Pc(Qu)	Blue Pine/Chir Pine with minor *Quercus* sp
Qu-Nb	*Quercus* sp/Mixed broadleaf
Qu-Nb(He)	*Quercus* sp/Mixed brl with minor Hemlock
Qu-Nb(Pb)	*Quercus* sp/Mixed brl with minor Blue Pine
Pb-Sp	Blue Pine/Spruce
Nc-He	Mixed coniferous/Hemlock
Nb-Nc	Mixed coniferous/Mixed broadleaf
He-Pb(Sp)	Hemlock/Blue Pine with minor Spruce
He-Sp	Hemlock/Spruce
He-Sp(Pb)	Hemlock/Spruce with minor Blue Pine
Sp-He(Pb)	Spruce/Hemlock with minor Blue Pine
Dp	*Daphnephyllum* sp.
Nb-Dp	Mixed broadleaf/*Daphnephyllum* sp.
Qu-Pc	*Quercus* sp./Chir Pine
Qg-Pb	*Quercus griffithii*/Blue Pine
Fi(Ju)	Fir with minor Juniper
He-Be(Fi)	Hemlock/Betula sp. with minor Fir
Pb-Sp(Qu)	Blue Pine/Spruce with minor *Quercus* sp.
Qu-He	*Quercus* sp./Hemlock
Ju-Fi	*Juniperus* sp./Fir
Qu-He(Sp)	Quercus sp./Hemlock with minor Spruce
Pb-Qu(Sp)	Blue Pine/*Quercus* sp. with minor Spruce
Pb(Sp)	Blue Pine with minor Spruce
Sp-Pb(He)	Spruce/Blue Pine with minor Hemlock
Sp-Pb(Qu)	Spruce/Blue Pine with minor *Quercus* sp.
Qu-Sp	*Quercus* sp./Spruce
Qu-Sp(Be)	*Quercus* sp./Spruce with minor *Betula* sp.
Ju(Fi)	*Juniperus* sp. with minor Fir
He-Fi(Be)	Hemlock/Fir with minor Betula sp.
He-Sp(Fi)	Hemlock/Spruce with minor Fir
Sp(Fi)	Spruce with minor Fir
Pb-Sp(He)	Blue Pine/Spruce with minor Hemlock
He-Qu	Hemlock/*Quercus* sp.
He-Qu(Sp)	Hemlock/*Quercus* sp. with minor Spruce
Fi(Sp)	Fir with minor Spruce
Fi-Ju(He)	Fir/*Juniperus* sp. with minor Hemlock

Fi-Sp(He)	Fir/Spruce with minor Hemlock
Ju-Sp	*Juniperus* sp./Spruce
Pb(Qs)	Blue Pine with minor *Quercus semecarpifolia*
Pb-He(Qs)	Blue Pine/Hemlock with minor *Q. semecarpifolia*
Op	*Populus* sp.
Pb-Op	Blue Pine/*Populus* sp.
Pb-Qs(Sp)	Blue Pine/*Q. semecarpifolia* with minor Spruce
Pb-Qs(He)	Blue Pine/ *Q. semecarpifolia* with minor Hemlock
Pb-Sp(Qs)	Blue Pine/Spruce with minor *Q. semecarpifolia*
Qs-Pb	*Quercus semecarpifolia*/Blue Pine
Qs-Pb(Sp)	*Q. semecarpifolia*/Blue Pine with minor Spruce
Qs-Sp	*Quercus semecarpifolia*/Spruce
Sp-Fi(Qs)	Spruce/Fir with minor *Q. semecarpifolia*
Sp(Pb)	Spruce with minor Blue Pine
Sp-Fi	Spruce/Fir
Sp-Fi(He)	Spruce/Fir with minor Hemlock
Sp-He(Fi)	Spruce/Hemlock with minor Fir
Sp-He(Ju)	Spruce/Hemlock with minor *Juniperus* sp.
Sp-Ju	Spruce/*Juniperus* sp.
Sp-Ju(Fi)	Spruce/*Juniperus* sp. with minor Fir
Sp-Pb(Qs)	Spruce/Blue Pine with minor *Q. semecarpifolia*
Sp-Qs(He)	Spruce/ *Q. semecarpifolia* with minor Hemlock
Sp-Qs(La)	Spruce/ *Q. semecarpifolia* with minor Larch
Sp-Qs(Pb)	Spruce/ Q. *semecarpifolia* with minor Blue Pine
He-Pb(Qs)	Hemlock/Blue Pine with minor *Q. semecarpifolia*.
He-Qs(Sp)	Hemlock/ *Q. semecarpifolia* with minor Spruce
Qs-He	*Quercus semecarpifolia*/Hemlock
Qs-He(Sp)	*Quercus semecarpifolia* /Hemlock with minor Spruce
Qs-Sp(Be)	*Quercus semecarpifolia* /Spruce with minor Betula
He-Qs(Nb)	Hemlock/Q. semec. with minor Mixed brl.
He-Rh	Hemlock/*Rhododendron* sp.
Sp-Rh	Spruce/*Rhododendron* sp.
He-Qs(Rh)	Hemlock/ *Quercus semecarpifolia* with minor Rhododendron
Qs-He(Rh)	*Quercus semecarpifolia* Hemlock with minor Rhododendron
He-Fi(Rh)	Hemlock/Fir with minor *Rhododendron* sp.
He-Sp(Qs)	Hemlock/Spruce with minor *Quercus semecarpifolia*
He-Qs(Fi)	Hemlock/ *Quercus semecarpifolia* with minor Fir
Pb-Sp(Fi)	Blue Pine/Spruce with minor Fir
He-Fi(Qs)	Hemlock/Fir with minor *Quercus semecarpifolia*
He-Rh(Nb)	Hemlock/*Rhododendron* sp. with minor Mixed brl.
Rh-Fi	*Rhododendron* sp./Fir
He-Rh(Qs)	Hemlock/*Rhododendron* sp. with minor *Quercus semecarpifolia*
He-Ju	Hemlock/*Juniperus* sp.
Be-Fi	*Betula* sp./Fir
Ju-Fi(Rh)	*Juniperus* sp./Fir with minor *Rhododendron* sp.
Ma-Nb	Macaranga/Mixed broadleaved
Nb-Ma	Mixed broadleaf/*Macaranga* sp.

Annexure VI: Forest Types of Bhutan[2]

Sl. No	Forest Type	Code	Characteristics	Characteristic species
1	Subtropical Forest	STFr	• Contain many tropical genera and species, forming dense jungle • Scattered Sal trees in Sarpang areas • **Altitudinal range: 200-1000 m (-1200 m)**	*Acraocarpus fraxinifolius, Ailanthus grandis, Bombax ceiba, Crateva regiliosa, Dellinia pentgyna, Duanbanga grandiflora. Gmelina arborea, Leea asiatica, Musa, Pnadanus, Pterospermum aceriflolium, Shorea robusta, Tetremeles nudiflora, Thunbergia*
2	Warm Broad-leaved Forest	WBFr	• Type of Subtropical forest, but occurs at higher altitude with lower rainfall • Contains mixture of Evergreen and deciduous broad-leaved species • Many of the tropical genera e.g., *Duabanga, Pterospermum and Tetrameles* are absent • **Altitudinal range: 1000-2000 m (-2300 m)**	*Alangium chinensis, Altingia excels, Bischofia javanica, Calicarpa arborea, Castanopsis indica, Cordia oblique, Dendrocalamus hookeri, Dichroa febrifuga, Engelhardia spicata, Eoudia fraxinifolia, Macaranga pustulata, Maesa spp., Mussaenda roxburghii, Pouzolzia sanguine, Raphidophora eximea, Schima wallichi, Wandlandia puberula*
3	Chirpine Forest	CPFr	• Low-altitude xerophytic forest occurring in the deeper dry valleys of Bhutan • Almost no other tree species occur in such forest other than *Chirpine* • **Altitudinal range:900-1800 m (-2000 m)**	*Buddleja asiatica, B. bhutanica, Cycas pectinata, Cymbopogon flexuosus, Euphobia royleana, Ficus obligodon, Grewia sapida, Indigofera dosua, Rhus paniculata, Zizyphus incurve*
4	Cool Broad-leaved Forest	CBFr	• Found on moist exposed slopes • Mixed forest in which oaks are LESS COMMON and other trees, both deciduous and evergreen, e.g., *Lauraceae, Exbucklandia* etc., are more abundant together with dense shrubs, climbers and epiphytes • **Altitudinal range:2000-2900 m**	*Acer campbelli, A. sterculiaceum, Betula alonoides, Brassiopsis alpine, Chirita lachensis, Corylopsis himalayana, Elatostema monandrum, E. obtusum, Exbucklandia populnea,* *Ilex fragilis, Lecanthus peduncularis, Lindera neesiana, L. pulcherrima, Persea clarkeana, Pilea bracteosa, Rosa moschata, Rubus lineatus, Schisandra grandiflora, Symplocus dryiphila*

[2] Derived from Flora of Bhutan

5	Evergreen Oak Forest	EOFr	• Characteristic feature of some parts of Central Bhutan (for e.g., Trongsa and hills above Mongar) • Composition varies according to altitude and rainfall • At lower levels, *Castanopsis hystrix* and *C. tribuloides* are often dominant, higher up Quercus lamellose becomes commoner • With increasing dryness, more xerophytic *Quercus* species, e.g., *Q. lanata, Q. grifithii* and *Q. semicarpifolia* and *Pinus wallichiana* are seen • Not much shrub layer, whilst shady humid floors are dominated by small herbs • **Altitudinal range: (1800-) 2000-2600 m**	*Acer campbelli, castanopsis hystrix, C. tribuloides, Elatostema hookerianum, E. sessile, Galeola lindleyana, Juglans regia, Pilea symmeria, Quercus lamellose, Skimmia arborescens, Symplocus lucida*
6	Blue Pine Forest	BPFr	• Temperate equivalent of Chirpine forest and occupies the dry valleys of Bhutan • Bluepine dominant with *Quercus species* in some places • Xerophytic shrubs occur and herbs mostly appear during the monsoon season • **Altitudinal range: 2100-3000 (-3200) m**	*Berberis asiatica, Berchemia edgeworthii, Cotoneaster griffithii, Eleagnus parviflora, Euonymus grandiflorus, Indigofera heterantha, Jasminium humile, Prinsepia utilis, Lyonia ovalifolia, Quercus griffithii, Q. semicarpifolia, Rhododendron arboretum, Rosa sericea, Spirea canescens, Zanthoxylum armatum*
7	Spruce Forest	SPFr	• Spruce forest with Hemlock and Fir forests occupy the montane cloud-forest zone of Bhutan • Often mixed with each other but separate forests can frequently be recognized • Spruce are found at lower altitude than Hemlock and Fir • **Altitudinal range:2700- 3100 (-3200) m**	*Acer cappadocicum, A. pectinatum, Berberis praecipua, Enkianthus deflexus, Larix grifithiana, Lindera heterophylla, Osmanthus suavis, Picea brachytyla, P. spinolosa, Salix daltiniana, Salvia campanulata, Taxus baccata*
8	Hemlock Forest	HMFr	• Appears at higher altitude than Spruce where *Tsuga dumosa* is dominant species mixed with Spruce and Fir • Shrubby and arborescent rhododendrons are frequent with dense growth of ferns, lichens and bryophytes • **Altitudinal range: 2800-3100 m**	*Arundinaria griffithiana, Betual utilis, Buddleja colvilei, Daphne bholua, Gaultheria fragmentissima, Larix griffithiana, Litsea sericea, Maddenia himalaica, Magnolia globosa, Pnax pseudo-ginseng, Rhododendron falconeri, R. hodgsonis, R. keysii, Rubus calophyllus, R. pentagonus,*

				Sorbus thibetica, Tsuga dumosa, Viburnum mullaha
9	Fir Forest	FIFr	• Occurs in the highest ridges of Bhutan below tree line, where huge tracts are covered by no other tree species than Fir (*Abies densa*) and some Hemlock and Birch in places. • Luxuriant undergrowth of Rhododendrons and other shrubs with many small herbs on mossy ground layer are found. • As tree lines are approached, the firs become stunted and are mixed with Junipers and smaller Rhododendron species • **Altitudinal range: 3300-3800 m**	*Abies densa, Arundinaria maling, Betula utilis, Bryicarpum himalaicum, Daphne bholua,* *Juniperus pseudosabina, Maddenia himalaica, Primula denticulate, Prunus rufa, Rheum acuminatum, Rhododendron cinnabarinum, R. hodgsonii, Ribes tikare, Rubus fragariodes, Skimmia laureola, Sorbus foliolosa, Viburnum nervosum*
10	Juniper-Rhododendron Scrub	JUSc	• Moist scrub vegetation occurring above treeline throughout Northern and Central Bhutan • Consists of scattered shrubs of *Junipers*, *Rhododendron* and *Potentilla arbuscula* but with rich herb layer appearing during the monsoon • Damp grassy meadow commonly found in this zone • **Altitudinal range: 3700-4200 m**	*Gaultheria trichophylla, Juniperus recurva, J. squamata, Morina nepalensis, Pedicularis megalantha, Phlomis tibetica, Potentilla arbuscula, Primula sikkimensis, Rhodendron lepidotum, Thalictrum chelidonii, Trollius purnilus*
11	Dry Alpine Scrub	DASc	• More xerophytic vegetation found • Higher altitude than Juniper-Rhododendron Scrub • **Altitudinal range: 4000-4600 m**	*Aconitum orochryseum, Astragalus acaulis, Chesneya nubigena, Cremanthodium thomsonii, Ephedra gerardiana, Meconopsis calderiana, Rheum nobile, Rhododendron anthopogon, Salix lindleyana, Saussurea gossypiphora, S. obvallata, Saxifraga moorcroftiana, Tanacetum gossypinum, Thermopsis barbata*

Annexure VII: List of Tree Species

Species code	Botanical Name	Family	Common Name			
			Dzongkha	English	Tshanglakha	Lhotshamkha
1	*Abies densa*	Pinaceae	Dhungshing	Fir	Waang shing	Gobresalla
2	*Acacia auriculiformis*	Leguminosae				Akasmoni
3	*Acacia catechu*	Leguminosae				Khair
4	*Acacia lenticularis*	Leguminosae				Kakur
5	*Acacia mearnsii*	Leguminosae		Black wattle		
6	*Acacia* spp.	Leguminosae				
7	*Acer campbellii*	Sapindaceae	Chalam	Maple	Sermaling shing/Busung Jashing	
8	*Acer laevigatum*	Sapindaceae				Putli
9	*Acer oblongum*	Sapindaceae				
10	*Acer* spp.	Sapindaceae				
11	*Acrocarpus fraxinifolius*	Leguminosae	Cha shing		Choktse shing	Mandalhy
12	*Actinodaphne obovata*	Lauraceae				
13	*Actinodaphne* spp.	Lauraceae				
14	*Acuba* spp.	Lauraceae				
15	*Adina cordifolia*	Rubiaceae				Haldu, Karan
16	*Aesculus assamica*	Sapindaceae		Horse chestnut		Satpati
17	*Agapetes saligna*	Ericaceae				
18	*Aglaia spectabilis*	Meliaceae				
19	*Agrostistachys borneensis*	Euphorbiaceae				
20	*Ailanthus excelsa*	Simaroubaceae				Maharukh
21	*Ailanthus grandis*	Simaroubaceae	Poeka shing		Pokar shing	
22	*Ailanthus integrifolia*	Simaroubaceae				Gokul
23	*Ailanthus* spp.	Simaroubaceae				
24	*Alangium alpinum*	Cornaceae				Galasu
25	*Alangium chinense*	Cornaceae	Luma shing			
26	*Alangium* spp.	Cornaceae				
27	*Albizia falcataria*	Leguminosae				
28	*Albizia julibrissin*	Leguminosae				
29	*Albizia lebbeck*	Leguminosae				Kalosiris
30	Albizia lucidior	Leguminosae				
31	*Albizia odoratissima*	Leguminosae				Karkursiris
32	*Albizia procera*	Leguminosae				Setosiris
33	*Albizia* spp.	Leguminosae				
34	*Alcimandra cathcartii*	Magnoliaceae		Golden trumpet		Titechamp
35	*Alcimandra* spp.	Magnoliaceae				
36	*Alnus nepalensis*	Betulaceae	Gama	Alder		
37	*Alnus* spp.	Betulaceae				
38	*Alstonia neriifolia*	Apocynaceae				
39	*Alstonia scholaris*	Apocynaceae				
40	*Altingia excelsa*	Altingiaceae				Setikath, Jhikri, jutuli
41	*Amoora rohituka*	Meliaceae				Lahasune

42	*Amoora spp.*	Meliaceae				
43	*Amoora wallichii*	Meliaceae				Lali, Amari
44	*Anogeissus latifolia*	Combretaceae				
45	*Anthocephalus cadamba*	Rubiaceae				Kadam
46	*Aphanamixis polystachya*	Meliaceae			wagorey doroshing	
47	*Aphanamixis spp.*	Meliaceae				
48	*Aquilaria malaccensis*	Thymelaeaceae	Aarnag	Eaglewood	Aarnag	Agoor/Agar
49	*Artocarpus chama*	Moraceae			Yitsu sing	Lathar
50	*Artocarpus heterophyllus*	Moraceae	Dam-zay shing		Dremling sey	Rukkathal
51	*Artocarpus hirsuta*	Moraceae			Aini koko	
52	*Artocarpus lacucha*	Moraceae				barrar, dewa
53	*Artocarpus spp.*	Moraceae				
54	*Aucuba himalaica*	Garryaceae				
55	*Azadirachta indica*	Meliaceae	Ja shing		Lhyra shing	Bakaina, Lhem
56	*Baccaurea ramiflora*	Phyllanthaceae				Kusum
57	*Baccauria spp.*	Phyllanthaceae				
58	*Barleria prionitis*	Acanthaceae				
59	*Bauhinia purpurea*	Leguminosae	Zibzibshing		Pegpeyposhing	
60	*Bauhinia sp.*	Leguminosae				
61	*Bauhinia variegata*	Leguminosae	Ruchashing		Ruchashing	Koiralo
62	*Beilschmiedia dalzellii*	Lauraceae				Tarshing
63	*Beilschmiedia gammieana*	Lauraceae			Golong shing	Tarshing
64	*Beilschmiedia roxburghiana*	Lauraceae				Thulotarshing
65	*Beilschmiedia sikkimensis*	Lauraceae				
66	*Beilschmiedia spp.*	Lauraceae				
67	*Benthamidia capitata*	Cornaceae	Phoetshe		Namenpa shing	Ramkatar
68	*Betula alnoides*	Betulaceae	Taap shing	Birch	Chaar shing	Saur
69	*Betula spp.*	Betulaceae		Birch		
70	*Betula utilis*	Betulaceae	La taap		Phuga chaar shing	Bhojpatra
71	*Bischofia javanica*	Phyllanthaceae	Goile shing	Black jack		Kanjal
72	*Boehmeria rugulosa*	Urticaceae			Dongtsong	Dar
73	*Bombax ceiba*	Malvaceae	Pemageyer shing	Red Cotton Tree	Pemageyershing	Simal
74	*Brassaiopsis hainla*	Araliaceae				Chuletro
75	*Brassaiopsis hispida*	Araliaceae				Phutta
76	*Brassaiopsis mitis*	Araliaceae				Chuletro
77	*Brassaiopsis spp.*	Araliaceae				Chuletro
78	*Bridelia retusa*	Phyllanthaceae	Treta shing		Menchha shing	Gayo, Gaumbha, kuir, kulir
79	*Bridelia tomentosa*	Phyllanthaceae				Muse Gayo
80	*Callicarpa arborea*	Lamiaceae	Khalema		Jeesey shing	Guyelo
81	*Calophyllum polyanthum*	Clusiaceae				
82	*Camellia kissii*	Theaceae	Yangchen metog		Hinguwa	
83	*Canarium sikkimense*	Burseraceae		Hornbeam		Gokul Dhup
84	*Carpinus viminea*	Betulaceae	Rutoshing		lungshing	

85	*Caryota urens*	Arecaceae	Dung Dung kha			
86	*Cassia fistula*	Leguminosae	Chakap-Juma shing		Dongkashing	Rajbirse
87	*Cassia siamea*	Leguminosae	Minjuri			Minjuri
88	*Castanopsis hystrix*	Fagaceae	Sokey		Tshe shing	Katus
89	*Castanopsis indica*	Fagaceae	Sokey		Tshe shing	Aule Katus
90	*Castanopsis lanceifolia*	Fagaceae				Patle katus
91	*Castanopsis spp.*	Fagaceae				
92	*Castanopsis tribuloides*	Fagaceae	Sokey			Musrekatus
93	*Cedrela toona*	Meliaceae				Tooni
94	*Celtis australis*	Cannabaceae	Phantang		Sok sokpa shing	Khari
95	*Choerospondias axillaris*	Anacardiaceae	Charra shing		Throong-chung shing	Lapshi
96	*Chukrasia tabularis*	Meliaceae	Chuzim			Halonre, Katli
97	*Cinnamomum bejolghota*	Lauraceae	Drongdo		Tespar shng chilloo	Bhhalesinkoli
98	*Cinnamomum glaucescens*	Lauraceae	Phagpa neng shing		Shingtsazim	Kawla or Malagiri
99	*Cinnamomum impressinervium*	Lauraceae				Sissi, Korsane
100	Cinnamomum javanicum	Lauraceae				Dalchini
101	*Cinnamomum spp.*	Lauraceae				
102	*Cinnamomum tamala*	Lauraceae				Tejpat
103	*Cordia grandis*	Boraginaceae				
104	*Cordia obliqua*	Boraginaceae				
105	Coriaria nepalensis	Coriariaceae	Limphu shing		Thabshing	
106	*Corylopsis himalayana*	Hamamelidaceae				
107	*Corylus ferox*	Betulaceae				
108	*Croton himalaicus*	Euphorbiaceae				
109	*Croton tiglium*	Euphorbiaceae	Lapcha			
110	*Cryptomeria japonica*	Cupressaceae	Ja tshen shing		Japan shoogpu	Dhupi
111	*Cupressus corneyana*	Cupressaceae	Tshenden shing			
112	*Cupressus spp.*	Cupressaceae				
113	*Cyathea spinulosa*	Cyatheaceae				
114	*Dalbergia latifolia*	Leguminosae		Rosewood		Satisal
115	*Dalbergia sericea*	Leguminosae	Pchang			Bandre siris
116	*Dalbergia sissoo*	Leguminosae	Jesengshing or Tshe-nen shing		Sissoo shing	Sissoo
117	*Daphniphyllum chartaceum*	Daphniphyllaceae	Juru shing		Awa shing	Chandan
118	*Daphniphyllum himalense*	Daphniphyllaceae				Chandan
119	*Delonix regia*	Leguminosae				Gul Mohar
120	*Desmodium oojeinense*	Leguminosae				
121	*Dillenia indica*	Dilleniaceae				Panchphale
122	*Dillenia pentagyna*	Dilleniaceae				Tantri
123	*Diploknema butyracea*	Sapotaceae	Yeeka shing		Peen shing	
124	*Dipterocarpus macrocarpus*	Dipterocarpaceae			Hollong	
125	*Drimycarpus racemosus*	Anacardiaceae				

126	*Drypetes indica*	Putranjivaceae				
127	*Duabanga grandiflora*	Lythraceae	Patang shing		Bikaling shing	Lampate
128	*Echinocarpus decicarpus*	Elaeocarpaceae				Gobrel
129	*Elaeocarpus sikkimensis*	Elaeocarpaceae				Bhadrase
130	*Elaeocarpus sphaericus*	Elaeocarpaceae				Rhudrax
131	Elaeocarpus varunua	Elaeocarpaceae				Bhadrase
132	*Engelhardtia spicata*	Juglandaceae				Mauwa
133	*Enkianthus deflexus*	Ericaceae				
134	*Eriobotrya petiolata*	Rosaceae				Maya kath
135	*Eriobtrya bengalensis*	Rosaceae				Maya kath
136	*Erythrina arborescens*	Leguminosae	Chatshey shing		Karshing	
137	*Erythrina spp.*	Leguminosae				Phaledo
138	*Erythrina stricta*	Leguminosae				Phaledo
139	*Erythrina suberosa*	Leguminosae				Phaledo
140	*Eucalyptus camaldulensis*	Myrtaceae	Tobdashin	Red gum		
141	*Eucalyptus globulus*	Myrtaceae	Tobdashin	Blue gum		
142	*Eucalyptus spp.*	Myrtaceae				
143	*Euphorbia spp.*	Euphorbiaceae				
144	*Eurya acuminata*	Pentaphylacaceae				
145	*Eurya cavinervis*	Pentaphylacaceae				
146	*Eurya cerasifolia*	Pentaphylacaceae				
147	*Eurya spp.*	Pentaphylacaceae				
148	Evodia fraxinifolia	Rutaceae				Khanakpa
149	*Exbucklandia populnea*	Hamamelidaceae	Chenjushing		Lem shing	
150	*Ficus auriculata*	Moraceae	Baku shing		Chongma	Lhbharo
151	*Ficus glaberrima*	Moraceae			Pangthang chongma	Karpoa
152	*Ficus hispida*	Moraceae	Koksa			Koksa
153	*Ficus lacor*	Moraceae				
154	*Ficus neriifolia*	Moraceae			Rui shing	
155	*Ficus semicordata*	Moraceae	Ridang shing		Barachongma	Khalhw
156	*Ficus spp.*	Moraceae				
157	*Ficus subincisa*	Moraceae			Gugai chongma	Looteykhanium
158	*Fraxinus spp.*	Moraceae				
159	*Fraxinus xanthoxyloides*	Oleaceae				Lankuri
160	*Gamblea ciliata*	Araliaceae				
161	*Garcinia stipulata*	Clusiaceae				
162	*Garuga pinnata*	Burseraceae				Dur Lampate
163	*Glochidion assamicum*	Phyllanthaceae				
164	*Glochidion bhutanicum*	Phyllanthaceae			Kotokmo shing	
165	*Glochidion thomsonii*	Phyllanthaceae				
166	*Gmelina arborea*	Lamiaceae	Gamar shing		Kholomshing	Khamari
167	*Grevillea robusta*	Proteaceae		Silver oak		
168	*Grewia asiatica*	Malvaceae				
169	*Grewia optiva*	Malvaceae				
170	*Gynocardia odorata*	Achariaceae	Lentem			

171	*Helicia nilagirica*	Proteaceae				
172	*Heteropanax fragrans*	Araliaceae				
173	Holoptelea integrifolia	Ulmaceae				
174	*Hovenia acerba*	Rhamnaceae	Pumoo ruto		Froomtegpa shing	Bhogote
175	*Hovenia dulcis*	Rhamnaceae				Bange Kath
176	*Hymenodictyon excelsum*	Rubiaceae	Lalikaram			Lalikaram
177	*Illicium griffithii*	Schisandraceae	Dhom leeshi		Khaila tseenang	
178	Itea macrophylla	Iteaceae				
179	*Jambosa formosa*	Myrtaceae				Ambake
180	*Juglans regia*	Juglandaceae	Ta shing		Khey shing	Okhar
181	*Juniperus pseudosabina*	Cupressaceae	Shoop shing	Black juniper	Shoop shing	
182	*Juniperus recurva*	Cupressaceae	Shoop shing	Weeping Blue juniper	Shoop shing	
183	*Juniperus spp.*	Cupressaceae				
184	*Juniperus squamata*	Cupressaceae	Shoop shing		Shoogpo shing	
185	*Kydia calycina*	Malvaceae			Pichala or Chamaktangshing	Kuninde, pichala
186	*Lagerstroemia hirsuta*	Lythraceae	Dongka shng		Buram shing	Jarul
187	*Lagerstroemia parviflora*	Lythraceae	Dongka shng		Buram shing	Sidha/Buri Damera
188	Larix griffithii	Pinaceae	Zashing	Larch		
189	*Leucaena leucocephala*	Leguminosae				
190	*Lindera pulcherrima*	Lauraceae			Sengkyermey shing	Sissi
191	*Lithocarpus dealbatus*	Fagaceae			Shakor shing	Askaula
192	*Lithocarpus elegans*	Fagaceae			Shakor shing	Askaula
193	*Lithocarpus fenestratus*	Fagaceae	Thasa sokey		Sodhka tshai shing	
194	*Lithocarpus pachyphyllus*	Fagaceae	Sokey		Tshai shing	Sungurekatus
195	*Litsea hookeri*	Lauraceae				
196	*Litsea monopetala*	Lauraceae			Seychhanglu shing	Kutmeri
197	*Lyonia ovalifolia*	Ericaceae	Zentu shing		Shajuley shing	Angeri
198	*Lyonia spp.*	Ericaceae				
199	*Lyonia villosa*	Ericaceae				Lek angeri
200	*Macaranga denticulata*	Euphorbiaceae				
201	*Macaranga pustulata*	Euphorbiaceae				
202	*Macaranga spp.*	Euphorbiaceae				
203	*Machilus spp.*	Euphorbiaceae				
204	*Maclura cochinchinensis*	Moraceae				
205	*Macropanax spp.*	Araliaceae				
206	*Macropanax undulatus*	Araliaceae				
207	*Maddenia himalaica*	Rosaceae				
208	*Maesa chisia*	Primulaceae				
209	*Magnolia campbellii*	Magnoliaceae	Gong gong metog		Dzamling metog	Ghoge champ
210	*Magnolia globosa*	Magnoliaceae				Kokrechamp
211	*Magnolia pterocarpa*	Magnoliaceae				
212	*Magnolia spp.*	Magnoliaceae				
213	*Mallotus philippensis*	Euphorbiaceae				Rohini
214	*Mallotus spp.*	Euphorbiaceae				

215	*Malus spp.*	Euphorbiaceae				
216	*Mangifera indica*	Anacardiaceae	Am chukuli		Aam sey	Aam
217	*Mangifera spp.*	Anacardiaceae				
218	*Mangifera sylvatica*	Anacardiaceae				Chucheamp
219	*Melia azedarach*	Meliaceae			Jashing / Ngerashing	Kakaina
220	*Mesua ferrea*	Calophyllaceae		Ironwood		Nageswar
221	*Michelia cathcartii*	Magnoliaceae				Titechamp
222	*Michelia champaca*	Magnoliaceae	Kha shi		Kar shing orChampey shing	Champ
223	*Michelia doltsopa*	Magnoliaceae	Kha shi		Kar shingor Champey shing	Rani champ
224	*Michelia kisopa*	Magnoliaceae	Kha shi		Kar shing or Champey shing	
225	*Michelia spp.*	Magnoliaceae				
226	*Michelia velutina*	Magnoliaceae				Phusre, guaychamp
227	*Miliusa macrocarpa*	Annonaceae				
228	*Mimosa pudica*	Leguminosae				
229	Mitrephora harae	Annonaceae				
230	*Mohania nepalensis*	Berberidaceae				
231	*Mohania spp.*	Berberidaceae				
232	*Morus alba*	Moraceae				
233	*Morus laevigata*	Moraceae				Kimbu
234	*Morus macroura*	Moraceae	Tshendey			Bola
235	*Morus spp.*	Moraceae				
236	*Myrica esculenta*	Myricaceae	Chisishing			Kaphal
237	*Neolitsea foliosa*	Lauraceae				
238	*Nyssa javanica*	Cornaceae	Pasjamshing		Lai momnang	Lekhchilau
239	*Oreocnide rubescens*	Urticaceae				
240	*Oroxylum indicum*	Bignoniaceae	Tshampaka metog		Namkhaling metog	
241	*Osmanthus spp.*	Oleaceae				
242	*Osmanthus suavis*	Oleaceae				
243	*Ostodes paniculata*	Euphorbiaceae				Bepari
244	*Pandanus nepalensis*	Pandanaceae				
245	*Pandanus sikkimensis*	Pandanaceae				Taari ka
246	*Pandanus spp.*	Pandanaceae				
247	Parasassafras confertiflorum	Lauraceae				
248	*Pentapanax racemosus*	Araliaceae				Chinde
249	*Pentapanax spp.*	Araliaceae				
250	*Persea bootanica*	Lauraceae				
251	*Persea clarkeana*	Lauraceae				Phampal
252	*Persea fructifera*	Lauraceae			Golee shing	Lapchephal
253	*Persea glaucescens*	Lauraceae				
254	*Persea spp.*	Lauraceae				
255	*Peveta spp.*	NA				
256	*Phoebe attenuata*	Lauraceae	Theinab			Angare
257	*Phoebe goalparensis*	Lauraceae				Bonsum
258	*Phoebe hainesiana*	Lauraceae				
259	*Phoebe lanceolata*	Lauraceae				Jhakrikath
260	*Phoebe spp.*	Lauraceae				

261	*Phoenix acaulis*	Arecaceae				
262	*Phoenix rupicola*	Arecaceae				
263	*Phyllanthus emblica*	Phyllanthaceae	Churooshing		Churgensey shing	Amla
264	*Picea spinulosa*	Pinaceae	Bashing	Spruce		Kalosalla
265	*Pieris formosa*	Ericaceae	Kheb-chey or Shadhoog Dhoog Shing			Dhoogshing, Balu
266	*Pinus bhutanica*	Pinaceae	Tongphu			
267	*Pinus roxburghii*	Pinaceae	Thaetong	Chir Pine	Roi nang shing	Chir
268	*Pinus wallichiana*	Pinaceae	Tongphu	Blue pine	Chang shing	
269	*Piptanthus nepalensis*	Leguminosae				
270	*Plectocomia himalayana*	Arecaceae				
271	*Podocarpus spp.*	Podocarpaceae				
272	*Polyalthia simiarum*	Annonaceae				
273	*Populus ciliata*	Salicaceae	Kashing		Kashing	Pipal pate
274	*Populus rotundifolia*	Salicaceae	Kashing chungku			
275	*Populus spp.*	Salicaceae				
276	*Prinsepia utilis*	Rosaceae				
277	*Prunus carmesina*	Rosaceae				
278	*Prunus cerasoides*	Rosaceae	Paiyun			
279	*Prunus nepalensis*	Rosaceae				
280	*Prunus spp.*	Rosaceae				
281	*Pterocarpus sinuata*	Fabaceae				
282	*Pterospermum acerifolium*	Malvaceae	Dha shom			Hatipaile
283	*Pterospermum spp.*	Malvaceae				
284	*Pterygota alata*	Malvaceae	Badam			
285	*Pyrus pashia*	Rosaceae	Lih	Pear	Litong	Lih
286	*Quercus glauca*	Fagaceae	Thonp shing		Thongpa shing	Musurephalan
287	*Quercus glutinosa*	Fagaceae				
288	*Quercus griffithii*	Fagaceae	Sisi		Bainang Shing	Kasru
289	*Quercus lamellosa*	Fagaceae	Bangka or Dhom sokey		Fangkhoima shing	Bajranth
290	*Quercus lanata*	Fagaceae	Ghoom		Betshinang shing	Banj
291	*Quercus leucotricophora*	Fagaceae	Ghoom		Betshinang shing	
292	*Quercus oxyodon*	Fagaceae				
293	*Quercus semecarpifolia*	Fagaceae	Bjishing		Betshi nang shing	
294	*Quercus semiserrata*	Fagaceae				Khosru
295	*Quercus spp.*	Fagaceae				
296	*Rhododendron arboreum*	Ericaceae	Eto meto		Zhu daang metog	Guras
297	*Rhododendron barbatum*	Ericaceae				
298	Rhododendron campylocarpum	Ericaceae				
299	*Rhododendron cinnabarinum*	Ericaceae				
300	*Rhododendron falconeri*	Ericaceae				
301	*Rhododendron grande*	Ericaceae				

302	*Rhododendron hodgsonii*	Ericaceae				
303	*Rhododendron kendrickii*	Ericaceae				
304	*Rhododendron kesangiae*	Ericaceae				
305	*Rhododendron maddenii*	Ericaceae				
306	*Rhododendron nevium*	Fagaceae				
307	*Rhododendron nudiflorum*	Ericaceae				
308	*Rhododendron spp.*	Fagaceae				
309	*Rhododendron succothii*	Ericaceae				
310	*Rhododendron thomsonii*	Ericaceae				
311	*Rhododendron wallichii*	Ericaceae				
312	*Rhododendron wightii*	Ericaceae				
313	*Rhus chinensis*	Anacardiaceae				
314	*Rhus hookeri*	Anacardiaceae			Jar shing	Bhalayo
315	*Rhus paniculata*	Anacardiaceae	Choka shing		Khyr khobtang	
316	*Rhus spp.*	Anacardiaceae				
317	*Rhus succedanea*	Anacardiaceae	Say shing			
318	*Robinia pseudoacacia*	Leguminosae	Tshang tsha shing		Zoo tsee shing	
319	*Salix babylonica*	Salicaceae	Changma shing	Weeping willow	Changma shing	
320	*Salix bhutanensis*	Salicaceae			Borang changma	
321	Salix calyculata	Salicaceae			Kholongchuu changma	
322	*Salix daltoniana*	Salicaceae	Changma nab		Changma nagpo	
323	*Salix excelsa*	Salicaceae	Haa changma			
324	*Salix lindleyana*	Salicaceae	Jowodhoor shing changma			
325	*Salix longiflora*	Salicaceae	Changma chungku			
326	*Salix myrtillacea*	Salicaceae	Lingzhi changma			
327	*Salix nepalensis*	Salicaceae				
328	*Salix obscura*	Salicaceae			Changma barma	
329	*Salix oreophila*	Salicaceae	Phu changma			
330	*Salix spp.*	Salicaceae				
331	*Salix thomsoniana*	Salicaceae	Chendebje e changma			
332	*Salix wallichiana*	Salicaceae	Langma			
333	*Sapindus rarak*	Sapindaceae	Nakupani		Killing Shing	Ritha
334	*Sapindus spp.*	Sapindaceae				
335	*Sapium baccatum*	Euphorbiaceae	Seleng			
336	*Sapium eugeniifolium*	Euphorbiaceae				Phirphire, Pipalpate
337	*Sapium insigne*	Euphorbiaceae				
338	*Sarcochlamys pulcherrima*	Urticaceae				
339	*Sarcosperma arboreum*	Sapotaceae				Kalikath

340	*Sauraja nepaulensis*	Actinidiaceae	Mangma dom		Mingdormashing	
341	*Schefflera impressa*	Araliaceae				
342	*Schefflera spp.*	Araliaceae				
343	*Schima wallichii*	Theaceae	Puyam or gogra		Zalashing	
344	*Schleichera spp.*	Sapindaceae				
345	*Shorea robusta*	Dipterocarpaceae		Sal		
346	*Sigesbeckia orientalis*	Compositae				
347	*Sloanea decicarpus*	Elaeocarpaceae				
348	*Sloanea sterculiacea*	Elaeocarpaceae		Schefflera impressa		
349	*Sloanea tomentosa*	Elaeocarpaceae				
350	*Sorbus griffithii*	Rosaceae				Pasi
351	*Sorbus microphylla*	Rosaceae	Tsema shing			Sanupasi
352	*Sorbus spp.*	Rosaceae				
353	*Spondias mangifera*	Anacardiaceae				Amaro
354	*Spondias pinnata*	Anacardiaceae	Bochong shing		Ambar shing	Amaro
355	*Spondias spp.*	Anacardiaceae				
356	*Stephania dludra*	Menispermaceae				
357	*Sterculia alata*	Malvaceae				
358	*Sterculia spp.*	Malvaceae				
359	*Sterculia villosa*	Malvaceae			Phrangshing	Odal/godgudal
360	*Stereospermum chelonoides*	Bignoniaceae				
361	*Stereospermum personatum*	Bignoniaceae				Parari
362	*Stereospermum sp.*	Bignoniaceae				
363	*Symplocos dryophila*	Symplocaceae				
364	*Symplocos glomerata*	Symplocaceae	Dhomzim		Zeem shing	Khara
365	*Symplocos lucida*	Symplocaceae	Dhomma shing			Khara
366	*Symplocos paniculata*	Symplocaceae	Pangtse shing		Zeem shing	
367	*Symplocos spicata*	Symplocaceae				Khara/ Kholme
368	*Symplocos spp.*	Symplocaceae				
369	*Syzygium claviflorum*	Myrtaceae				Harrejammuna
370	*Syzygium cumini*	Myrtaceae	Nyasse shing		Mentse sey shing	Jammun
371	*Syzygium formosum*	Myrtaceae				
372	*Syzygium spp.*	Myrtaceae				
373	*Talauma hodgsonii*	Magnoliaceae	Khem		Kadering shing	Balukath
374	*Tamarindus indica*	Leguminosae				Titiri
375	*Taxus baccata*	Taxaceae	Keyrangshing	Yew		
376	*Tectona grandis*	Lamiaceae	Tshomar shing	Teak	Teak shing	
377	*Terminalia alata*	Combretaceae	Ala shing		Baroo ata shing	Pakhasaj
378	*Terminalia arjuna*	Combretaceae				Arjun
379	*Terminalia bellirica*	Combretaceae	Baroo			
380	Terminalia bialata	Combretaceae		White chaglan		
381	*Terminalia catappa*	Combretaceae			Leykhulong shing	Badam
382	*Terminalia chebula*	Combretaceae	Aaroo		Aaroo	Harra

383	*Terminalia myriocarpa*	Combretaceae	Bhoop shing	Hollock	Bakalo shing	Panisaj
384	*Terminalia procera*	Combretaceae				Badam
385	*Terminalia spp.*	Combretaceae				
386	*Terminalia tomentosa*	Combretaceae				Pakhasaj, Sain
387	*Tetradium fraxinifolium*	Rutaceae	Dongmar shing			
388	*Tetrameles nudiflora*	Tetramelaceae	Kadong shing			Mainakath
389	*Toona ciliata*	Meliaceae				Tooni/ poma
390	*Toona spp.*	Meliaceae				
391	*Toona sureni*	Meliaceae				Toon
392	*Toricellia tiliifolia*	Cornaceae				
393	*Trema integrifolia*	Ulmaceae				
394	*Trevesia palmata*	Araliaceae				
395	*Trevesia spp.*	Araliaceae				
396	Trevia nudiflora	Euphorbiaceae				Pitali, ramritta
397	*Tsuga dumosa*	Pinaceae	Sey shing	Hemlock		Tengresallam
398	*Turpinia pomifera*	Staphyleaceae				Thali
399	*Ulmus lanceifolia*	Ulmaceae		Elm		Aulepipli/Sandanpipli
400	*Vaccinium spp.*	Ericaceae				
401	*Viburnum cylindricum*	Adoxaceae				
402	*Viburnum erubescens*	Adoxaceae				
403	*Viburnum nervosum*	Adoxaceae				
404	*Viburnum spp.*	Adoxaceae				
405	*Vitex heterophylla*	Lamiaceae				Panchpate
406	*Vitex negundo*	Lamiaceae				
407	*Wallichia densiflora*	Arecaceae				Rang bhang
408	*Walsura tubulata*	Meliaceae				Phalame
409	*Wrightia arborea*	Apocynaceae				
410	*Zanthoxylum armatum*	Rutaceae			Thingye Gee shing	
411	*Zanthoxylum budrunga*	Rutaceae				Timur
412	*Zanthoxylum rhetsa*	Rutaceae				
413	*Zanthoxylum spp.*	Rutaceae				
414	*Ziziphus spp.*	Rhamnaceae				

Note: The list is developed based on Flora of Bhutan and trees recorded in First National Forest Inventory. List of the trees will be continuously updated and additional species codes will be assigned for new addition.

Annexure VIII: List of Shrubs

The List of Shrub has been listed from the Flora of Bhutan, Grierson and Long. The list will be subject to change and will be amended as when more authoritative information is available. Any addition to the list will be conveyed to the NFI crew.

SN	Botanical Name	Family	Local Name /Common name
1	*Acacia farnesiana*	Leguminosae	
2	*Acacia gageana*	Leguminosae	Arare Khanra(Lh)
3	*Acalpha hispida*	Euphorbiaceae	
4	*Acalpha wilkesiana*	Euphorbiaceae	
5	*Acronychia pedunculata*	Rutaceae	Puanle(Lh)
6	*Actinidi callosa*	Actinidiaceae	Tekiphal(Lh)
7	*Actinidi strigosa*	Actinidiaceae	
8	*Alchornea mollis*	Euphorbiaceae	
9	*Alchornea tiliifolia*	Euphorbiaceae	Sanu Malata(Lh)
10	*Allamanda cathartica*	Apocynaceae	Golden(Eng)
11	*Allophylus chartaceus*	Sapindaceae	
12	*Alstonia neriifolia*	Apocynaceae	Chatiwan(Lh)
13	*Alstonia sebusi*	Apocynaceae	
14	*Antidesma acidum*	Euphorbiaceae	Archal(Lh)
15	*Antidesma acuminatum*	Euphorbiaceae	Kalo Bilaune(Lh)
16	*Antidesma ghaesembilla*	Euphorbiaceae	Chipli(Lh)
17	*Antistrophe oxantha*	Myrsinaceae	
18	*Ardisia colorata*	Myrsinaceae	
19	*Ardisia crispa*	Myrsinaceae	
20	*Ardisia macrcarpa*	Myrsinaceae	Ressin (Dz) Damai Gera, Khao Argale (Lh)
21	*Ardisia thyrisiflora*	Myrsinaceae	
22	*Arenga westerhoutii*	Arecaceae	
23	*Artabotrys caudatus*	Annonaceae	Kali Lahara(Lh)
24	*Artabotrys hexapetalus*	Annonaceae	Katar Champa(Lh)
25	*Asidocarya uvifera*	Menispermaceae	
26	*Aspidoptery glabriuscula*	Malpighiaceae	
27	*Baliospermum corymbiferum*	Euphorbiaceae	
28	*Baliospermum densiflorum*	Euphorbiaceae	
29	*Baliospermum montanum*	Euphorbiaceae	Harital(Lh)
30	*Baliospermum nepalense*	Euphorbiaceae	
31	*Bauhinia purpurea*	Leguminosae	Zib zib shing (Dz) Pegpeyposhing (Ts) Tanki (Lh)
32	*Bauhinia variegata*	Leguminosae	Rucha shing(Dz) Koerlo or Taki(Lh)
33	*Berberis angulosa*	Berberidaceae	Chutro(Lh)
34	*Berberis aristata*	Berberidaceae	Kerpa zoo(Ts) Chutro(Lh)
35	*Berberis asiatica*	Berberidaceae	Kepai tsang(Dz) Kerpa zoo (Ts)
36	*Berberis beesiana*	Berberidaceae	
37	*Berberis griffithiana*	Berberidaceae	
38	*Berberis hookeri*	Berberidaceae	
39	*Berberis insignis*	Berberidaceae	Chutro(Lh)
40	*Berberis macrosepala*	Berberidaceae	
41	*Berberis praecipua*	Berberidaceae	Kepe tsang(Dz)
42	*Berberis thomsoniana*	Berberidaceae	Chutro(Lh)
43	*Berberis tsarica*	Berberidaceae	
44	*Berberis virescens*	Berberidaceae	
45	*Bougavinvillea jussieu*	Nyctaginaceae	
46	*Breynia retusa*	Euphorbiaceae	
47	*Bridelia retusa*	Euphorbiaceae	Gayo(Lh)

48	*Bridelia Sikkimensis*	Euphorbiaceae	Gayo(Lh)
49	*Bridelia stipularis*	Euphorbiaceae	Lahara Gayo(Lh)
50	*Bridelia tomentosa*	Euphorbiaceae	Muse Gayo(Lh)
51	*Brucia mollis*	Simaroubaceae	
52	*Caesalpinia cucullata*	Leguminosae	Tse Hein(Dz) , Bokshi Khanra (Lh)
53	*Caesalpinia decapetala*	Leguminosae	Tatse Tsang, Tsangi Metog(Dz)
54	*Caesalpinia pulcherrima*	Leguminosae	
55	*Cajanus cajan*	Leguminosae	Pigeon pea(Eng)
56	*Calamus acanthospathus*	Arecaceae	Pukka bet(Lh)
57	*Calamus erectus*	Arecaceae	Phekri(Lh)
58	*Calliandra haematocephala*	Leguminosae	
59	*Callicarpa longifolia*	Verbenaceae	Sanu Guenyhlo(Lh)
60	*Callicarpa macrophylla*	Verbenaceae	
61	*Callicarpa rubella*	Verbenaceae	Nangay Wam(Dz) Jinlab sey shing(Ts)
62	*Camellia kissii*	Theaceae	Hinguwa(Lh)
63	*Camellia sinensis*	Theaceae	Jashing(Dz) Jashing (Ts) Cha(Lh)
64	*Campylotropis griffithii*	Leguminosae	
65	*Campylotropis speciosa*	Leguminosae	
66	*Capparis acutifolia*	Capparaceae	Chila pati(Lh)
67	*Capparis assamica Hook.f*	Capparaceae	
68	*Capparis cantoniensis*	Capparaceae	
69	*Capparis multiflora Hook.f*	Capparaceae	
70	*Capparis olacifolia Hook.f*	Capparaceae	Naski, Hais(Lh)
71	*Capparis sikkimensis*	Capparaceae	
72	*Caragana jubata*	Leguminosae	
73	*Caragana sukiensis*	Leguminosae	
74	*Caryopteris bicolor*	Verbenaceae	Sun Pati(Lh)
75	*Caryopteris paniculata*	Verbenaceae	
76	*Cassia alata*	Leguminosae	Dhongkala dhaza(Ts)
77	*Cassia occidentalis*	Leguminosae	
78	*Cassia surattensis*	Leguminosae	
79	*Ceratostigma grifithii*	Plumbaginaceae	
80	*Cereus peruvianus*	Cactaceae	Hedge Cactus (Eng)
81	*Ceriscoides campanulata*	Rubiaceae	
82	*Chassalia curviflora*	Rubiaceae	
83	*Chloranthus elatior*	Chloranthaceae	
84	*Choenomeles lagenaria*	Rosaceae	Khomang Shing(Ts)
85	*Cinnamomum glanduliferum*	Lauraceae	Kipchu shing(Dz), Kawla or malagiri(Lh)
86	*Cinnamomum glaucescens*	Lauraceae	Shingtsa zim(Dz) Phagpa neng shing (Ts) Ghansaray(Lh)
87	*Cinnamomum tenuipilis*	Lauraceae	
88	*Circaeaster agrestis*	Circaeasteraceae	
89	*Cissampelos pareira*	Menispermaceae	Bue roobjee (Dz) jing roo (Ts) Thamarke, Batulpati (Lh)
90	*Citrus medica*	Rutaceae	Humpa(Dz)
91	*Clausena excavate*	Rutaceae	
92	*Cleidion speciflorum*	Euphorbiaceae	Bepari(Lh)
93	*Clerodendrum bracteatum*	Verbenaceae	Yong ziwa shing(Ts) Chitu(Lh)
94	*Clerodendrum colebrookeanum*	Verbenaceae	Boka Kane(Lh)
95	*Clerodendrum hastatum*	Verbenaceae	
96	*Clerodendrum serratum*	Verbenaceae	Andekhi(Lh)
97	*Clerodendrum viscosum*	Verbenaceae	Chitu(Lh)
98	*Clerodendrum wallichii*	Verbenaceae	
99	*Cocculus laurifolius*	Menispermaceae	
100	*Codiaeum variegatum*	Euphorbiaceae	

101	*Colebrookea oppositifolia*	Labiatae	Dosro(Lh)
102	*Coriaria napalensis*	Coriariaceae	Limphu shi, Nimbo(Dz)
103	*Coriaria terminalis*	Coriariaceae	
104	*Corylopsis himalayana*	Hamamelidaceae	Grong Grongmo Shing(Ts)
105	*Cotoneaster acuminatus*	Rosaceae	
106	*Cotoneaster microphyllus*	Rosaceae	Katragpa roo(Ts) Brush jhar(Lh) Med: Japho Tsi Tsi,
107	*Cotoneaster nitidus*	Rosaceae	
108	*Cotoneaster racemiflorus*	Rosaceae	
109	*Cotoneaster rotundifolius*	Rosaceae	
110	*Cotoneaster rubens*	Rosaceae	
111	*Cotoneaster sanguineus*	Rosaceae	
112	*Cotoneaster sherriffii*	Rosaceae	
113	*Cotoneaster simonsii*	Rosaceae	
114	*Crotolaria alata*	Leguminosae	
115	*Crotolaria bracteata*	Leguminosae	
116	*Crotolaria capitata*	Leguminosae	
117	*Crotolaria cytisoides*	Leguminosae	
118	*Crotolaria pallid*	Leguminosae	
119	*Crotolaria tetragona*	Leguminosae	
120	*Croton bonplandianus*	Euphorbiaceae	Seytsala Ngyon(Ts)
121	*Croton joufra*	Euphorbiaceae	
122	*Croton roxburghii*	Euphorbiaceae	
123	*Cryptolepis buchanani*	Asclepiadaceae	Langchu Robji(Dz) Dude Lahara(Lh)
124	*Cyathula capitata*	Amaranthaceae	
125	*Cyathula tomentosa*	Amaranthaceae	Tagpa roba(Ts)
126	*Cyclea bicristata*	Menispermaceae	
127	*Decaisnea insignis*	Lardizabalaceae	
128	*Deeringia amaranthoides*	Amaranthaceae	Sa shing(Ts) Bakri sag(Lh)
129	*Desmodium caudatum*	Leguminosae	
130	*Desmodium concinum*	Leguminosae	
131	*Desmodium confertum*	Leguminosae	
132	*Desmodium elegans*	Leguminosae	Tatur Shi(Dz); Beymangrobu(Ts) ; Neptans Shing; Sarkinu(Lh)
133	*Desmodium gyroides*	Leguminosae	Mardum Kumchimo Shing(Ts)
134	*Desmodium heterocarpon*	Leguminosae	
135	*Desmodium khasianum*	Leguminosae	
136	*Desmodium laxiflorum*	Leguminosae	
137	*Desmodium microphyllum*	Leguminosae	
138	*Desmodium motorium*	Leguminosae	
139	*Desmodium multiflorum*	Leguminosae	
140	*Desmodium sequax*	Leguminosae	
141	*Desmodium trifolium*	Leguminosae	
142	*Desmodium triquetrum*	Leguminosae	
143	*Desmos chinensis*	Annonaceae	
144	*Desmos dumosus*	Annonaceae	Male Lahara(Lh)
145	*Deutzia corymbosa*	Philadelphaceae	
146	*Deutzia staminea*	Philadelphaceae	
147	*Dichroa febrifuga*	Hydrangceae	
148	*Dobinea vulgaris*	Anacardiaceae	Zumphu sengkormay(Ts)
149	*Dodonaea angustifolia*	Sapindaceae	
150	*Ehretia psilosiphon*	Boraginaceae	
151	*Elsholtzia frticosa*	Labiatae	Bhote(Lh)
152	*Embelia floribunda*	Myrsinaceae	Chiuri Amla Lahara(Lh)
153	*Embelia frondosa*	Myrsinaceae	
154	*Embelia ribes*	Myrsinaceae	Khubari(Ts)
155	*Eriosema himalaicum*	Leguminosae	
156	*Euchresta horsfieldii*	Leguminosae	

157	*Euphorbia leucocephala*	Euphorbiaceae	
158	*Euphorbia millii*	Euphorbiaceae	
159	*Euphorbia pulcherrima*	Euphorbiaceae	
160	*Euphorbia royleana*	Euphorbiaceae	
161	*Euptelea pleiosperma*	Eupteleaceae	
162	*Eurya acuminate*	Theaceae	Sanu Jhingni(Lh)
163	*Eurya cavinervis*	Theaceae	
164	*Fagerlindia fasciculata*	Rubiaceae	
165	*Fissistigma polyanthum*	Annonaceae	
166	*Flemengia bhutanica*	Leguminosae	
167	*Flemengia fruitculosa*	Leguminosae	
168	*Flemengia macrophylla*	Leguminosae	Batwasi(Lh)
169	*Flemengia strobilifera*	Leguminosae	
170	*Flueggea virosa*	Euphorbiaceae	Geykang Shing(Ts) , Darim Pate, Phalame(Lh)
171	*Forsythia intermedia*	Oleaceae	
172	*Fraxinus floribunda*	Oleaceae	Draythub (Dz) lakuri(Lh)
173	*Fraxinus paxiana*	Oleaceae	Lankuri(Lh)
174	*Gardenia augusta*	Rubiaceae	
175	*Garuga floribunda*	Burseraceae	Dabdabe(Lh)
176	*Glochidion acuminatum*	Euphorbiaceae	Latikath(Lh)
177	*Glochidion assamicum*	Euphorbiaceae	Haldikath(Lh)
178	*Glochidion bhutanicum*	Euphorbiaceae	Kotokmo Shing(Ts)
179	*Glochidion khasicum*	Euphorbiaceae	
180	*Glochidion nubigenum*	Euphorbiaceae	
181	*Glochidion oblatum*	Euphorbiaceae	
182	*Glochidion velutinum*	Euphorbiaceae	
183	*Gomphostemma parviflorum*	Labiatae	Kaman Dhusur(Dz)
184	*Gylcosmis cymosa*	Rutaceae	
185	*Gylcosmis pentaphylla*	Rutaceae	
186	*Heynea trijuga*	Meliaceae	Ankhataruwa(Lh)
187	*Himalrandia tetrasperma*	Rubiaceae	
188	*Hiptage bengalensis L.*	Malpighiaceae	Charpate Lahara(Lh)
189	*Holmskioldia sanguinea*	Verbenaceae	Chaling momnang(Ts) Chinese Hat Plant(Eng)
190	*Holobellia latifolia*	Lardizabalaceae	Enterobjay(Dz)
191	*Homonoia riparia*	Euphorbiaceae	Khola Ruis(Lh)
192	*Hoya lanceolata*	Asclepiadaceae	
193	*Hydrangea anomala*	Hydrangceae	
194	*Hydrangea aspera*	Hydrangceae	
195	*Hydrangea heteromalla*	Hydrangceae	
196	*Hydrangea macrophylla*	Hydrangceae	
197	*Hydrangea stylosa*	Hydrangceae	
198	*Hypericum choisianum*	Hypericaceae	
199	*Hypericum griffithii*	Hypericaceae	
200	*Hypericum hookerianum*	Hypericaceae	
201	*Hypericum sherriffii*	Hypericaceae	
202	*Hypericum uralum*	Hypericaceae	Urilo(Lh)
203	*Ichnocarpus frutescens*	Apocynaceae	Dude Lahara(Lh)
204	*Ichnocarpus polyanthus*	Apocynaceae	Dude Lahara(Lh)
205	*Illicium griffithii*	Illiciaceae	Dhom leeshi(Dz) Khaila tseenang (Ts) Star Anis(Eng)
206	*Indigofera dosua*	Leguminosae	Kumchingma Shing(Ts) ; Chiringgi Jhar(Lh)
207	*Indigofera atropurpurea*	Leguminosae	
208	*Indigofera cassioides*	Leguminosae	
209	*Indigofera cylindracea*	Leguminosae	
210	*Indigofera exilis*	Leguminosae	
211	*Indigofera hebepetala*	Leguminosae	
212	*Indigofera heterantha*	Leguminosae	

213	*Indigofera pseudoreticulata*	Leguminosae	
214	*Indigofera zollingeriana*	Leguminosae	
215	*Ipomea carnea*	Convolvuaceae	
216	*Isodon coetse*	Labiatae	
217	*Isodon rugosus*	Labiatae	Siluguka(Dz)
218	*Isodon ternifolius*	Labiatae	Peng-dong-dongla(Dz)
219	*Ixora coccinea*	Rubiaceae	
220	*Ixora javanica*	Rubiaceae	
221	*Ixora undulate*	Rubiaceae	Kalikat(Lh)
222	*Jasminum caudatum*	Oleaceae	Kagaji Phul(Lh)
223	*Jasminum dispermum*	Oleaceae	hare Lahara(Lh)
224	*Jasminum elongatum*	Oleaceae	
225	*Jasminum grandiflorum*	Oleaceae	
226	*Jasminum humile*	Oleaceae	
227	*Jasminum ianceolarium*	Oleaceae	
228	*Jasminum iaurifolium*	Oleaceae	
229	*Jasminum nepalense*	Oleaceae	
230	*Jasminum nervosum*	Oleaceae	
231	*Jasminum officinale*	Oleaceae	
232	*Jasminum sambac*	Oleaceae	Arabian Jasmine(Eng)
233	*Jasminum sempervirens*	Oleaceae	
234	*Jatropa curas*	Euphorbiaceae	Nera Khar Shing(Ts) Poison nut(Eng)
235	*Jatropa podagrica*	Euphorbiaceae	
236	*Juncus sphacelatus*	Juncaceae	
237	*Kadsura heteroclite*	Schisandraceae	Pattiamlo(Lh)
238	*Lantana camara*	Verbenaceae	Shing singba(Ts) Barra(Lh)
239	*Lasianthus biermannii*	Rubiaceae	Siyal Phusre(Lh)
240	*Lepisanthes senegalensis*	Sapindaceae	Achatta(Lh)
241	*Leptodermis amoena*	Rubiaceae	
242	*Leptodermis kumaonensis*	Rubiaceae	
243	*Leptodermis ludlowii*	Rubiaceae	
244	*Leptodermis stapfiana*	Rubiaceae	
245	*Lespedeza gerardiana*	Leguminosae	
246	*Lespedeza juncea*	Leguminosae	
247	*Leucaena leucocephala*	Leguminosae	Tsa shing(Dz) Tsee shing (Ts) Ghans siris(Lh)
248	*Lindera heterophylla*	Lauraceae	Chur tego(Dz)
249	*Lindera melatomacea*	Lauraceae	
250	*Lindera neesiana*	Lauraceae	Nenshing/Roo neng(Ts)
251	*Lindera pulcherrima*	Lauraceae	Sengkyermay shing(Ts) Sisi (Lh)
252	*Litsea cubeba*	Lauraceae	Nenshing(Ts) , Timur(Lh)
253	*Litsea kingie*	Lauraceae	Siltimur(Lh)
254	*Litsea laeta*	Lauraceae	
255	*Litsea salicifolia*	Lauraceae	Sanu pahenle(Lh)
256	*Litsea sericea*	Lauraceae	Geywe(Dz), Lekh siltimur (Lh)
257	*Luculia gratissima*	Rubiaceae	Tongden Meto(Dz)
258	*Maesa macrophylla*	Myrsinaceae	
259	*Mahonia napaulensis*	Berberidaceae	Chutro, Kesari(Lh)
260	*Malus bacata*	Rosaceae	Khomang Shing(Dz),
261	*Malus pumila*	Rosaceae	Apple(Eng)
262	*Malus sikkimensis*	Rosaceae	Mindu Shing(Dz)
263	*Manihot esculenta*	Euphorbiaceae	Dori,Simal Tarul(Lh) Sengi Ki(Kh) Casava Tapioca(Eng)
264	*Melianthus major*	Hippocastanaceae	
265	*Meliosma dilleniifolia*	Sabiaceae	Lekh Gogun(Lh)
266	*Meliosma simplicifolia*	Sabiaceae	Chiuri, Chiwari, patpate(Lh)

267	*Miliusa macrocarpa*	Annonaceae	
268	*Miliusa roxburghiana*	Annonaceae	
269	*Mimosa himalayana*	Leguminosae	Arere Khanra(Lh)
270	*Mimosa pudica*	Leguminosae	Shawa-dengkhan ngon (Ts) Booarey (Lh)
271	*Morinda angustifolia*	Rubiaceae	Hardi-Kat(Lh)
272	*Murraya koenigii*	Rutaceae	Ngebtang shing(Ts)
273	*Murraya paniculata*	Rutaceae	
274	*Mussaenda glabra*	Rubiaceae	Kange Lahara(Lh)
275	*Mussaenda macrophylla*	Rubiaceae	Dhobine Phul(Lh)
276	*Mussaenda roxburghii*	Rubiaceae	Mencha patong(Ts) Dhobi Kat(Lh)
277	*Mussaenda treutleri*	Rubiaceae	Neptenta (Dz) Dhobine Phul(Lh)
278	*Myrsine semiserrata*	Myrsinaceae	Palami,Phalame,Jhingni(Lh)
279	*Narvelia zeylanica*	Ranunculaceae	
280	*Neillia rubiflora*	Rosaceae	
281	*Neillia thyrsiflora*	Rosaceae	
282	*Nopalea cochenillifera*	Cactaceae	Cochineal Cactus(Eng)
283	*Nostolachma khasiana*	Rubiaceae	
284	*Nyctanthes arbor*	Verbenaceae	
285	*Opuntia vulgaris*	Cactaceae	Gawairinga Tsang(Dz)
286	*Orthosiphon rubicundus*	Labiatae	
287	*Osmanthus suavis*	Oleaceae	Chatshe Kam(Dz) Silingi (Lh)
288	*Ostodes paniculata*	Euphorbiaceae	Bepari(Lh)
289	*Paederia cruddasiana*	Rubiaceae	Biri(Lh)
290	*Paederia foetida*	Rubiaceae	Biri, Biri Lahare(Lh)
291	*Paeonia suffruticosa*	Ranunculaceae	
292	*Parabaena sagittata*	Menispermaceae	Karpati Lahara(Lh)
293	*Paramignya monophylla*	Rutaceae	Natkanta(Lh)
294	*Pavatta polyantha*	Rubiaceae	Kanjol Phul(Lh)
295	*Pavatta subcapitata*	Rubiaceae	
296	*Pedilanthus tithymaloides*	Euphorbiaceae	
297	*Pegia nitida*	Anacardiaceae	Lahara Anp(Lh)
298	*Pericampylus glaucus*	Menispermaceae	Tschethangru(Lh)
299	*Periploca calophylla*	Asclepiadaceae	
300	*Petrea volubilis*	Verbenaceae	Eng: Queen; Wreath(Lh)
301	*Philadelphus tomentosus*	Philadelphaceae	
302	*Photina beauverdiana*	Rosaceae	
303	*Phyllanthus clarkei*	Euphorbiaceae	
304	*Phyllanthus glaucus*	Euphorbiaceae	Dosem(Dz) Prang Shing (Tr)
305	*Phyllanthus leschenaultii*	Euphorbiaceae	
306	*Phyllanthus parvifolius*	Euphorbiaceae	
307	*Phyllanthus reticularis*	Euphorbiaceae	Dosem(Dz)
308	*Phyllanthus sikkimensis*	Euphorbiaceae	
309	*Phyllanthus emblica*	Euphorbiaceae	Amala(Lh)
310	*Pinanga gracilis*	Arecaceae	
311	*Piper attenuatum*	Piperaceae	Chabo(Lh)
312	*Piper betleoides*	Piperaceae	Pan(Lh)
313	*Piper chuvya*	Piperaceae	Chaba(Lh)
314	*Piper khasianum*	Piperaceae	Chabo(Lh)
315	*Piper longum*	Piperaceae	Peepeeling(Dz) Peepeeling(Ts) Pipla (Lh)
316	*Piper mullesua*	Piperaceae	Peepeeling(Dz) Peepeeling(Ts) Dala Charbo (Lh)
317	*Piper pedicellatum*	Piperaceae	Bale Chabo, Long pipla(Lh)
318	*Piper peepuloides*	Piperaceae	Ruk peepla(Lh)
319	*Piper rhytidocarpum*	Piperaceae	Chabo, Tsabo(Lh)
320	*Piper suipigua*	Piperaceae	Dakley Chabo(Lh)
321	*Piper syvaticum*	Piperaceae	
322	*Piptanthus nepalensis*	Leguminosae	Gahate Phul(Lh)

323	*Pithecellobium dulce*	Leguminosae	
324	*Pittosporum napaulense*	Pittosporaceae	
325	*Pogostemon benghalensis*	Labiatae	
326	*Pogostemon elsholtzioides*	Labiatae	
327	*Pogostemon tuberculosus*	Labiatae	
328	*Polygala arillata*	Polgalaceae	Baahu(Dz)
329	*Polygala karensium*	Polgalaceae	
330	*Potentilla arbuscula*	Rosaceae	Chiriya Phal(Lh)
331	*Premna interrupta*	Verbenaceae	
332	*Prinsepia utilis*	Rosaceae	
333	*Prunus jenkinsii*	Rosaceae	
334	*Prunus rufa*	Rosaceae	Lekh paiyun(Lh)
335	*Prunus undulata*	Rosaceae	Lekh arupate(Lh)
336	*Psilanthus bengalensis*	Rubiaceae	Chitu,Morichi kat(Lh)
337	*Psychotria calocarpa*	Rubiaceae	Damey Gach(Lh)
338	*Psychotria denticulata*	Rubiaceae	Bon Golcul(Lh)
339	*Psychotria erratica*	Rubiaceae	
340	*Psychotria monticola*	Rubiaceae	
341	*Pterolobium hexapetalum*	Leguminosae	
342	*Pterolobium macropterum*	Leguminosae	
343	*Pycnarrhena pleniflora*	Menispermaceae	
344	*Pyracantha crenulata*	Rosaceae	
345	*Rapanea capitellata*	Myrsinaceae	Kalachamp,Phalamkanth(Lh)
346	*Reinwardtia indica*	Linaceae	
347	*Rhus chinensis*	Anacardiaceae	Pok pokpa shing((Ts)
348	*Rhus paniculata*	Anacardiaceae	Khyr khobtang(Dz)
349	*Rhus succedanea*	Anacardiaceae	Say shing(Ts)
350	*Ribes acuminatum*	Grossulariaceae	
351	*Ribes alpestre*	Grossulariaceae	
352	*Ribes glaciale*	Grossulariaceae	
353	*Ribes griffithii*	Grossulariaceae	
354	*Ribes himalense*	Grossulariaceae	
355	*Ribes laciniatum*	Grossulariaceae	
356	*Ribes luridum*	Grossulariaceae	
357	*Ribes orientale*	Grossulariaceae	
358	*Rosa brunonii*	Rosaceae	Tagtsher kaap(Dz)
359	*Rosa macrophylla*	Rosaceae	Tagtsher marp(Dz)
360	*Rosa sericea*	Rosaceae	Sew Shing(Dz), Sisi Chungchung (Lh) Med: Sewai Metog,
361	*Rubus acuminatus*	Rosaceae	Koma tshang(Dz) Biraley kara or Sanu aselu(Lh)
362	*Rubus alexeterius*	Rosaceae	
363	*Rubus biflorus*	Rosaceae	Thulu gongsey(Ts)
364	*Rubus calophyllus*	Rosaceae	
365	*Rubus calycinoides*	Rosaceae	Tsheymai tsheloo (Dz)
366	*Rubus cooperi*	Rosaceae	
367	*Rubus efferatus*	Rosaceae	
368	*Rubus ellipticus*	Rosaceae	Tsheymai tsheloo(Dz) Sergong or Gong zoo(Ts)
369	*Rubus hamiltoni*	Rosaceae	
370	*Rubus hypargyrus*	Rosaceae	
371	*Rubus indotibetanus*	Rosaceae	N: Gempe Aselu(Lh)
372	*Rubus inopertus*	Rosaceae	(Lh) Phusre Asaelu(Lh)
373	*Rubus insignis*	Rosaceae	
374	*Rubus irritans*	Rosaceae	
375	*Rubus lineatus*	Rosaceae	
376	*Rubus macilentus*	Rosaceae	
377	*Rubus mesogaeus*	Rosaceae	

378	*Rubus niveus*	Rosaceae	Thulu Gong; Trongsa(Ts): Tsang Guma; Kalo Aselu(Lh)
379	*Rubus paniculatus*	Rosaceae	Domay tsheloo(Dz)
380	*Rubus penagonous*	Rosaceae	
381	*Rubus phengodes*	Rosaceae	
382	*Rubus preptanthus*	Rosaceae	
383	*Rubus Pungens*	Rosaceae	
384	*Rubus sikkimensis*	Rosaceae	
385	*Rubus splendidissimus*	Rosaceae	
386	*Rubus sumatranus*	Rosaceae	
387	*Rubus thomsonii*	Rosaceae	
388	*Rubus treutleri*	Rosaceae	
389	*Sabia campanulata*	Sabiaceae	Kali Lahara(Lh)
390	*Sabia lanceolata*	Sabiaceae	Simali Lahara(Lh)
391	*Sabia paniculata*	Sabiaceae	Kali Lahara(Lh)
392	*Sabia parviflora*	Sabiaceae	Simali Lahara(Lh)
393	*Sabia purpurea*	Sabiaceae	
394	*Saurauja armata*	Actinidiaceae	Mangmadom(Dz) Nyabjala shing(Ts)
395	*Sauropus androgynus*	Euphorbiaceae	
396	*Sauropus quadrangularis*	Euphorbiaceae	
397	*Sauropus repandus*	Euphorbiaceae	
398	*Schisandra grandiflora*	Schisandraceae	Singghatte lahare(Lh)
399	*Skimmia laureola*	Rutaceae	Jainberiphul(Lh)
400	*Smilax minutiflora*	Smilacaceae	
401	*Smilax myrtillus*	Smilacaceae	
402	*Sophora velutina*	Leguminosae	
403	*Sophora wightii*	Leguminosae	
404	*Spartium junceum*	Leguminosae	
405	*Spermadictyon suaveolens*	Rubiaceae	Bhain Chanpa(Lh)
406	*Spiraea arcuta*	Rosaceae	
407	*Spiraea bella*	Rosaceae	
408	*Spiraea canescens*	Rosaceae	
409	*Spiraea micrantha*	Rosaceae	Khangtshalo(Ts)
410	*Stephania elegans*	Menispermaceae	
411	*Stephania glabra*	Menispermaceae	Tamarke Pailo(Lh)
412	*Stephania glandulifera*	Menispermaceae	Chechu robji (Dz) Zala mathang roo (Ts)
413	*Stephania japonica*	Menispermaceae	Charcharey Lahara(Lh)
414	*Strophanthus wallichii*	Apocynaceae	
415	*Symplocos dryophila*	Symplocaceae	Kharane(Lh)
416	*Symplocos glomerata*	Symplocaceae	Kholme(Lh)
417	*Symplocos ramosissima*	Symplocaceae	Kharane(Lh)
418	*Tarennoidea wallichii*	Rubiaceae	
419	*Tephrosia Candida*	Leguminosae	Kumchumo Shing(Ts), Bun Mara(Lh)
420	*Tetradium glabrifolium*	Rutaceae	Thulo Khanakpa(Lh)
421	*Tetradium ruticarpum*	Rutaceae	
422	*Toddalia asiatica*	Rutaceae	Kapore ru/Khaytore(Ts)
423	*Tournefortia hookeri*	Boraginaceae	Arupate Lahara(Lh)
424	*Tournefortia montana*	Boraginaceae	
425	*Toxocarpus aurantiacus*	Asclepiadaceae	
426	*Toxocarpus himalensis*	Asclepiadaceae	
427	*Trachelospermum assamense*	Apocynaceae	
428	*Trachelospermum axillare*	Apocynaceae	Lali-lara(Lh)
429	*Tylophora tenerrima*	Asclepiadaceae	
430	*Uraria lagopus*	Leguminosae	
431	*Uraria sinensis*	Leguminosae	
432	*Vitex negundo*	Verbenaceae	Sewali(Lh)
433	*Wallichia densiflora*	Arecaceae	Takoru(Lh)

434	*Wendlandia grandis*	Rubiaceae	Tilki(Lh)
435	*Wendlandia pendula*	Rubiaceae	
436	*Wendlandia puberula*	Rubiaceae	
437	*Wendlandia speciosa*	Rubiaceae	
438	*Wrightia arborea*	Apocynaceae	Raba warong shing(Ts) Khirra (Lh)
439	*Wrightia coccinea*	Apocynaceae	
440	*Zanthoxylum acanthopodium*	Rutaceae	Dreytshang(Dz) Hagee zoo(Ts) Boke Timur(Lh)
441	*Zanthoxylum armatum*	Rutaceae	Thing-gi (Dz) Gee shing(Ts) Bale timur(Lh)
442	*Zanthoxylum bungeanum*	Rutaceae	Thing-gi (Dz) Gee shing(Ts) Timur(Lh)
443	*Zanthoxylum oxyphyllum*	Rutaceae	Bhainsi Timur(Lh)
444	*Zanthoxylum tomentellum*	Rutaceae	

Annexure IX: List of Herbs

SN	Botanical Name	Local Name
1	*Acalypha brachystachya*	
2	*Achyranthes aspera*	
3	*Achyranthes bidentata*	
4	*Aconitum bisma*	
5	*Aconitum bulbilliferum*	
6	*Aconitum deinorrhizum*	
7	*Aconitum ferox*	
8	*Aconitum fletcherianum*	
9	*Aconitum funiculare*	
10	*Aconitum heterophylloides*	
11	*Aconitum hicksii*	
12	*Aconitum hookeri*	
13	*Aconitum laciniatum*	
14	*Aconitum nakaoi*	
15	*Aconitum naviculture*	
16	*Aconitum novoluridum*	
17	*Aconitum orochryseum*	
18	*Aconitum patulum*	
19	*Aconitum scaposum*	
20	*Aconitum sherrifii*	
21	*Aconitum spicatum*	
22	*Acrocephalus indicus*	
23	*Acronema bellum*	
24	*Acronema hookeri*	
25	*Acronema nervosum*	
26	*Acronema sichuanense*	
27	*Acronema tenerum*	
28	*Actaea acuminata*	
29	*Adonis brevistyla*	
30	*Aerva sanguinolenta*	
31	*Aeschynomene indica L.*	
32	*Ajuga bracteosa*	
33	*Ajuga lobata*	
34	*Ajuga macrosperma*	

35	*Alternanthera bettzickiana*	
36	*Alternanthera brasiliana*	
37	*Alternanthera pungens*	
38	*Alternanthera sessilis*	
39	*Alysicarpus vaginalis*	
40	*Amaranthus hybridus*	Lasomo(Ts)
41	*Amaranthus spinosus*	
42	*Amaranthus viridis*	
43	*Anagallis arvensis*	
44	*Androsace geraniifolia*	
45	*Androsace globifera*	
46	*Androsace hemisphaerica*	
47	*Androsace henryi*	
48	*Androsace hookeriana*	
49	*Androsace ludlowiana*	
50	*Androsace selago*	
51	*Androsace strigillosa*	
52	*Androsace tapete*	
53	*Anemone demissa*	
54	*Anemone griffithii*	
55	*Anemone obtusiloba*	Ugala(Trongsa)
56	*Anemone polyanthes*	
57	*Anemone rivularis*	
58	*Anemone rupestris*	
59	*Anemone rupicola*	
60	*Anemone smithiana*	
61	*Anemone trullifolia*	
62	*Anemone vitifolia*	
63	*Anethum graveolens*	
64	*Anglelica cyclocarpa*	
65	*Anglelica sikkimensis*	
66	*Anisadenia meisner*	
67	*Anisadenia pubescens*	
68	*Anisadenia saxatilis*	
69	*Anisochilus pallisdus*	
70	*Apios carnea*	
71	*Apium graveolens*	
72	*Arabidopsis himalaica*	
73	*Arabidopsis lasiocarpa*	
74	*Arabidopsis mollissima*	
75	*Arabis amplexicaulis*	
76	*Arabis axilliflora*	
77	*Arabis pterosperma*	
78	*Arabis venusta*	
79	*Archyosperma primulifolium*	
80	*Arenaria ciliolata*	
81	*Arenaria debilis*	
82	*Arenaria densissima*	
83	*Arenaria depauperata*	
84	*Arenaria edgeworthiana*	

85	*Arenaria glanduligera*	
86	*Arenaria ischnophylla*	
87	*Arenaria ludlowii hara*	
88	*Arenaria melandryiformis*	
89	*Arenaria melandryoides*	
90	*Arenaria polytrichoides*	
91	*Arenaria pulvinata*	
92	*Arenaria rotundifolia*	
93	*Argimonia pilosa*	Brumzey(Tr)
94	*Argostemma sarmentosum*	
95	*Argostemma verticllatum*	
96	*Argyrela venusta*	
97	*Aruncus dioicus*	
98	*Asteropyrum peltatum*	
99	*Astilbe rivularis*	(Ts) Tonsar Gugay; Nep: Buro Okhate
100	*Astilbe rubra*	
101	*Astragalus floridus*	
102	*Astragalus acaulis*	
103	*Astragalus bhotanensis*	
104	*Astragalus chlorostachys*	
105	*Astragalus concretus*	
106	*Astragalus donianus*	
107	*Astragalus kongrensis*	
108	*Astragalus lessertioides*	
109	*Astragalus rigidulus*	
110	*Astragalus sikkimensis*	
111	*Astragalus stipulatus*	
112	*Astragalus strictus*	
113	*Astragalus tongolensis*	
114	*Barbarea elata*	
115	*Barbarea intermedia*	
116	*Basella alba*	
117	*Bergenia ciliata*	
118	*Bergenia purpurascens*	
119	*Boenninghausenia albiflora*	Med: Yerma shing
120	*Boerhavia coccinea*	
121	*Brachystemma calycinum*	
122	*Brassica juncea*	
123	*Brassica campestris*	
124	*Braya forrestii*	
125	*Braya oxycarpa*	
126	*Braya tibetica*	
127	*Bryocarpum himalaicum*	Dum (Dz)
128	*Bupleurm candollei*	
129	*Bupleurm dalhousieanum*	
130	*Bupleurm falcatum*	
131	*Bupleurm gracillimum*	
132	*Bupleurm hamiltonii*	
133	*Bupleurm marginatum*	
134	*Butea buteiformis*	Phrogpa Laga(Ts)

135	*Cajanus elongatus*	
136	*Cajanus mollis*	Semchung Robjay(Dz)
137	*Calathodes palamata*	
138	*Callianthemum pimpinelloides*	
139	*Callitriche palustris*	
140	*Callitriche stagnalis*	
141	*Caltha palustris*	
142	*Caltha scaposa*	
143	*Calystegia hederacea*	
144	*Camylotropis bunge*	
145	*Capsella bursapastoris*	Shepherd's purse(Eng)
146	*Cardamine elegantula*	
147	*Cardamine flexuosa*	
148	*Cardamine griffithii*	
149	*Cardamine impatiens*	
150	*Cardamine loxostemonoides*	
151	*Cardamine macrophylla*	
152	*Cardamine multijuga*	
153	*Cardamine scoriarum*	
154	*Cardamine trifoliolata*	
155	*Cardamine violacea*	
156	*Cardamine yunnanensis*	
157	*Carum carvi*	
158	*Cassia hochstetteri*	
159	*Cassia lechenaultiana*	
160	*Cathcartia villosa*	
161	*Celosia argentea*	
162	*Centella asiatica*	Tuni manakuni (Dz)
163	*Cerastium glomeratum*	
164	*Chaeropyyllum villosum*	
165	*Chamaesium novemjugum*	
166	*Chenopodium album*	
167	*Chenopodium ambrosioides*	
168	*Chenopodium botrys*	
169	*Chenopodium ficifolium Smith*	Hethu, Nep: Bethu(Dz)
170	*Chrysobraya glaricola*	
171	*Chrysosplenium adoxoides*	
172	*Chrysosplenium carnosum*	
173	*Chrysosplenium forrestii*	
174	*Chrysosplenium griffithiii*	
175	*Chrysosplenium nepalense*	
176	*Chrysosplenium tenellum*	
177	*Cimicifuga foetida*	
178	*Cleome gynandra*	
179	*Cleome viscosa*	
180	*Clitoria mariana*	
181	*Clitoria ternatea*	
182	*Cnidium bhutanicum*	
183	*Cochlearia himalaica*	
184	*Consolida ambigua*	Larkspur(Eng)

185	*Convolvlus arvensis*	
186	*Coriandrum sativum*	
187	*Cortia depressa*	
188	*Cortiella cortioides*	
189	*Cortiella hookeri*	
190	*Corydalis alperstris*	
191	*Corydalis autantiaca*	
192	*Corydalis bowes-lyonii*	
193	*Corydalis calliantha*	
194	*Corydalis cashmeriana*	
195	*Corydalis casimiriana*	
196	*Corydalis chaerophylla*	
197	*Corydalis chasmophila*	
198	*Corydalis crispa*	
199	*Corydalis delicatula*	
200	*Corydalis dorjii*	
201	*Corydalis drepanantha*	
202	*Corydalis dubia*	
203	*Corydalis ecristata*	
204	*Corydalis flaccida*	
205	*Corydalis franchetiana*	
206	*Corydalis gerdae*	
207	*Corydalis juncea*	
208	*Corydalis laelia*	
209	*Corydalis lathyroides*	
210	*Corydalis leptocarpa*	
211	*Corydalis longipes*	
212	*Corydalis meifolia*	
213	*Corydalis oligantha*	
214	*Corydalis ophiocarpa*	
215	*Corydalis oxalidifolia*	
216	*Corydalis polygalina*	
217	*Corydalis sikkimensis*	
218	*Corydalis stracheyi*	
219	*Corydalis trifolitata*	
220	*Crawfuradia campanulacea*	
221	*Crawfuradia puberula*	
222	*Crawfuradia specousa*	
223	*Crotolaria albida*	
224	*Crotolaria ferruginea*	
225	*Crotolaria humifusa*	
226	*Crotolaria trifoliastrum*	
227	*Cucubalus bacciferus*	
228	*Cuminum cyminum*	
229	*Cuscuta campestris*	
230	*Cuscuta europaea*	
231	*Cuscuta reflexa*	Roba-je (Dz)
232	*Cuscuta scandens*	
233	*Cyathula prostrata*	
234	*Cynoglossum lanceolatum*	Khirpatey (Lh)

235	*Delphinium altissimum*	
236	*Delphinium bhutanicum*	
237	*Delphinium caeruleum*	
238	*Delphinium cooperi*	
239	*Delphinium glaciale*	
240	*Delphinium ludlowii*	
241	*Delphinium muscosum*	
242	*Delphinium nepalense*	
243	*Delphinium scabriflorum*	
244	*Delphinium stapeliosmum*	
245	*Delphinium viscosum*	
246	*Desmodium ducclouxii*	
247	*Desmodium heterocarpon*	
248	*Desmodium podocarpum*	
249	*Desmodium williamsii*	
250	*Dianthus barbatus*	Sweet William (Eng)
251	*Dianthus chinensis*	Chinese or Indian Pink (Eng)
252	*Dichocarpum adiantifolium*	
253	*Dilophia salsa*	
254	*Dolichos tenuicaulis*	
255	*Dontostemon glandulosus*	
256	*Draba bhutanica*	
257	*Draba elata*	
258	*Draba eriopoda*	
259	*Draba eriopoda*	
260	*Draba gracillima*	
261	*Draba hicksii*	
262	*Draba lasiophylla*	
263	*Draba oariocarpa*	
264	*Draba oreades*	
265	*Draba sherriffii*	
266	*Draba sikkimensis*	
267	*Draba williamsii*	
268	*Drosera peltata*	
269	*Drymaria cordata*	
270	*Drymaria villosa*	
271	*Duchesnea indica*	
272	*Dumasia villosa*	
273	*Elsholtzia blanda*	Shingtsem (Dz)
274	*Elsholtzia ciliata*	
275	*Elsholtzia concinna*	
276	*Elsholtzia densa*	
277	*Elsholtzia eriostachya*	
278	*Elsholtzia pilosa*	
279	*Elsholtzia stachyodes*	
280	*Elsholtzia strobilifera*	
281	*Eryngium foetidum*	
282	*Erysimum hieracifolium*	
283	*Erysimum longisiliquum*	
284	*Erysimum pachycarpum*	

285	*Eutrema deltoideum*	
286	*Eutrema griffithii*	
287	*Eutrema heterophyllum*	
288	*Eutrema himalaicum*	
289	*Eutrema himalayensis*	
290	*Eutrema hirta*	
291	*Eutrema hypericifolia*	
292	*Eutrema longifolia*	
293	*Eutrema prostrata*	
294	*Eutrema stracheyi*	
295	*Eutrema thymifolia*	
296	*Evplvulus alsinoides*	
297	*Exacum hamiltonii*	Geethri Meto (Dz)
298	*Exacum ters*	
299	*Foeniculum vulgare*	
300	*Fragaria daltoniana*	
301	*Fragaria nubicola*	
302	*Fumaria indica*	
303	*Gentiana albicalyx*	
304	*Gentiana algida*	
305	*Gentiana bryoides*	
306	*Gentiana capitata*	
307	*Gentiana cephalodes*	
308	*Gentiana crassuloides*	
309	*Gentiana depressa*	
310	*Gentiana elwesii*	
311	*Gentiana emodi*	
312	*Gentiana gilvostrata*	
313	*Gentiana glabriusula*	
314	*Gentiana hicksii*	
315	*Gentiana himalayensis*	
316	*Gentiana infelix*	
317	*Gentiana karelinii*	
318	*Gentiana lacerulata*	
319	*Gentiana leucantha*	
320	*Gentiana loureirii*	
321	*Gentiana maeulchanensis*	
322	*Gentiana marginata*	
323	*Gentiana micans*	
324	*Gentiana micantiformis*	
325	*Gentiana nyalamensis*	
326	*Gentiana obconica*	
327	*Gentiana oreodox*	
328	*Gentiana ornata*	
329	*Gentiana pedicellata*	
330	*Gentiana phyllocalyx*	
331	*Gentiana prainii*	
332	*Gentiana prolata*	
333	*Gentiana sikkimensis*	
334	*Gentiana simulatrix*	

335	*Gentiana tibetica*	
336	*Gentiana tubiflora*	
337	*Gentiana urnula*	
338	*Gentiana veitchiorum*	
339	*Gentiana verayi*	
340	*Gentianella azurea*	
341	*Gentianella griersonii*	
342	*Gentianella paludosa*	
343	*Gentianella pedunculata*	
344	*Gentianella stellariifolia*	
345	*Gentianella urnigera*	
346	*Geranium donianum*	
347	*Geranium lambertii*	
348	*Geranium nakaoanum*	
349	*Geranium nepalense*	
350	*Geranium polyanthes*	
351	*Geranium procurrens*	
352	*Geranium refractum*	
353	*Geum aleppicum*	
354	*Geum elatum*	
355	*Geum macrpsepalum*	
356	*Geum sikkimense*	
357	*Glinus lotoides*	
358	*Glycine max*	Soybean (Eng)
359	*Gomphrena celosioides*	
360	*Gomphrena globosa*	
361	*Gueldenstaedtia himalaica*	
362	*Gypsophila cerastioides*	
363	*Hackelia bhutanica*	
364	*Hackelia obtusifolia*	
365	*Hackelia uncinata*	
366	*Halenia elliptica*	
367	*Haplosphera himalayensis*	
368	*Hedysarum sikkimense*	
369	*Heliotropium indcum*	
370	*Heliotropium strigosum*	
371	*Heracleum bhutanicum*	
372	*Heracleum nepalense*	
373	*Heracleum obtusifolium*	
374	*Heracleum sphondylium*	
375	*Heracleum sublineare*	
376	*Heracleum woodii*	
377	*Houttuynia cordata*	Mombering, Nombaring (Ts)
378	*Hydrobryum griggithii*	
379	*Hydrocotyle himalaica*	Ghora tophay (Lh)
380	*Hydrocotyle nepalensis*	
381	*Hydrocotyle sibthorpiodes*	
382	*Hypericum elodeoides*	
383	*Hypericum gramineum*	
384	*Hypericum himalaicum*	

385	*Hypericum japonicum*	
386	*Hypericum leptocarpum*	
387	*Hypericum ludlowii*	
388	*Hypericum monanthemum*	
389	*Hypericum petiolulatum*	
390	*Hypericum wightianum*	
391	*Hyptis suaveolens*	
392	*Impatiens arguta*	
393	*Impatiens cristata*	
394	*Impatiens discolor*	
395	*Impatiens drepanophora*	
396	*Impatiens exilis*	
397	*Impatiens florigera*	
398	*Impatiens infundibularis*	
399	*Impatiens jurpia*	
400	*Impatiens latiflora*	
401	*Impatiens longipes*	
402	*Impatiens puberula*	
403	*Impatiens pulchra*	
404	*Impatiens racemosa*	
405	*Impatiens radiata*	
406	*Impatiens spirifer*	
407	*Impatiens stenantha*	
408	*Impatiens tripetala*	Doorgonang (Ts)
409	*Indigofera linifolia*	
410	*Indigofera trifoliata*	
411	*Ipomoea batatas*	
412	*Ipomoea indica*	
413	*Ipomoea nill*	
414	*Ipomoea pes-tigridis*	
415	*Ipomoea purpurea*	
416	*Ipomoea turbinata*	
417	*Isodon atroruber*	
418	*Isodon coetse*	
419	*Isodon hispidus*	
420	*Isodon lophanthoides*	Dolo patey (Dz)
421	*Isodon repens*	
422	*Isodon scrophularioides*	
423	*Isodon ternifolius*	Peng-dong-dongla (Dz)
424	*Kelloggia chinensis*	
425	*Keraymonia pinnatifolia*	
426	*Labilab purpureus*	Orey(Ts) Shimi (Nep)
427	*Lalldhwojia acronemiflia*	
428	*Lasiocaryum densiflorum*	
429	*Lasiocaryum ludlowii*	
430	*Lasiocaryum munroi*	
431	*Lepidium capitatum*	
432	*Lepidostemon pedunculosus*	
433	*Lepidum virginicum*	
434	*Leucas cephalotes*	

435	*Leucas ciliate*	
436	*Leucas indica*	
437	*Leucas lanata*	
438	*Leucas mollissima*	
439	*Lignariella hobsonii*	
440	*Ligusticum acuminatum*	
441	*Ligusticum elatum*	
442	*Lomatogonium brachyantherum*	
443	*Lomatogonium chumbicum*	
444	*Lomatogonium himalayense*	
445	*Lomatogonium sikkimense*	
446	*Lomatogonium stapfii*	
447	*Lotus corniculatus*	Birdsfoot Trefoil (Eng)
448	*Loxostemon pulchellus*	
449	*Lysimachia alternifolia*	
450	*Lysimachia chenopodio*	
451	*Lysimachia congestiflora*	
452	*Lysimachia decurrens*	
453	*Lysimachia evalvis*	
454	*Lysimachia ferruginea*	
455	*Lysimachia japonica*	
456	*Lysimachia laxa*	
457	*Lysimachia lobeliodes*	
458	*Lysimachia prolifera*	
459	*Macrotyloma uniflorum*	
460	*Meconopsis concinna*	
461	*Meconopsis discigera*	
462	*Meconopsis grandis*	
463	*Meconopsis horridula*	
464	*Meconopsis napaulensis*	
465	*Meconopsis paniculata*	
466	*Meconopsis primulina*	
467	*Meconopsis sherriffii*	
468	*Meconopsis simplicifolia*	
469	*Meconopsis sinuate*	
470	*Meconopsis superb*	
471	*Meeboldia digitata*	
472	*Megacondon stylophorus*	
473	*Melilotus indica*	
474	*Melissa axillaris*	
475	*Mentha longifolia*	
476	*Mentha spicata*	Babari (Lh)
477	*Mercurialis leiocarpa*	
478	*Merremia umbellate*	
479	*Merremia vitifolia*	
480	*Micromeria biflora*	
481	*Microsisymbrium axillare*	
482	*Microsisymbrium dasycarpum*	
483	*Microula bhutanica*	
484	*Mirabilis himalaica*	

485	*Mirabilis jalapa*	4 o'clock (Eng)
486	*Mollugo nudicaulis*	
487	*Mollugo stricta*	
488	*Neanotis gracilis*	
489	*Neanotis ingrate*	
490	*Nelumbo nucifera*	
491	*Nepeta lamiopsis*	
492	*Notochaete hamosa*	
493	*Ocimum americanum*	
494	*Ocimum basilicum*	
495	*Oenanthel hookeri*	
496	*Oenanthel javanica*	
497	*Oenanthel thomosonii*	
498	*Olidenlandia brachypoda*	
499	*Olidenlandia corymbosa*	
500	*Olidenlandia diffusa*	
501	*Omphlogramma elwesiana*	
502	*Onosma bhutanica*	
503	*Onosma emodi*	
504	*Onosma hookeri*	
505	*Onosma paniculatum*	
506	*Ophiorrhiza fasciculata*	
507	*Ophiorrhiza heterostyla*	
508	*Ophiorrhiza longii*	
509	*Ophiorrhiza ochroleuca*	
510	*Ophiorrhiza repens*	
511	*Ophiorrhiza rosea*	
512	*Ophiorrhiza rugosa*	
513	*Ophiorrhiza succirubra*	
514	*Ophiorrhiza treutleri*	
515	*Origanum vulgare*	
516	*Orthosiphon*	
517	*Orthosiphon rubicundus*	
518	*Osmorhiza aristata*	
519	*Oxalis corniculata*	
520	*Oxalis corymbosa*	
521	*Oxalis griffithii*	
522	*Oxalis latifolia*	
523	*Oxalis leucolepis*	
524	*Oxygraphis endlicheri*	
525	*Oxytropis lapponica*	
526	*Paederia cruddasiana*	Biri (Lh)
527	*Paederia foetida*	Biri Lara (Lh)
528	*Papaver rhoeas*	Field Poppy (Eng)
529	*Papaver somniferum*	
530	*Paraquilegia anemonoides*	
531	*Parnassia chinensis*	
532	*Parnassia cooperi*	
533	*Parnassia delavayi*	
534	*Parnassia nubicola*	

535	*Parnassia pusilla*	
536	*Parnassia wightiana*	
537	*Paroxygraphis sikkimensis*	
538	*Parrya nudicaulis*	
539	*Pegaeophyton minutum*	
540	*Pegaeophyton scapiflorum*	
541	*Pelargonium aiton*	
542	*Peperomia heyneana*	
543	*Peperomia pellucida*	
544	*Peperomia tetraphylla*	
545	*Phaeonychium parryoides*	
546	*Phlomis breviflora*	
547	*Phlomis macrophylla*	
548	*Phlomis rotate*	
549	*Phlomis tibetica*	
550	*Phyla nodiflora*	
551	*Phyllanthus debilis*	
552	*Phyllanthus urinaria*	
553	*Phyllanthus virgatus*	
554	*Physospermopsis kingdonwardii*	
555	*Physospermopsis obtusiuscula*	
556	*Phytolacca acinosa*	Kashakani (Dz)
557	*Pimpinella diversifolia*	
558	*Pimpinella tibetanica*	
559	*Pimpinella urceolata*	
560	*Pisum communis*	
561	*Pisum sativum*	Field Pea, Garden Pea (Eng)
562	*Plectranthus barbatus*	
563	*Pleurospermopsis sikkimensis*	
564	*Pleurospermum album*	
565	*Pleurospermum amabile*	
566	*Pleurospermum angelicoides*	
567	*Pleurospermum apiolens*	
568	*Pleurospermum benthamii*	
569	*Pleurospermum dentatum*	
570	*Pleurospermum hookeri*	
571	*Pleurospermum pilosum*	
572	*Podophylum hexandrum*	
573	*Podophylum sikkimense*	
574	*Pogostemon amaranthoides*	Namda (Dz)
575	*Pogostemon brachystachus*	
576	*Pogostemon fraternus*	
577	*Pogostemon linearis*	
578	*Polycarpon prostratum*	
579	*Polygala furcata*	
580	*Polygala persicariifolia*	
581	*Polygala sibirica*	
582	*Polygala tararinowii*	
583	*Potentilla achilleifolia*	
584	*Potentilla anserine*	

585	*Potentilla bhutanica*	
586	*Potentilla bryoides*	
587	*Potentilla coriandrifolia*	
588	*Potentilla cuneata*	
589	*Potentilla eriocarpa*	
590	*Potentilla eriocarpoides*	
591	*Potentilla forestii*	
592	*Potentilla fragaroides*	
593	*Potentilla griffithii*	
594	*Potentilla latiloba*	
595	*Potentilla leuconota*	
596	*Potentilla lineate*	
597	*Potentilla microphylla*	
598	*Potentilla monanthes*	
599	*Potentilla peduncularis*	
600	*Potentilla polyphylla*	
601	*Potentilla saundersiana*	
602	*Potentilla spodiochlora*	
603	*Potentilla sundacia*	
604	*Potentilla supine*	
605	*Primula alpicola*	
606	*Primula assamica*	
607	*Primula atrodentata*	
608	*Primula bellidifolia*	
609	*Primula bhutanica*	
610	*Primula bracteosa*	
611	*Primula calderiana*	
612	*Primula capitata*	
613	*Primula caveana*	
614	*Primula chumbiensis*	
615	*Primula concinna*	
616	*Primula denticulate*	
617	*Primula dickieana*	
618	*Primula dryadifolia*	
619	*Primula eburnean*	
620	*Primula elongate*	
621	*Primula erythrocarpa*	
622	*Primula filipes*	
623	*Primula gambeliana*	
624	*Primula geraniifolia*	
625	*Primula glabra*	
626	*Primula graclipes*	
627	*Primula griffithii*	
628	*Primula hooheri*	
629	*Primula jigmediana*	
630	*Primula kingie*	
631	*Primula klattii*	
632	*Primula listeri*	
633	*Primula macrophylla*	
634	*Primula megalocarpa*	

635	*Primula mollis*	
636	*Primula munroi*	
637	*Primula muscoides*	
638	*Primula oblique*	
639	*Primula prenantha*	
640	*Primula primulina*	
641	*Primula reticulate*	
642	*Primula sapphirina*	
643	*Primula sherriffae*	
644	*Primula sikkimensis*	
645	*Primula smithiana*	
646	*Primula soldanelloides*	
647	*Primula stirtoniana*	
648	*Primula strumosa*	
649	*Primula tanneri*	
650	*Primula tenella*	
651	*Primula tsariensis*	
652	*Primula vaginata*	
653	*Primula waddellii*	
654	*Primula walshii*	
655	*Primula waltonii*	
656	*Primula whitei*	
657	*Primula xanthopa*	
658	*Primulatenuiliba*	
659	*Primulatibeteca*	
660	*Prunella vulgaris*	
661	*Pseudostellaria heterantha*	
662	*Pseudostellaria pax*	
663	*Pseudostellaria sylvatica*	
664	*Pternopetalum radiatum*	
665	*Pternopetalum subalpinum*	
666	*Pycnoplinthopsis bhutanica*	
667	*Ranunculus adoxifolius*	
668	*Ranunculus brotherusii*	
669	*Ranunculus cantoniensis*	
670	*Ranunculus chinensis*	
671	*Ranunculus diffuses*	
672	*Ranunculus ficariifolius*	
673	*Ranunculus laetus*	
674	*Ranunculus pulchellus*	
675	*Ranunculus sceleratus*	
676	*Ranunculus silerifolius*	
677	*Ranunculus trichophyllus*	
678	*Ranunculus tricuspis*	
679	*Raphanus raphanistrum*	Wild radish (Eng)
680	*Raphanus sativus*	Radish (Eng)
681	*Rhodiola amabilis*	
682	*Rhodiola atsaensis*	
683	*Rhodiola bupleuroides*	
684	*Rhodiola chrysanthemifolia*	

685	*Rhodiola coccinea*	
686	*Rhodiola crenulata*	
687	*Rhodiola cretinii*	
688	*Rhodiola fastigata*	
689	*Rhodiola himalensis*	
690	*Rhodiola hobsonni*	
691	*Rhodiola humilis*	
692	*Rhodiola ludlowii*	
693	*Rhodiola marginata*	
694	*Rhodiola sherriffi*	
695	*Rhodiola stapfii*	
696	*Rhynchosa harae*	
697	*Rhynchosa minima*	
698	*Rorippa benghalensis*	
699	*Rorippa madagascariensis*	
700	*Rorippa palustris*	
701	*Rubia hispidicaulis*	
702	*Rubia manjith*	Manjit (Lh)
703	*Rubia wallichiana*	
704	*Sagina japonica*	
705	*Salomonia cantoniensis*	
706	*Salvia amplicalyx*	
707	*Salvia campanulata*	
708	*Salvia castanea*	
709	*Salvia nubicola*	
710	*Salvia plectranthoides*	
711	*Salvia sikkimensis*	
712	*Salvia species*	
713	*Salvia splendens*	
714	*Salvia wardii*	
715	*Sanguisorba diandra*	Jadum (Dz)
716	*Sanguisorba filiformis*	
717	*Sanicula elata*	
718	*Saxifraga andersonii*	
719	*Saxifraga asarifolia*	
720	*Saxifraga bergenioides*	
721	*Saxifraga brachypoda*	
722	*Saxifraga brunosis*	
723	*Saxifraga caveana*	
724	*Saxifraga clivorum*	
725	*Saxifraga contraria*	
726	*Saxifraga diversifolia*	
727	*Saxifraga erinacea*	
728	*Saxifraga filicaulis*	
729	*Saxifraga flavida*	
730	*Saxifraga georgei*	
731	*Saxifraga glabricaulis*	
732	*Saxifraga granulifera*	
733	*Saxifraga haematochora*	
734	*Saxifraga harry-smithii*	

735	*Saxifraga hemiphaerica*	
736	*Saxifraga hispidula*	
737	*Saxifraga hookeri*	
738	*Saxifraga humilis*	
739	*Saxifraga jacquemontiana*	
740	*Saxifraga kinchingingae*	
741	*Saxifraga kingiana*	
742	*Saxifraga latiflora*	
743	*Saxifraga lepida*	
744	*Saxifraga lychnitis*	
745	*Saxifraga matta-florida*	
746	*Saxifraga melanocentra*	
747	*Saxifraga Montana*	
748	*Saxifraga moorcroftiana*	
749	*Saxifraga mucronulata*	
750	*Saxifraga nigrolandulifera*	
751	*Saxifraga pallid*	
752	*Saxifraga parnassiflora*	
753	*Saxifraga parva*	
754	*Saxifraga perpusilla*	
755	*Saxifraga petrophilia*	
756	*Saxifraga pilifera*	
757	*Saxifraga pseudopallida*	
758	*Saxifraga pulvinaria*	
759	*Saxifraga rubriflora*	
760	*Saxifraga saginoides*	
761	*Saxifraga saxorum*	
762	*Saxifraga serrula*	
763	*Saxifraga sherriffii*	
764	*Saxifraga sikkimensis*	
765	*Saxifraga stella-aurea*	
766	*Saxifraga stolitzkae*	
767	*Saxifraga strigosa*	
768	*Saxifraga subsessiliflora*	
769	*Saxifraga subspathulata*	
770	*Saxifraga tangutica*	
771	*Saxifraga tentaculata*	
772	*Saxifraga thiantha*	
773	*Saxifraga tsangchanesis*	
774	*Saxifraga umbellulata*	
775	*Saxifraga vacillans*	
776	*Saxifraga viscidula*	
777	*Saxifraga wardii*	
778	*Schulzia bhutanica*	
779	*Schulzia dissecta*	
780	*Scutellaria dependens*	
781	*Scutellaria discolor*	
782	*Scutellaria grossa*	
783	*Scutellaria violacea*	
784	*Sebaea microphylla*	

785	*Sedum correptum*	
786	*Sedum filipes*	
787	*Sedum fischeri*	
788	*Sedum gagei*	
789	*Sedum griffithi*	
790	*Sedum multiculae*	
791	*Sedum oreades*	
792	*Sedum spectabile*	
793	*Sedum triactina*	
794	*Sedum trullipetalum*	
795	*Selinum candollei*	
796	*Selinum wallicianum*	
797	*Shuteria ferruginea*	
798	*Shuteria hirsute*	
799	*Shuteria involucrate*	
800	*Sibbaldia byssitecta*	
801	*Sibbaldia macropetala*	
802	*Sibbaldia micropetala*	
803	*Sibbaldia parviflora*	
804	*Sibbaldia perpusilloides*	
805	*Sibbaldia purpurea*	
806	*Silene armeria*	
807	*Silene bhutanica*	
808	*Silene birgittae*	
809	*Silene caespitella*	
810	*Silene gonosperma*	
811	*Silene indica*	
812	*Silene julaensis*	
813	*Silene linae*	
814	*Silene nepalensis*	
815	*Silene nigrescens*	
816	*Silene purii*	
817	*Silene stracheyi*	
818	*Sinocarum minus*	
819	*Sinocarum pauciradiatum*	
820	*Sinocarum pulchellum*	
821	*Sinocarum sikkimense*	
822	*Sinocarum wolffianum*	
823	*Sinocrassula berger*	
824	*Sinocrassula indica*	
825	*Siphocranion macranthum*	
826	*Soiradiclis cylindrical*	
827	*Souliea vaginata*	
828	*Spergula arvensis*	
829	*Spermacoce mauritiana*	
830	*Spermacoce pusilla*	
831	*Spongiocarpella purpurea*	
832	*Stachys melissaefolia*	
833	*Stachys scaberula*	
834	*Stellaria congestiflora*	

835	*Stellaria decumbens*	
836	*Stellaria lanata*	
837	*Stellaria media*	
838	*Stellaria monosperma*	
839	*Stellaria patens*	
840	*Stellaria reticulivena*	
841	*Stellaria sikkimensis*	
842	*Stellaria uliginosa*	
843	*Stellaria vestita*	
844	*Stilbanthus scandens*	
845	*Swertia bimaculata*	Chirata (Lh)
846	*Swertia candelabrum*	
847	*Swertia cordata*	
848	*Swertia crossoloma*	
849	*Swertia grandiflora*	
850	*Swertia hookeri*	
851	*Swertia macrosperma*	
852	*Swertia multicaulis*	
853	*Swertia paniculata*	
854	*Swertia pseudohookeri*	
855	*Swertia ramose*	
856	*Swertia staintonii*	
857	*Swertia teres*	
858	*Swertia virescens*	
859	*Tetramnus flexilis*	
860	*Teucrium grandifolium*	
861	*Teucrium quadrifarium*	
862	*Teucrium viscidum*	
863	*Thalictrum alpinum*	
864	*Thalictrum chelidonii*	
865	*Thalictrum cultratum*	
866	*Thalictrum elegans*	
867	*Thalictrum foetidum*	
868	*Thalictrum foliolosum*	
869	*Thalictrum javanicum*	
870	*Thalictrum leuconotum*	
871	*Thalictrum punuanum*	
872	*Thalictrum rostellatum*	
873	*Thalictrum setulosinerve*	
874	*Thalictrum squamiferum*	
875	*Thalictrum virgatum*	
876	*Thermosis barbata*	Losi Metok (Dz)
877	*Thlaspi andersonii*	
878	*Thlaspi arvense*	
879	*Thlaspi cochleariodes*	
880	*Tiarella polyphylla*	
881	*Tongoloa gracilis*	
882	*Tongoloa loloensis*	
883	*Tordyliopsis brunonis*	
884	*Torilis Japonica*	

885	*Torularia humilis*	
886	*Trachyspermum ammi*	
887	*Trachyspermum anethifolium*	
888	*Tribulus terrestris*	
889	*Trigonella emodi*	
890	*Tripterospermum nigrobaccatum*	
891	*Tripterospermum volubile*	
892	*Trollius pumilus*	
893	*Trollius sikkimensis*	
894	*Trollius vaginatus*	
895	*Tropaeolum majus*	
896	*Tylophora fasicuata*	
897	*Tylophora rotundifolia*	
898	*Uraria lagopodioides*	
899	*Uraria picta*	
900	*Veratrilla baillonii*	
901	*Verbena officinalis*	
902	*Vicatia connifolia*	

Annexure X: Rhododendrons of Bhutan

Sl.No	Botanical name
1	*Rhododendron griffithianum*
2	*Rhododedron grande*
3	*Rhododendron kesangiae*
4	*Rhododendron falconeri*
5	*Rhododenron hodgsonii*
6	*Rhododendron campylocarpum*
7	*Rhododendron kendrickii*
8	*Rhododendron papillatum*
9	*Rhododendron arboretum*
10	*Rhododendron niveum*
11	*Rhododendron wightii*
12	*Rhododendron bhutanense*
13	*Rhododendron lanatum*
14	*Rhododendron flinckii*
15	*Rhododendron tsariense*
16	*Rhododendron campanulatum*
17	*Rhododendron aeruginosum*
18	*Rhododendron wallichii*
19	*Rhododendron barbatum*
20	*Rhododendron argipeplum*
21	*Rhododendron succothii*
22	*Rhododendron neriiflorum*
23	*Rhododendron fulgens*
24	*Rhododendron thomsonii*
25	*Rhododendron edgeworthii*
26	*Rhododendron pendulum*
27	*Rhododendron maddenii*
28	*Rhododendron dalhousiae*
29	*Rhododendron lindleyi*
30	*Rhododendron ciliatum*
31	*Rhododendron triflorum*
32	*Rhododendron nivale*
33	*Rhododendron vaccinioides*
34	*Rhododendron pumilum*
35	*Rhododendron cinnabarinum*
36	*Rhododendron setosum*
37	*Rhododendron keysii*
38	*Rhododendron virgatum*
39	*Rhododendron leptocarpum*
40	*Rhododendron camelliiflorum*
41	*Rhododendron glaucophyllum*
42	*Rhododendron lepidotum*
43	*Rhododendron baileyi*
44	*Rhododendron anthopogon*
45	*Rhododendron pogonophyllum*
46	*Rhododendron fragariflorum*

Annexure XI: Bamboos of Bhutan[3]

Sl.No	Botanical name	Local name
1	*Ampelocalamus patellaris*	Dhemm or Shogodhong(Ts)
2	*Arundinaria racemosa*	Sui chung(Ts)
3	*Bambusa alamii*	Dhemm(Ts),Mugi bans(Lh)
4	*Bambusa balcooa*	Zhooshing(Dz),Soh(Ts),Dhanu bans(Lh)
5	*Bambusa clavata*	Pagshing (Dz), Pagshi (Kh), Soo (Ts),Chiley bans (Lh)
6	*Bambusa nutans (subsp. Cupalata)*	Jhushing (Dz), Mal bans (Lh), Jushi / Gren (Kh)
7	*Bambusa tulda*	Juhu shing(Dz)
8	*Bambusa vulgaris*	Soh(Ts)
9	*Bambusa pallida*	
10	*Borinda grossa*	Baa (Dz); Rhui (Bu &Kh) shee / shi (Ts)
11	*Cephalostachyum latifolium*	Jhi(Dz), Soh(Ts),Ghopi bans(Lh)
12	*Chimonobambus callosa*	
13	*Dendrocalamus giganteus*	Pagshi (Dz), Tama, Leeshing(Ts),
14	*Dendrocalamus hamiltonii*	Pagshi (Dz), Leeshing, or gugsho (Ts), Tama, choya or jungali bans (Lh),Soo (Kh)
15	*Dendrocalamus hookeri*	
16	*Drepanostachyum annulatum*	Him (Dz), Sheechung(Ts), Ban nigalo(Lh)
17	*Drepanostachyum intermedium*	Sheedaza(Ts), Titenigalo(Lh)
18	*Drepanostachyum khasianum*	Daohe(Dz), Tsongsuiza(Ts), Ban nigalo(Lh)
19	*Himalayacalamus falconeri*	Soh zuima(Ts),Singhane(Lh)
20	*Himalayacalamus hookerianus*	Soh shee(Ts), Padang or Parang(Lh)
21	*Melocanna baccifera*	Philim bans/Lahure bans (Lh)
22	*Neomicrocalamus andropogonifolius*	Reengshu (Ts), Langma (Lh)
23	*Pseudostachyum polymorphum*	Soh kurpee (Ts), Philim (Lh)
24	*Teinostachyum dullooa*	Tokhre bans (Lh)
25	*Thamnocalamus spathiflorus*	Hum (Dz), Ratonigalo (Lh)
26	*Yushania hirsute*	Hima (Dz), Suizachilo (Ts)
27	*Yushania maling*	Suiza (Ts), Maling (Lh)
28	*Yushania microphylla*	Mingma (Dz), Suizadhoomba (Ts)
29	*Yushania pantlingiin*	Threyshee (Ts)
30	*Yushania sagittifera*	Damo Dew-Yangka (Arrow bamboo)

[3] *Source: Bamboos of Bhutan, An Illustrated Guide-Chris Stapleton Royal Botanic Garden, Kew on behalf of The overseas Development Administration, London. (Local names derived from "Know the Plants of Bhutan-Vol II" by Ugyen Thinley)*

Dorjee et al., 2020. Yushania sagittifera (Poaceae: Bambusoideae), a new species discovery from Bhutan

Dorjee, S., Stapleton, C.M.A., Chophel, U., Phurpa., Tshering, D. and Samdrup, Tshering. (2020). Bambusa pallida (Poaceae: Bambusoideae), a new record for Bhutan. J.Amer.Bamboo.Soc. 30:1-5.

Annexure XII: List of Non-Wood Forest Produce That Can Be Collected and Traded[4]

Sl. No	Name		Part(s) used
	Scientific	Local	
1	*Aconitum laciniatum*	Bongkar (Dz), Maanchhen (Ts)	Root / tuber
2	*Aconitum orochryseum*	Bong nga (Ts), Bongkar (Med)	
3	*Aconogonum tortusum*	Ngalachog (Dz)	Root
4	*Acorus calamus*	Chudar or chudala (Dz), bojo or bojho (Lh), bar-tsi (Ts)	Rhizome
5	*Artemisia spp.*	Khempa (Dz), Titey-pati (Lh)	Leaf, twig and stem
6	*Asphaltum punjabinum /A.amomalutum*	Shilajit	Refine part / processed
7	*Bambusa clavata*	Chiley bans (Lh), Pagshing (Dz), Pagshi (Kh), Soo (Ts)	Culms, young shoots
8	*Bambusa nutans*	Jhushing (Dz), Mal bans (Lh), Jushi / Gren (Kh)	
9	*Borinda grossa*	Baa (Dz); Rhui (Bu & Kh) shee / shi (Ts)	Culms
10	*Cassia fistula*	Golden shower (Eng), Rajbriksha or Rajbrikshay (Lh), Donka sey or Donko shing (Ts), Donga (Med)	Pods and seeds
11	*Choerospondia axillaris*	Lapsi (Lh)	Fruits
12	*Ophiocordyceps sinensis*	Yar-tsha guenbub (Dz), yar-tsa gumba (Lh)	Entire form
13	*Cymbopogon spp.*	Sorbhang (Ts), Lemon grass (Eng)	Upper parts
14	*Daphne spp.*	Dheynap (Dz), Kaga-tey, Kagati, Lokta in (Lh)	Bark
15	*Edgeworthia gardneri*	Dheykap (Dz), Argaylee (Lh)	
16	*Dendrocalamus hamiltonii*	Pagshi (Dz), Tama, choya or jungali bans (Lh), Leeshing, or gugsho (Ts), Soo (Kh)	Culm, young shoots
17	*Diplazium esculentum*	Nakey(Dz), Dhawai(Ts)	Young shoots
18	*Diploknema butyracea (Syn. Aesandra butyracea, Bassia butyracea)*	Chiuri (Lh), Butter tree (En), Yega shi (Dz), Pin-shing (Ts)	Fruits

[4] *Source: Non Wood Forest Produce Development Section, Social Forestry and Extension Division, DoFPS*

Annexure XIII: Mammals of Bhutan[5]

Sl.No	Scientific Name	Common Name
1	*Hipposideros Pomona*	Andersen's Leaf-nosed Bat
2	*Soriculus macrusus*	Arboreal Brown Toothed Shrew
3	*Elephas maximus*	Asian elephant
4	*Barbastella leucomelas*	Asian/Eastern Barbestelle Bat
5	*Scotophilus heathi*	Asiatic Greater Yellow Bat
6	*Bubalus arnee*	Asiatic Water Buffalo
7	*Macaca assamenis*	Assamese Macaque
8	*Soriculus baileyi*	Bailey's Shrew
9	*Tylonycteris pachypus*	Bamboo Bat
10	*Muntiacus mutjak*	Barking Deer
11	*Martes foina*	Beech or Stone marten
12	*Vulpes bengalensis*	Bengal Fox
13	*Arctictis binturong*	Binturong/ Asian Bearcat
14	*Rattus rattus*	Black Rat/ House Rat
15	*Taphozous melanopogon*	Black-bearded Tomb Bat
16	*Ochotana curzoniae*	Black-lipped Pika
17	*Lepus nigricollis*	Blacknaped Hare
18	*Sphaerias blansfordi*	Blanford's Fruit Bat
19	*Pseudois nayaur*	Blue sheep
20	*Rhinolophus Lepidus*	Blyth's Horseshoe Bat
21	*Plecotus auritus*	Brown long-eared Bat
22	*Mus platythrix*	Brown Spiny Field Mouse
23	*Trachypithecus pileatus*	Capped Langur
24	*Rhinolophus subbadius*	Chestnut Horseshoe Bat
25	*Manis pentadactyla*	Chinese Pangolin
26	*Axis axis*	Chital/spotted Deer
27	*Pipistrellus affinis*	Chocolate Pipistrelle
28	*Neofelis nebulosa*	Clouded leopard
29	*Nyctalus noctula*	Common Noctule
30	*Herpestes edwardsii*	Common or Grey Mongoose
31	*Lutra lutra*	Common Otter
32	*Paradoxurus hermaphroditus*	Common Palm Civet
33	*Ochotona roylei*	Common Pika
34	*Pipistrellus pipistrellus*	Common Pipistrelle
35	*Eptesicus serotinus*	Common Serotine Bat
36	*Herpestes urva*	Crab-eating Mongoose
37	*Cuon alpinus primaevus*	Dhole/ Wild Dog
38	*Scotozous dormer*	Dormer's Bat
39	*Leopoldamys edwardsi*	Edward's Rat
40	*Nectogale elegans*	Elegant/Tibetan water Shrew
41	*Mus saxicola*	Elliot's Spiny Mouse
42	*Mus cervicolor*	Fawn-coloured Mouse
43	*Prionailursus viverrinus*	Fishing cat
44	*Ochotana forresti*	Forrest's Pika
45	*Rousettus leschenaultia*	Fulvous Fruit bat
46	*Hipposderous fulvus*	Fulvus Leaf-nosed Bat
47	*Platanista gangetica*	Ganges River Dolphins
48	*Bos gaurus*	Gaur
49	*Ochotana gloveri*	Glover's Pika
50	*Catopuma temmincki*	Golden cat
51	*Trachypithecus geei*	Golden Langur
52	*Nemorhaedus goral*	Goral

53	*Petaurista caniceps*	Gray-Headed Flying Squirrel
54	*Petaurista noblis*	Gray's Giant Flying Squirrel
55	*Ia io*	Great Evening Bat
56	*Rhinolophus luctus*	Great Indian Horse shoe bat
57	*Rhinoceros unicornis*	Great one-horned Rhinoceros
58	*Murina leucogaster*	Great Tube-nosed Bat
59	*Bandicota indica*	Greater Bandicot Rat
60	*Megaderma lyra*	Greater False Vampire Bat
61	*Hipposiderous arminger*	Greater Himalayan Leaf-nosed bat
62	*Rhinolophus ferrumequinum*	Greater Horseshoe Bat
63	*Semnopithecus entellus*	Grey Langur/ Hanuman Langur
64	*Crocidura attenuate*	Grey/Woodland Shrew
65	*Myotis annectans*	Hairy-faced Bat
66	*Harpiocephalus harpia*	Hairy-winged Bat
67	*Kerivoula hardwickii*	Hardwicke's forest Bat
68	*Scotomanes ornatus*	Harlequin Bat
69	*Macroglossus sobrinus*	Hill Long- tongued Fruit bat
70	*Ursus thibetanus laniger*	Himalayan Black Bear
71	*Petaurista magnificus*	Himalayan Flying Squirrel
72	*Paguma larvata*	Himalayan Palm Civet
73	*Rattus nitidus*	Himalayan Rat
74	*Capricornis sumatraensis*	Himalayan Serow
75	*Soriculus nigrescens*	Himalayan Shrew/ Sikkim Large Clawed Shrew
76	*Alticola stoliczkanus*	Himalayan Vole
77	*Mustela sibirica*	Himalayan Weasel
78	*Martes flavigula*	Himalayan Yellow-Throated Marten
79	*Chimarrogale himalayica*	Himalyan Water Shrew
80	*Canis lupus*	HimilayanWolf/ Tibetan Wolf
81	*Caprolagus hispidus*	Hispid Hare
82	*Myotis formosus*	Hodgson's Bat
83	*Soriculus caudatus*	Hodgson's Brown Toothed Shrew
84	*Arctonyx collaris*	Hog badger
85	*Axis porcinus*	Hog Deer
86	*Hipposiderous larvatus*	Horsefield's Leaf-nosed Bat
87	*Crocidura horsfieldi*	Horsefiled's Shrew
88	*Mus musculus*	House Mouse
89	*Suncus murinus*	House/Musk Shrew
90	*Murina huttoni*	Hutton's Tube-nosed Bat
91	*Golunda ellioti*	Indian Bush Rat
92	*Pteropus giganteus*	Indian Flying Fox
93	*Soriculus leucops*	Indian long-tailed Shrew
94	*Manis crassicaudata*	Indian Pangolin
95	*Pipistrellus coromandra*	Indian Pipistrelle
96	*Rhinolophus affinis*	Intermediate Horseshoe Bat
97	*Pipistrellus javanicus*	Javan's Pipistrelle
98	*Felis chaus*	Jungle Cat
99	*Hipposiderous lankadiva*	Lankadiva Bat
100	*Pipistrellus circumdatus*	Large Black Pipistrelle
101	*Viverra zibetha*	Large Indian civet
102	*Rhinolophus macrotis*	Large-eared Horseshoe bat
103	*Ochotona macrotis*	Large-eared Pika
104	*Melogale personata*	Large-toothed Ferret Badger
105	*Dacnomys millardi*	Large-toothed Rat
106	*Hipposiderous ater Dusky*	Leaf-nosed Bat
107	*Rhinolophu pusillus*	Least Horseshoe Bat
108	*Hipposiderous cineraceus*	Least Leaf- nosed Bat
109	*Panthera pardus*	Leopard
110	*Prionailursus bengalensis*	Leopard cat

111	*Bandicota bengalensis*	Lesser Bandicot Rat
112	*Cynopterus brachyotis*	Lesser Dog-faced Fruit bat
113	*Megaderma spasa*	Lesser False Vampire Bat
114	*Sorex bedfordia*	Lesser Stripe-backed Shrew
115	*Myotis sicarius*	Little Brown bat
116	*Niviventereha*	Little Himalayan Rat
117	*Murina aurata*	Little Tube-nosed Bat
118	*Vandeleuria oleracea*	Long-tailed Tree Mouse
119	*Eonycteris spelaea*	Long-tongued Fruit Bat
120	*Canis aureus*	Lower Risk
121	*Lynx lynx*	Lynx
122	*Pardofelis marmorata*	Marbled cat
123	*Bos frontalis*	Mithun
124	*Ochotona thibetana*	Moupin's Pika
125	*Moschus chrysogaster*	Musk Deer
126	*Taphozous nudiventris*	Naked-rumped Tomb Bat
127	*Myotis muricola*	Nepalese- whiskered Bat
128	*Megaerops niphanae*	Niphan's Tailless Fruit bat
129	*Tupaia belangeri*	Northern Tree Shrew
130	*Rattus norvegicus*	Norway Rat
131	*Ochotana nubrica*	Nubra Pika
132	*Kerivoula picta*	Painted Bat
133	*Mustela altaica*	Pale Weasel
134	*Felis manul*	Pallas cat
135	*Hylopetes alboniger*	Parti-coloured Flying Squirrel
136	*Pipistrellus paterculus*	Paternal Pipistrelle
137	*Belomys pearsoni*	Pearson's / Hairy footed Flying Squirrel
138	*Rhinolophus pearsonii*	Pearson's Horseshoe bat
139	*Minopterus pusillus*	Pusillus Long- Fingered Bat
140	*Sus salvanius*	Pygmy hog
141	*Pipistrellus mimus*	Pygmy Pipistrelle
142	*Sorex minutes*	Pygmy Shrew
143	*Suncus etruscus*	Pygmy White-toothed Shrew
144	*Cervus elaphus wallichi*	Red deer/Sikkim Red Deer
145	*Vulpes vulpes*	Red Fox
146	*Petaurista petaurista*	Red Giant Flying squirrel
147	*Ailurus fulgens*	Red Panda
148	*Macaca mulatta*	Rhesus Macaque
149	*Murina cyclotis*	Round- eared Tube-nosed bat
150	*Rhinolophus rouxii*	Rufous Horseshoe Bat
151	*Minopterus schreibersii*	Schreiber's Long Fingered Bat
152	*Talpa micrura*	Short - tailed Mole
153	*Cynopterus sphinx*	Short- nosed Fruit Bat
154	*Mus pahari*	Sikkim Mouse
155	*Rattus sikkimensis*	Sikkim Rat
156	*Microtus sikimensis*	Sikkim Vole
157	*Melursus ursinus*	Sloth Bear
158	*Nycticebus Bengalensis*	Slow Loris
159	*Cervus unicolor*	Smabar
160	*Viverricula indica*	Small India Civet
161	*Herpestes javanicus*	Small Indian Mongoose
162	*Amblonyx cinerus*	Small-Clawed Otter
163	*Melogale moschata*	Small-toothed Ferret Badger
164	*Myotis siligorensis*	Small-toothed Whiskered Bat
165	*Lutrogale perspicillata*	Smooth Coated Otter
166	*Uncia uncial*	Snow Leopard
167	*Millardia meltada*	Soft-furred Field Rat/Metad
168	*Crocidura fuliginosa*	South east Asian White Toothed Shrew

169	*Peturista elegans*	Spotted Giant Flying Squirrel
170	*Prionodon pardicolor*	Spotted Linsang
171	*Cervus duvauceli*	Swamp Deer
172	*Coelops frithi*	Tail-less Leaf-nosed Bat
173	*Budorcas taxicolor*	Takin
174	*Eptesicus tatei*	Tate's Bat
175	*Alticolastracheyi*	Thoma's Mountain Vole
176	*Pipistrellus cadornae*	Thomas's Pipistrelle
177	*Hesperoptenus tickelli*	Tickell's Bat
178	*Panthera tigris*	Tiger
179	*Rhinolophus trifoliatus*	Trefoli Horseshe Bat
180	*Rattus turkestanicus*	Turkestan Rat
181	*Myotis daubentonii*	Water Bat
182	*Myotis mystacinus*	Whiskered Bat
183	*Niniventer niniventer*	White-bellied Rat
184	*Sus scrofa*	Wild boar
185	*Apodemus sylavaticus*	Wood Mouse
186	*Eupetaurus cinerus*	Wooly Flying Squirrel
187	*Lepus oiostolus*	Wooly Hare
188	*Bos grunniens*	Yak
189	*Mustela kathiah*	Yellow-Bellied Weasel

Annexure XIV: Birds of Bhutan[6]

SN	Scientific name	Common name
1	*Abroscopus albogularis*	Rufous-faced Warbler
2	*Abroscopus schisticeps*	Black-faced Warbler
3	*Abroscopus superciliaris*	Yellow-bellied Warbler
4	*Accipiter badius*	Shikra
5	*Accipiter gentilis*	Northern Goshawk
6	*Accipiter nisus*	Eurasian Sparrowhawk
7	*Accipiter trivirgatus*	Crested Goshawk
8	*Accipiter virgatus*	Besra
9	*Aceros nipalensis*	Rufous-necked Hornbill
10	*Aceros undulatus*	Wreathed Hornbill
11	*Acridotheres fuscus*	Jungle Myna
12	*Acridotheres ginginianus*	Bank Myna
13	*Acridotheres grandis*	Great Myna
14	*Acridotheres tristis*	Common Myna
15	*Acrocephalus aedon*	Thick-billed Warbler
16	*Acrocephalus agricola*	Paddyfield Warbler
17	*Acrocephalus dumetorum*	Blyth's Reed Warbler
18	*Actinodura egertoni*	Rusty-fronted Barwing
19	*Actinodura nipalensis*	Hoary-throated Barwing
20	*Actitis hypoleucos*	Common Sandpiper
21	*Aegithalos concinnus*	Black-throated Tit
22	*Aegithalos iouschistos*	Rufous-fronted Tit
23	*Aegithina tiphia*	Common Iora
24	*Aegolius funereus*	Boreal Owl
25	*Aegypius monachus*	Cinereous Vulture
26	*Aethopyga gouldiae*	Mrs Gould's Sunbird
27	*Aethopyga ignicauda*	Fire-tailed Sunbird
28	*Aethopyga nipalensis*	Green-tailed Sunbird
29	*Aethopyga saturata*	Black-throated Sunbird
30	*Aethopyga siparaja*	Crimson Sunbird
31	*Aix galericulata*	Mandarin Duck
32	*Alauda gulgula*	Oriental Skylark
33	*Alcedo atthis*	Common Kingfisher
34	*Alcedo hercules*	Blyth's Kingfisher
35	*Alcippe castaneceps*	Rufous-winged Fulvetta
36	*Alcippe ludlowi*	Brown-throated Fulvetta

[6] Source: Nature Conservation Division, Department of Forests and Park Services

37	*Alcippe nipalensis*	Nepal Fulvetta
38	*Alcippe rufogularis*	Rufous-throated Fulvetta
39	*Alcippe vinipectus*	White-browed Fulvetta
40	*Alophoixus flaveolus*	White-throated Bulbul
41	*Amaurornis phoenicurus*	White-breasted Waterhen
42	*Ampeliceps coronatus*	Yellow-crested Myna
43	*Anas acuta*	Northern Pintail
44	*Anas clypeata*	Northern Shoveler
45	*Anas crecca*	Common Teal
46	*Anas falcata*	Falcated Duck
47	*Anas formosa*	Baikal Teal
48	*Anas penelope*	Eurasian Wigeon
49	*Anas platyrhynchos*	Mallard
50	*Anas poecilorhyncha*	Indian Spot-billed Duck
51	*Anas querquedula*	Garganey
52	*Anas strepera*	Gadwall
53	*Anastomus oscitans*	Asian Openbill
54	*Anser albifrons*	Greater White-fronted Goose
55	*Anser anser*	Greylag Goose
56	*Anser indicus*	Bar-headed Goose
57	*Anthracoceros albirostris*	Oriental Pied Hornbill
58	*Anthreptes singalensis*	Ruby-cheeked Sunbird
59	*Anthus campestris*	Tawny Pipit
60	*Anthus cervinus*	Red-throated Pipit
61	*Anthus godlewskii*	Blyth's Pipit
62	*Anthus hodgsoni*	Olive-backed Pipit
63	*Anthus richardi*	Richard's Pipit
64	*Anthus roseatus*	Rosy Pipit
65	*Anthus rubescens*	Buff-bellied Pipit
66	*Anthus rufulus*	Paddyfield Pipit
67	*Anthus spinoletta*	Water Pipit
68	*Anthus trivialis*	Tree Pipit
69	*Apus nipalensis*	House Swift
70	*Apus acuticauda*	Dark-rumped Swift
71	*Apus pacificus*	Fork-tailed Swift
72	*Aquila chrysaetos*	Golden Eagle
73	*Aquila clanga*	Greater Spotted Eagle

74	*Aquila hastata*	Indian Spotted Eagle
75	*Aquila heliaca*	Eastern Imperial Eagle
76	*Aquila nipalensis*	Steppe Eagle
77	*Arachnothera longirostra*	Little Spiderhunter
78	*Arachnothera magna*	Streaked Spiderhunter
79	*Arborophila mandellii*	Chestnut-breasted Partridge
80	*Arborophila rufogularis*	Rufous-throated Partridge
81	*Arborophila torqueola*	Hill Partridge
82	*Ardea cinerea*	Grey Heron
83	*Ardea insignis*	White-bellied Heron
84	*Ardea purpurea*	Purple Heron
85	*Ardeola bacchus*	Chinese Pond Heron
86	*Ardeola grayii*	Indian Pond Heron
87	*Artamus fuscus*	Ashy Woodswallow
88	*Asio flammeus*	Short-eared Owl
89	*Asio otus*	Long-eared Owl
90	*Athene brama*	Spotted Owlet
91	*Athene noctua*	Little Owl
92	*Aviceda jerdoni*	Jerdon's Baza
93	*Aviceda leuphotes*	Black Baza
94	*Aythya baeri*	Baer's Pochard
95	*Aythya ferina*	Common Pochard
96	*Aythya fuligula*	Tufted Duck
97	*Aythya nyroca*	Ferruginous Duck
98	*Batastur teesa*	White-eyed Buzzard
99	*Batrachostomus hodgsoni*	Hodgson's Frogmouth
100	*Blythipicus pyrrhotis*	Bay Woodpecker
101	*Brachypteryx hyperythra*	Rusty-bellied Shortwing
102	*Brachypteryx leucophrys*	Lesser Shortwing
103	*Brachypteryx montana*	White-browed Shortwing
104	*Brachypteryx stellata*	Gould's Shortwing
105	*Bradypterus luteoventris*	Brown Bush Warbler
106	*Bradypterus seebohmi*	Russet Bush Warbler
107	*Bradypterus tacsanowskius*	Chinese Bush Warbler
108	*Bradypterus thoracicus*	Spotted Bush Warbler
109	*Bubo bengalensis*	Indian Eagle Owl
110	*Bubo bubo*	Eurasian Eagle Owl

111	*Bubo nipalensis*	Spot-bellied Eagle Owl
112	*Bubulcus ibis*	Cattle Egret
113	*Buceros bicornis*	Great Hornbill
114	*Burhinus indicus*	Indian Thick-knee
115	*Buteo burmanicus*	Himalayan Buzzard
116	*Buteo hemilasius*	Upland Buzzard
117	*Buteo rufinus*	Long-legged Buzzard
118	*Butorides striata*	Striated Heron
119	*Cacomantis merulinus*	Plaintive Cuckoo
120	*Cacomantis passerinus*	Grey-bellied Cuckoo
121	*Cacomantis sonneratii*	Banded Bay Cuckoo
122	*Cairina scutulata*	White-winged Duck
123	*Calandrella acutirostris*	Hume's Short-toed Lark
124	*Calandrella brachydactyla*	Greater Short-toed Lark
125	*Calandrella cheleensis*	Asian Short-toed Lark
126	*Calandrella raytal*	Sand Lark
127	*Calcarius lapponicus*	Lapland Longspur
128	*Calidris ferruginea*	Curlew Sandpiper
129	*Calidris minuta*	Little Stint
130	*Calidris temminckii*	Temminck's Stint
131	*Callacanthis burtoni*	Spectacled Finch
132	*Calmator jacobinus*	Jacobin Cuckoo
133	*Caprimulgus affinis*	Savanna Nightjar
134	*Caprimulgus asiaticus*	Indian Nightjar
135	*Caprimulgus indicus*	Grey Nightjar
136	*Caprimulgus macrurus*	Large-tailed Nightjar
137	*Carduelis spinoides*	Yellow-breasted Greenfinch
138	*Carpodacus edwardsii*	Dark-rumped Rosefinch
139	*Carpodacus erythrinus*	Common Rosefinch
140	*Carpodacus nipalensis*	Dark-breasted Rosefinch
141	*Carpodacus pulcherrimus*	Beautiful Rosefinch
142	*Carpodacus puniceus*	Red-fronted Rosefinch
143	*Carpodacus rodochroa*	Pink-browed Rosefinch
144	*Carpodacus rubescens*	Blanford's Rosefinch
145	*Carpodacus rubicilloides*	Streaked Rosefinch
146	*Carpodacus thura*	White-browed Rosefinch
147	*Carpodacus trifasciatus*	Three-banded Rosefinch

148	*Casmerodius albus*	Great Egret
149	*Celeus brachyurus*	Rufous Woodpecker
150	*Centropus bengalensis*	Lesser Coucal
151	*Centropus sinensis*	Greater Coucal
152	*Cephalopyrus flammiceps*	Fire-capped Tit
153	*Certhia discolor*	Brown-throated Treecreeper
154	*Certhia hodgsoni*	Hodgson's Treecreeper
155	*Certhia nipalensis*	Rusty-flanked Treecreeper
156	*Ceryle rudis*	Pied Kingfisher
157	*Cettia acanthizoides*	Yellowish-bellied Bush Warbler
158	*Cettia brunnifrons*	Grey-sided Bush Warbler
159	*Cettia flavolivacea*	Aberrant Bush Warbler
160	*Cettia fortipes*	Brownish-flanked Bush Warbler
161	*Cettia major*	Chestnut-crowned Bush Warbler
162	*Cettia pallidipes*	Pale-footed Bush Warbler
163	*Ceyx erithacus*	Oriental Dwarf Kingfisher
164	*Chaimarrornis leucocephalus*	White-capped Water Redstart
165	*Chalcophaps indica*	Emerald Dove
166	*Charadrius alexandrinus*	Kentish Plover
167	*Charadrius dubius*	Little Ringed Plover
168	*Charadrius leschenaultii*	Greater Sand Plover
169	*Charadrius mongolus*	Lesser Sand Plover
170	*Charadrius placidus*	Long-billed Plover
171	*Chloropsis aurifrons*	Golden-fronted Leafbird
172	*Chloropsis hardwickii*	Orange-bellied Leafbird
173	*Chroicocephalus brunnicephalus*	Brown-headed Gull
174	*Chroicocephalus genei*	Slender-billed Gull
175	*Chroicocephalus ridibundus*	Black-headed Gull
176	*Chrysococcyx maculatus*	Asian Emerald Cuckoo
177	*Chrysococcyx xanthorhynchus*	Violet Cuckoo
178	*Chrysocolaptes lucidus*	Greater Flameback
179	*Chrysoma sinense*	Yellow-eyed Babbler
180	*Ciconia episcopus*	Woolly-necked Stork
181	*Ciconia nigra*	Black Stork
182	*Cinclidium frontale*	Blue-fronted Robin
183	*Cinclus cinclus*	White-throated Dipper
184	*Cinclus pallasii*	Brown Dipper

185	*Circaetus gallicus*	Short-toed Snake Eagle
186	*Circus spilonotus*	Eastern Marsh Harrier
187	*Circus aeruginosus*	Eurasian Marsh Harrier
188	*Circus cyaneus*	Hen Harrier
189	*Circus macrourus*	Pallid Harrier
190	*Circus melanoleucos*	Pied Harrier
191	*Cissa chinensis*	Common Green Magpie
192	*Clamator coromandus*	Chestnut-winged Cuckoo
193	*Clangula hyemalis*	Long-tailed Duck
194	*Cochoa purpurea*	Purple Cochoa
195	*Cochoa viridis*	Green Cochoa
196	*Collocalia brevirostris*	Himalayan Swiftlet
197	*Columba hodgsonii*	Speckled Wood Pigeon
198	*Columba leuconota*	Snow Pigeon
199	*Columba livia*	Common Pigeon
200	*Columba pulchricollis*	Ashy Wood Pigeon
201	*Columba rupestris*	Hill Pigeon
202	*Conostoma oemodium*	Great Parrotbill
203	*Copsychus malabaricus*	White-rumped Shama
204	*Copsychus saularis*	Oriental Magpie Robin
205	*Coracias benghalensis*	Indian Roller
206	*Coracias garrulus*	Eurasian Roller
207	*Coracina macei*	Large Cuckoo shrike
208	*Coracina melaschistos*	Black-winged Cuckooshrike
209	*Corvus levaillantii*	Eastern Jungle Crow
210	*Corvus corax*	Northern Raven
211	*Corvus macrorhynchos*	Large-billed Crow
212	*Corvus splendens*	House Crow
213	*Coturnix coturnix*	Common Quail
214	*Coturnix japonica*	Japanese Quail
215	*Cuculus canorus*	Eurasian Cuckoo
216	*Cuculus micropterus*	Indian Cuckoo
217	*Cuculus poliocephalus*	Lesser Cuckoo
218	*Cuculus saturatus*	Oriental Cuckoo
219	*Culicicapa ceylonensis*	Grey-headed Canary Flycatcher
220	*Cutia nipalensis*	Himalayan Cutia
221	*Cyornis poliogenys*	Pale-chinned Flycatcher

222	*Cyornis rubeculoides*	Blue-throated Flycatcher
223	*Cyornis unicolor*	Pale Blue Flycatcher
224	*Cypsiurus balasiensis*	Asian Palm Swift
225	*Delichon dasypus*	Asian House Martin
226	*Delichon nipalensis*	Nepal House Martin
227	*Dendrocitta formosae*	Grey Treepie
228	*Dendrocitta frontalis*	Collared Treepie
229	*Dendrocitta vagabunda*	Rufous Treepie
230	*Dendrocopos atratus*	Stripe-breasted Woodpecker
231	*Dendrocopos canicapillus*	Grey-capped Pygmy Woodpecker
232	*Dendrocopos cathpharius*	Crimson-breasted Woodpecker
233	*Dendrocopos darjellensis*	Darjeeling Woodpecker
234	*Dendrocopos hyperythrus*	Rufous-bellied Woodpecker
235	*Dendrocopos macei*	Fulvous-breasted Woodpecker
236	*Dendrocygna bicolor*	Fulvous Whistling-duck
237	*Dendrocygna javanica*	Lesser Whistling-duck
238	*Dendronanthus indicus*	Forest Wagtail
239	*Dicaeum chrysorrheum*	Yellow-vented Flowerpecker
240	*Dicaeum concolor*	Plain Flowerpecker
241	*Dicaeum cruentatum*	Scarlet-backed Flowerpecker
242	*Dicaeum erythrorynchos*	Pale-billed Flowerpecker
243	*Dicaeum ignipectus*	Fire-breasted Flowerpecker
244	*Dicaeum melanoxanthum*	Yellow-bellied Flowerpecker
245	*Dicrurus aeneus*	Bronzed Drongo
246	*Dicrurus annectans*	Crow-billed Drongo
247	*Dicrurus hottentottus*	Spangled Drongo
248	*Dicrurus leucophaeus*	Ashy Drongo
249	*Dicrurus macrocercus*	Black Drongo
250	*Dicrurus paradiseus*	Greater Racket-tailed Drongo
251	*Dicrurus remifer*	Lesser Racket-tailed Drongo
252	*Dinopium shorii*	Himalayan Flameback
253	*Ducula aenea*	Green Imperial Pigeon
254	*Ducula badia*	Mountain Imperial Pigeon
255	*Egretta garzetta*	Little Egret
256	*Elanus caeruleus*	Black-winged Kite
257	*Emberiza buchanani*	Grey-necked Bunting
258	*Emberiza godlewskii*	Godlewski's Bunting

259	*Emberiza melanocephala*	Black-headed Bunting
260	*Emberiza pusilla*	Little Bunting
261	*Emberiza rustica*	Rustic Bunting
262	*Emberiza spodocephala*	Black-faced Bunting
263	*Enicurus immaculatus*	Black-backed Forktail
264	*Enicurus leschenaulti*	White-crowned Forktail
265	*Enicurus maculatus*	Spotted Forktail
266	*Enicurus schistaceus*	Slaty-backed Forktail
267	*Enicurus scouleri*	Little Forktail
268	*Ephippiorhynchus asiaticus*	Black-necked Stork
269	*Epornis zantholeuca*	White-bellied Epornis
270	*Esacus recurvirostris*	Great Thick-knee
271	*Eudynamys scolopacea*	Asian Koel
272	*Eumyias thalassina*	Verditer Flycatcher
273	*Eurystomus orientalis*	Dollarbird
274	*Falco amurensis*	Amur Falcon
275	*Falco chicquera*	Red-necked Falcon
276	*Falco columbarius*	Merlin
277	*Falco peregrinus*	Peregrine Falcon
278	*Falco severus*	Oriental Hobby
279	*Falco subbuteo*	Eurasian Hobby
280	*Falco tinnunculus*	Common Kestrel
281	*Ficedula albicilla*	Taiga Flycatcher
282	*Ficedula hodgsonii*	Slaty-backed Flycatcher
283	*Ficedula hyperythra*	Snowy-browed Flycatcher
284	*Ficedula monileger*	White-gorgeted Flycatcher
285	*Ficedula parva*	Red-breasted Flycatcher
286	*Ficedula sapphira*	Sapphire Flycatcher
287	*Ficedula strophiata*	Rufous-gorgeted Flycatcher
288	*Ficedula subrubra*	Kashmir Flycatcher
289	*Ficedula superciliaris*	Ultramarine Flycatcher
290	*Ficedula tricolor*	Slaty-blue Flycatcher
291	*Ficedula westermanni*	Little Pied Flycatcher
292	*Francolinus francolinus*	Black Francolin
293	*Fringilla coelebs*	Common Chaffinch
294	*Fringilla montifringilla*	Brambling
295	*Fulica atra*	Eurasian Coot

296	*Gallicrex cinerea*	Watercock
297	*Gallinago gallinago*	Common Snipe
298	*Gallinago nemoricola*	Wood Snipe
299	*Gallinago solitaria*	Solitary Snipe
300	*Gallinago stenura*	Pintail Snipe
301	*Gallinula chloropus*	Common Moorhen
302	*Gallirallus striata*	Slaty-breasted Rail
303	*Gallus gallus*	Red Junglefowl
304	*Gampsorhynchus rufulus*	White-hooded Babbler
305	*Garrulax affinis*	Black-faced Laughingthrush
306	*Garrulax albogularis*	White-throated Laughingthrush
307	*Garrulax caerulatus*	Grey-sided Laughingthrush
308	*Garrulax erythrocephalus*	Chestnut-crowned Laughingthrush
309	*Garrulax gularis*	Rufous-vented Laughingthrush
310	*Garrulax imbricatus*	Bhutan Laughingthrush
311	*Garrulax leucolophus*	White-crested Laughingthrush
312	*Garrulax monileger*	Lesser Necklaced Laughingthrush
313	*Garrulax ocellatus*	Spotted Laughingthrush
314	*Garrulax pectoralis*	Greater Necklaced Laughingthrush
315	*Garrulax ruficollis*	Rufous-necked Laughingthrush
316	*Garrulax rufogularis*	Rufous-chinned Laughingthrush
317	*Garrulax squamatus*	Blue-winged Laughingthrush
318	*Garrulax striatus*	Striated Laughingthrush
319	*Garrulax subunicolor*	Scaly Laughingthrush
320	*Garrulus glandarius*	Eurasian Jay
321	*Gecinulus grantia*	Pale-headed Woodpecker
322	*Glareola lactea*	Small Pratincole
323	*Glaucidium brodiei*	Collared Owlet
324	*Glaucidium cuculoides*	Asian Barred Owlet
325	*Glaucidium radiatum*	Jungle Owlet
326	*Gorsachius melanolophus*	Malayan Night Heron
327	*Gracula religiosa*	Common Hill Myna
328	*Grandala coelicolor*	Grandala
329	*Grus grus*	Common Crane
330	*Grus nigricollis*	Black-necked Crane
331	*Grus virgo*	Demoiselle Crane
332	*Gypaetus barbatus*	Bearded Vulture

333	*Gyps bengalensis*	White-rumped Vulture
334	*Gyps himalayensis*	Himalayan Griffon
335	*Haematospiza sipahi*	Scarlet Finch
336	*Halcyon coromanda*	Ruddy Kingfisher
337	*Halcyon pileata*	Black-capped Kingfisher
338	*Halcyon smyrnensis*	White-throated Kingfisher
339	*Haliaeetus albicilla*	White-tailed Eagle
340	*Haliaeetus leucoryphus*	Pallas's Fish Eagle
341	*Haliastur indus*	Brahminy Kite
342	*Harpactes erythrocephalus*	Red-headed Trogon
343	*Harpactes wardi*	Ward's Trogon
344	*Hemiprocne coronata*	Crested Treeswift
345	*Hemipus picatus*	Bar-winged Flycatcher-shrike
346	*Hemixos flavala*	Ashy Bulbul
347	*Heterophasia annectans*	Rufous-backed Sibia
348	*Heterophasia picaoides*	Long-tailed Sibia
349	*Hieraaetus fasciatus*	Bonelli's Eagle
350	*Hieraaetus kienerii*	Rufous-bellied Eagle
351	*Hieraaetus pennatus*	Booted Eagle
352	*Hierococcyx fugax*	Hodgson's Hawk Cuckoo
353	*Hierococcyx sparverioides*	Large Hawk Cuckoo
354	*Hierococcyx varius*	Common Hawk Cuckoo
355	*Himantopus himantopus*	Black-winged Stilt
356	*Hirundapus caudacutus*	White-throated Needletail
357	*Hirundo daurica*	Red-rumped Swallow
358	*Hirundo rupestris*	Eurasian Crag Martin
359	*Hirundo rustica*	Barn Swallow
360	*Hodgsonius phaenicuroides*	White-bellied Redstart
361	*Hydrophasianus chirurgus*	Pheasant-tailed Jacana
362	*Hypothymis azurea*	Black-naped Monarch
363	*Hypsipetes leucocephalus*	Black Bulbul
364	*Ibidorhyncha struthersii*	Ibisbill
365	*Ichthyaetus ichthyaetus*	Pallas's Gull
366	*Ichthyophaga humilis*	Lesser Fish Eagle
367	*Ictinaetus malayensis*	Black Eagle
368	*Iduna caligata*	Booted Warbler
369	*Indicator xanthonotus*	Yellow-rumped Honeyguide

370	*Irena puella*	Asian Fairy Bluebird
371	*Ithaginis cruentus*	Blood Pheasant
372	*Ixobrychus cinnamomeus*	Cinnamon Bittern
373	*Ixos mcclellandii*	Mountain Bulbul
374	*Jynx torquilla*	Eurasian Wryneck
375	*Ketupa flavipes*	Tawny Fish Owl
376	*Ketupa zeylonensis*	Brown Fish Owl
377	*Lanius collurioides*	Burmese Shrike
378	*Lanius cristatus*	Brown Shrike
379	*Lanius schach*	Long-tailed Shrike
380	*Lanius tephronotus*	Grey-backed Shrike
381	*Lanius vittatus*	Bay-backed Shrike
382	*Larus barabensis*	Steppe Gull
383	*Larus canus*	Mew Gull
384	*Larus heuglini*	Heuglin's Gull
385	*Leiothrix argentauris*	Silver-eared Mesia
386	*Leiothrix lutea*	Red-billed Leiothrix
387	*Leptopoecile sophiae*	White-browed Tit Warbler
388	*Leptoptilos javanicus*	Lesser Adjutant
389	*Lerwa lerwa*	Snow Partridge
390	*Leucosticte brandti*	Brandt's Mountain Finch
391	*Leucosticte nemoricola*	Plain Mountain Finch
392	*Liocichla phoenicea*	Red-faced Liocichla
393	*Lioparus chrysotis*	Golden-breasted Fulvetta
394	*Lonchura punctulata*	Scaly-breasted Munia
395	*Lonchura striata*	White-rumped Munia
396	*Lophophorus impejanus*	Himalayan Monal
397	*Lophura leucomelanos*	Kalij Pheasant
398	*Loxia curvirostra*	Red Crossbill
399	*Luscinia brunnea*	Indian Blue Robin
400	*Luscinia calliope*	Siberian Rubythroat
401	*Luscinia pectoralis*	White-tailed Rubythroat
402	*Luscinia svecica*	Bluethroat
403	*Lymnocryptes minimus*	Jack Snipe
404	*Macronous gularis*	Pin-striped Tit Babbler
405	*Macropygia unchall*	Barred Cuckoo Dove
406	*Malacias capistrata*	Rufous Sibia

407	*Malacias pulchellus*	Beautiful Sibia
408	*Malacocincla abbotti*	Abbott's Babbler
409	*Megaceryle lugubris*	Crested Kingfisher
410	*Megalaima asiatica*	Blue-throated Barbet
411	*Megalaima australis*	Blue-eared Barbet
412	*Megalaima franklinii*	Golden-throated Barbet
413	*Megalaima haemacephala*	Coppersmith Barbet
414	*Megalaima lineata*	Lineated Barbet
415	*Megalaima virens*	Great Barbet
416	*Megalurus palustris*	Striated Grassbird
417	*Melanochlora sultanea*	Sultan Tit
418	*Melophus lathami*	Crested Bunting
419	*Mergus merganser*	Goosander
420	*Merops leschenaulti*	Chestnut-headed Bee-eater
421	*Merops orientalis*	Green Bee-eater
422	*Merops philippinus*	Blue-tailed Bee-eater
423	*Mesophoyx intermedia*	Intermediate Egret
424	*Metopidius indicus*	Bronze-winged Jacana
425	*Microhierax caerulescens*	Collared Falconet
426	*Microhierax melanoleucos*	Pied Falconet
427	*Milvus migrans*	Black Kite
428	*Minla cyanouroptera*	Blue-winged Siva
429	*Minla ignotincta*	Red-tailed Minla
430	*Minla strigula*	Bar-throated Siva
431	*Mirafra assamica*	Bengal Bushlark
432	*Monticola cinclorhynchus*	Blue-capped Rock Thrush
433	*Monticola rufiventris*	Chestnut-bellied Rock Thrush
434	*Monticola solitarius*	Blue Rock Thrush
435	*Motacilla alba*	White Wagtail
436	*Motacilla cinerea*	Grey Wagtail
437	*Motacilla citreola*	Citrine Wagtail
438	*Motacilla flava*	Yellow Wagtail
439	*Motacilla maderaspatensis*	White-browed Wagtail
440	*Mulleripicus pulverulentus*	Great Slaty Woodpecker
441	*Muscicapa dauurica*	Asian Brown Flycatcher
442	*Muscicapa ferruginea*	Ferruginous Flycatcher
443	*Muscicapa muttui*	Brown-breasted Flycatcher

444	*Muscicapa sibirica*	Dark-sided Flycatcher
445	*Muscicapella hodgsoni*	Pygmy Blue Flycatcher
446	*Mycerobas affinis*	Collared Grosbeak
447	*Mycerobas carnipes*	White-winged Grosbeak
448	*Mycerobas melanozanthos*	Spot-winged Grosbeak
449	*Myiomela leucura*	White-tailed Robin
450	*Myophonus caeruleus*	Blue Whistling Thrush
451	*Myzornis pyrrhoura*	Fire-tailed Myzornis
452	*Napothera epilepidota*	Eyebrowed Wren Babbler
453	*Nectarinia asiatica*	Purple Sunbird
454	*Neophron percnopterus*	Egyptian Vulture
455	*Niltava grandis*	Large Niltava
456	*Niltava macgrigoriae*	Small Niltava
457	*Niltava sundara*	Rufous-bellied Niltava
458	*Niltava vivida*	Vivid Niltava
459	*Ninox scutulata*	Brown Hawk Owl
460	*Nisaetus nipalensis*	Mountain Hawk Eagle
461	*Nucifraga caryocatactes*	Spotted Nutcracker
462	*Numenius arquata*	Eurasian Curlew
463	*Numenius phaeopus*	Whimbrel
464	*Nycticorax nycticorax*	Black-crowned Night Heron
465	*Nyctyornis athertoni*	Blue-bearded Bee-eater
466	*Oenanthe isabellina*	Isabelline Wheatear
467	*Oenanthe pleschanka*	Pied Wheatear
468	*Oriolus kundoo*	Indian Golden Oriole
469	*Oriolus tenuirostris*	Slender-billed Oriole
470	*Oriolus traillii*	Maroon Oriole
471	*Oriolus xanthornus*	Black-hooded Oriole
472	*Orthotomus cuculatus*	Mountain Tailorbird
473	*Orthotomus sutorius*	Common Tailorbird
474	*Otus lettia*	Collared Scops Owl
475	*Otus spilocephalus*	Mountain Scops Owl
476	*Otus sunia*	Oriental Scops Owl
477	*Pandion haliaetus*	Osprey
478	*Paradoxornis atrosuperciliaris*	Lesser Rufous-headed Parrotbill
479	*Paradoxornis fulvifrons*	Fulvous Parrotbill
480	*Paradoxornis gularis*	Grey-headed Parrotbill

482	*Paradoxornis ruficeps*	Greater Rufous-headed Parrotbill
483	*Paradoxornis unicolor*	Brown Parrotbill
484	*Parus ater*	Coal Tit
485	*Parus dichrous*	Grey-crested Tit
486	*Parus major*	Great Tit
487	*Parus monticolus*	Green-backed Tit
488	*Parus rubidiventris*	Rufous-vented Tit
489	*Parus spilonotus*	Yellow-cheeked Tit
490	*Passer domesticus*	House Sparrow
491	*Passer montanus*	Eurasian Tree Sparrow
492	*Passer rutilans*	Russet Sparrow
493	*Pavo cristatus*	Indian Peafowl
494	*Pelargopsis capensis*	Stork-billed Kingfisher
495	*Pellorneum albiventre*	Spot-throated Babbler
496	*Pellorneum ruficeps*	Puff-throated Babbler
497	*Perdix hodgsoniae*	Tibetan Partridge
498	*Pericrocotus speciosus*	Scarlet Minivet
499	*Pericrocotus brevirostris*	Short-billed Minivet
500	*Pericrocotus cinnamomeus*	Small Minivet
501	*Pericrocotus divaricatus*	Ashy Minivet
502	*Pericrocotus ethologus*	Long-tailed Minivet
503	*Pericrocotus roseus*	Rosy Minivet
504	*Pericrocotus solaris*	Grey-chinned Minivet
505	*Pernis ptilorhyncus*	Oriental Honey-buzzard
506	*Phaenicophaeus tristis*	Green-billed Malkoha
507	*Phalacrocorax carbo*	Great Cormorant
508	*Phalacrocorax fuscicollis*	Indian Cormorant
509	*Phalacrocorax niger*	Little Cormorant
510	*Philomachus pugnax*	Ruff
511	*Phodilus badius*	Oriental Bay Owl
512	*Phoenicurus auroreus*	Daurian Redstart
513	*Phoenicurus coeruleocephala*	Blue-capped Redstart
514	*Phoenicurus erythrogaster*	White-winged Redstart
515	*Phoenicurus frontalis*	Blue-fronted Redstart
516	*Phoenicurus hodgsoni*	Hodgson's Redstart
517	*Phoenicurus ochruros*	Black Redstart
518	*Phoenicurus schisticeps*	White-throated Redstart

519	*Phylloscopus mandellii*	Mandelli's Leaf Warbler
520	*Phylloscopus affinis*	Tickell's Leaf Warbler
521	*Phylloscopus cantator*	Yellow-vented Warbler
522	*Phylloscopus chloronotus*	Lemon-rumped Warbler
523	*Phylloscopus collybita*	Common Chiffchaff
524	*Phylloscopus fuligiventer*	Smoky Warbler
525	*Phylloscopus fuscatus*	Dusky Warbler
526	*Phylloscopus humei*	Hume's Warbler
527	*Phylloscopus inornatus*	Yellow-browed Warbler
528	*Phylloscopus maculipennis*	Ashy-throated Warbler
529	*Phylloscopus magnirostris*	Large-billed Leaf Warbler
530	*Phylloscopus pulcher*	Buff-barred Warbler
531	*Phylloscopus reguloides*	Blyth's Leaf Warbler
532	*Phylloscopus trochiloides*	Greenish Warbler
533	*Pica pica*	Eurasian Magpie
534	*Picumnus innominatus*	Speckled Piculet
535	*Picus canus*	Grey-headed Woodpecker
536	*Picus chlorolophus*	Lesser Yellownape
537	*Picus flavinucha*	Greater Yellownape
538	*Picus xanthopygaeus*	Streak-throated Woodpecker
539	*Pitta cyanea*	Blue Pitta
540	*Pitta nipalensis*	Blue-naped Pitta
541	*Pitta sordida*	Hooded Pitta
542	*Ploceus benghalensis*	Black-breasted Weaver
543	*Ploceus manyar*	Streaked Weaver
544	*Ploceus philippinus*	Baya Weaver
545	*Pluvialis apricaria*	European Golden Plover
546	*Pluvialis fulva*	Pacific Golden Plover
547	*Pnoepyga albiventer*	Scaly-breasted Wren Babbler
548	*Pnoepyga pusilla*	Pygmy Wren Babbler
549	*Podiceps cristatus*	Great Crested Grebe
550	*Podiceps nigricollis*	Black-necked Grebe
551	*Polyplectron bicalcaratum*	Grey Peacock Pheasant
552	*Pomatorhinus erythrocnemis*	Spot-breasted Scimitar Babbler
553	*Pomatorhinus erythrogenys*	Rusty-cheeked Scimitar Babbler
554	*Pomatorhinus ferruginosus*	Coral-billed Scimitar Babbler
555	*Pomatorhinus ruficollis*	Streak-breasted Scimitar Babbler

556	*Pomatorhinus schisticeps*	White-browed Scimitar Babbler
557	*Porphyrio porphyrio*	Purple Swamphen
558	*Porzana bicolor*	Black-tailed Crake
559	*Porzana fusca*	Ruddy-breasted Crake
560	*Porzana parva*	Little Crake
561	*Prinia atrogularis*	Hill Prinia
562	*Prinia cinereocapilla*	Grey-crowned Prinia
563	*Prinia criniger*	Striated Prinia
564	*Prinia hodgsonii*	Grey-breasted Prinia
565	*Prinia inornata*	
566	*Prinia rufescens*	Rufescent Prinia
567	*Prinia socialis*	Ashy Prinia
568	*Prinia sylvatica*	Jungle Prinia
569	*Propyrrhula subhimachala*	Crimson-browed Finch
570	*Prunella collaris*	Alpine Accentor
571	*Prunella fulvescens*	Brown Accentor
572	*Prunella himalayana*	Altai Accentor
573	*Prunella immaculata*	Maroon-backed Accentor
574	*Prunella rubeculoides*	Robin Accentor
575	*Prunella strophiata*	Rufous-breasted Accentor
576	*Psarisomus dalhousiae*	Long-tailed Broadbill
577	*Pseudibis papillosa*	Red-naped Ibis
578	*Pseudominla cinerea*	Yellow-throated Fulvetta
579	*Psittacula alexandri*	Red-breasted Parakeet
580	*Psittacula eupatria*	Alexandrine Parakeet
581	*Psittacula finschii*	Grey-headed Parakeet
582	*Psittacula himalayana*	Slaty-headed Parakeet
583	*Psittacula krameri*	Rose-ringed Parakeet
584	*Psittacula roseata*	Blossom-headed Parakeet
585	*Pteruthius flaviscapis*	White-browed Shrike Babbler
586	*Pteruthius melanotis*	Black-eared Shrike Babbler
587	*Pteruthius rufiventer*	Black-headed Shrike Babbler
588	*Pteruthius xanthochlorus*	Green Shrike Babbler
589	*Pycnonotus cafer*	Red-vented Bulbul
590	*Pycnonotus jocosus*	Red-whiskered Bulbul
591	*Pycnonotus leucogenys*	Himalayan Bulbul
592	*Pycnonotus melanicterus*	Black-crested Bulbul

593	*Pycnonotus striatus*	Striated Bulbul
594	*Pyrrhocorax graculus*	Yellow-billed Chough
595	*Pyrrhocorax pyrrhocorax*	Red-billed Chough
596	*Pyrrhoplectes epauletta*	Gold-naped Finch
597	*Pyrrhula erythaca*	Grey-headed Bullfinch
598	*Pyrrhula erythrocephala*	Red-headed Bullfinch
599	*Pyrrhula nipalensis*	Brown Bullfinch
600	*Recurvirostra avosetta*	Pied Avocet
601	*Regulus regulus*	Goldcrest
602	*Rhipidura albicollis*	White-throated Fantail
603	*Rhipidura hypoxantha*	Yellow-bellied Fantail
604	*Rhodonessa rufina*	Red-crested Pochard
605	*Rhyacornis fuliginosus*	Plumbeous Water Redstart
606	*Rimator malacoptilus*	Long-billed Wren Babbler
607	*Riparia diluta*	Pale Martin
608	*Riparia paludicola*	Plain Martin
609	*Riparia riparia*	Sand Martin
610	*Rostratula benghalensis*	Greater Painted-snipe
611	*Sarcogyps calvus*	Red-headed Vulture
612	*Saroglossa spiloptera*	Spot-winged Starling
613	*Sasia ochracea*	White-browed Piculet
614	*Saxicola caprata*	Pied Bushchat
615	*Saxicola ferrea*	Grey Bushchat
616	*Saxicola insignis*	Hodgson's Bushchat
617	*Saxicola torquata*	Common Stonechat
618	*Saxicoloides fulicata*	Indian Robin
619	*Schoeniparus dubia*	Rusty-capped Fulvetta
620	*Scolopax rusticola*	Eurasian Woodcock
621	*Seicercus affinis*	White-spectacled Warbler
622	*Seicercus burkii*	Green-crowned Warbler
623	*Seicercus castaniceps*	Chestnut-crowned Warbler
624	*Seicercus poliogenys*	Grey-cheeked Warbler
625	*Seicercus whistleri*	Whistler's Warbler
626	*Seicercus xanthoschistos*	Grey-hooded Warbler
627	*Serilophus lunatus*	Silver-breasted Broadbill
628	*Serinus pusillus*	Red-fronted Serin
629	*Serinus thibetanus*	Tibetan Serin

530	*Phylloscopus pulcher*	Buff-barred Warbler
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556	*Pomatorhinus schisticeps*	White-browed Scimitar Babbler
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562	*Prinia cinereocapilla*	Grey-crowned Prinia
563	*Prinia criniger*	Striated Prinia
564	*Prinia hodgsonii*	Grey-breasted Prinia
565	*Prinia inornata*	
566	*Prinia rufescens*	Rufescent Prinia

567	*Prinia socialis*	Ashy Prinia
568	*Prinia sylvatica*	Jungle Prinia
569	*Propyrrhula subhimachala*	Crimson-browed Finch
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571	*Prunella fulvescens*	Brown Accentor
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590	*Pycnonotus jocosus*	Red-whiskered Bulbul
591	*Pycnonotus leucogenys*	Himalayan Bulbul
592	*Pycnonotus melanicterus*	Black-crested Bulbul
593	*Pycnonotus striatus*	Striated Bulbul
594	*Pyrrhocorax graculus*	Yellow-billed Chough
595	*Pyrrhocorax pyrrhocorax*	Red-billed Chough
596	*Pyrrhoplectes epauletta*	Gold-naped Finch
597	*Pyrrhula erythaca*	Grey-headed Bullfinch
598	*Pyrrhula erythrocephala*	Red-headed Bullfinch
599	*Pyrrhula nipalensis*	Brown Bullfinch
600	*Recurvirostra avosetta*	Pied Avocet
601	*Regulus regulus*	Goldcrest
602	*Rhipidura albicollis*	White-throated Fantail
603	*Rhipidura hypoxantha*	Yellow-bellied Fantail

604	*Rhodonessa rufina*	Red-crested Pochard
605	*Rhyacornis fuliginosus*	Plumbeous Water Redstart
606	*Rimator malacoptilus*	Long-billed Wren Babbler
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608	*Riparia paludicola*	Plain Martin
609	*Riparia riparia*	Sand Martin
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611	*Sarcogyps calvus*	Red-headed Vulture
612	*Saroglossa spiloptera*	Spot-winged Starling
613	*Sasia ochracea*	White-browed Piculet
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615	*Saxicola ferrea*	Grey Bushchat
616	*Saxicola insignis*	Hodgson's Bushchat
617	*Saxicola torquata*	Common Stonechat
618	*Saxicoloides fulicata*	Indian Robin
619	*Schoeniparus dubia*	Rusty-capped Fulvetta
620	*Scolopax rusticola*	Eurasian Woodcock
621	*Seicercus affinis*	White-spectacled Warbler
622	*Seicercus burkii*	Green-crowned Warbler
623	*Seicercus castaniceps*	Chestnut-crowned Warbler
624	*Seicercus poliogenys*	Grey-cheeked Warbler
625	*Seicercus whistleri*	Whistler's Warbler
626	*Seicercus xanthoschistos*	Grey-hooded Warbler
627	*Serilophus lunatus*	Silver-breasted Broadbill
628	*Serinus pusillus*	Red-fronted Serin
629	*Serinus thibetanus*	Tibetan Serin
630	*Sitta cinnamoventris*	Chestnut-bellied Nuthatch
631	*Sitta formosa*	Beautiful Nuthatch
632	*Sitta frontalis*	Velvet-fronted Nuthatch
633	*Sitta himalayensis*	White-tailed Nuthatch
634	*Spelaeornis caudatus*	Rufous-throated Wren Babbler
635	*Spelaeornis formosus*	Spotted Wren Babbler
636	*Spelaeornis troglodytoides*	Bar-winged Wren Babbler
637	*Sphenocichla humei*	Himalayan Wedge-billed Babbler
638	*Spilornis cheela*	Crested Serpent Eagle
639	*Spinus spinus*	Eurasian Siskin
640	*Stachyris chrysaea*	Golden Babbler

641	*Stachyris nigriceps*	Grey-throated Babbler
642	*Stachyris ruficeps*	Rufous-capped Babbler
643	*Stachyris rufifrons*	Rufous-fronted Babbler
644	*Staphida castaniceps*	Striated Yuhina
645	*Sterna aurantia*	River Tern
646	*Sterna hirundo*	Common Tern
647	*Sternula acuticauda*	Black-bellied Tern
648	*Stigmatopelia chinensis*	Spotted Dove
649	*Stigmatopelia senegalensis*	Laughing Dove
650	*Streptopelia decaocto*	Eurasian Collared Dove
651	*Streptopelia orientalis*	Oriental Turtle Dove
652	*Streptopelia tranquebarica*	Red Collared Dove
653	*Strix nivicola*	Himalayan Wood Owl
654	*Strix leptogrammica*	Brown Wood Owl
655	*Sturnus contra*	Asian Pied Starling
656	*Sturnus malabaricus*	Chestnut-tailed Starling
657	*Sturnus pagodarum*	Brahminy Starling
658	*Sturnus vulgaris*	Common Starling
659	*Surniculus lugubris*	Drongo Cuckoo
660	*Sylvia curruca*	Lesser Whitethroat
661	*Sylviparus modestus*	Yellow-browed Tit
662	*Tachybaptus ruficollis*	Little Grebe
663	*Tachymarptis melba*	Alpine Swift
664	*Tadorna ferruginea*	Ruddy Shelduck
665	*Tadorna tadorna*	Common Shelduck
666	*Tarsiger chrysaeus*	Golden Bush Robin
667	*Tarsiger cyanurus*	Orange-flanked Bush Robin
668	*Tarsiger hyperythrus*	Rufous-breasted Bush Robin
669	*Tarsiger indicus*	White-browed Bush Robin
670	*Tephrodornis gularis*	Large Woodshrike
671	*Terpsiphone paradisi*	Asian Paradise-flycatcher
672	*Tesia castaneocoronata*	Chestnut-headed Tesia
673	*Tesia cyaniventer*	Grey-bellied Tesia
674	*Tesia olivea*	Slaty-bellied Tesia
675	*Tetraogallus tibetanus*	Tibetan Snowcock
676	*Tichodroma muraria*	Wallcreeper
677	*Tickellia hodgsoni*	Broad-billed Warbler

678	*Tragopan blythii*	Blyth's Tragopan
679	*Tragopan satyra*	Satyr Tragopan
680	*Tragopan temminckii*	Temminck's Tragopan
681	*Treron apicauda*	Pin-tailed Green Pigeon
682	*Treron bicincta*	Orange-breasted Green Pigeon
683	*Treron curvirostra*	Thick-billed Green Pigeon
684	*Treron phoenicoptera*	Yellow-footed Green Pigeon
685	*Treron pompadora*	Pompadour Green Pigeon
686	*Treron sphenura*	Wedge-tailed Green Pigeon
687	*Tringa erythtopus*	Spotted Redshank
688	*Tringa glareola*	Wood Sandpiper
689	*Tringa nebularia*	Common Greenshank
690	*Tringa ochropus*	Green Sandpiper
691	*Tringa totanus*	Common Redshank
692	*Troglodytes troglodytes*	Eurasian Wren
693	*Turdoides striatus*	Jungle Babbler
694	*Turdus maximus*	Tibetan Blackbird
695	*Turdus albocinctus*	White-collared Blackbird
696	*Turdus atrogularis*	Black-throated Thrush
697	*Turdus boulboul*	Grey-winged Blackbird
698	*Turdus eunomus*	Dusky Thrush
699	*Turdus feae*	Grey-sided Thrush
700	*Turdus kessleri*	Kessler's Thrush
701	*Turdus naumanni*	Naumann's Thrush
702	*Turdus obscurus*	Eyebrowed Thrush
703	*Turdus rubrocanus*	Chestnut Thrush
704	*Turdus ruficollis*	Red-throated Thrush
705	*Turdus unicolor*	Tickell's Thrush
706	*Turnix suscitator*	Barred Buttonquail
707	*Turnix tanki*	Yellow-legged Buttonquail
708	*Tyto alba*	Barn Owl
709	*Upupa epops*	Common Hoopoe
710	*Urocissa flavirostris*	Yellow-billed Blue Magpie
711	*Vanellus cinereus*	Grey-headed Lapwing
712	*Vanellus duvaucelii*	River Lapwing
713	*Vanellus indicus*	Red-wattled Lapwing
714	*Vanellus malarbaricus*	Yellow-wattled Lapwing

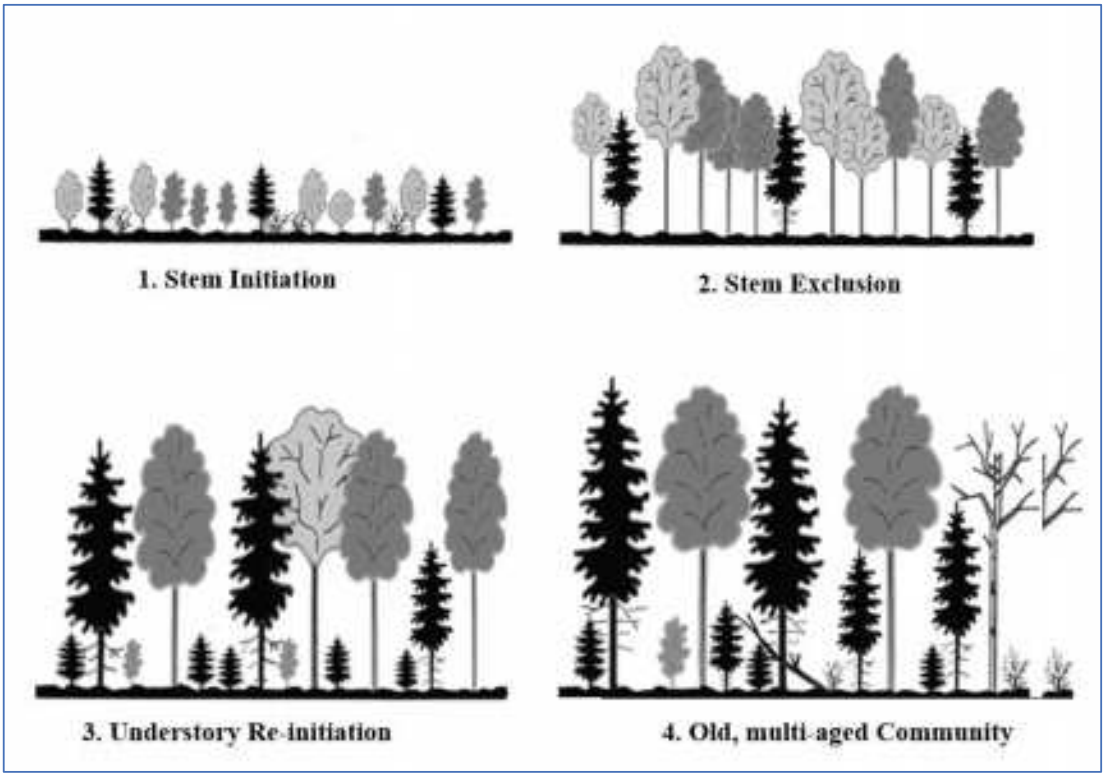
715	*Vanellus vanellus*	Northern Lapwing
716	*Xiphirhynchus superciliaris*	Slender-billed Scimitar Babbler
717	*Yuhina bakeri*	White-naped Yuhina
718	*Yuhina flavicollis*	Whiskered Yuhina
719	*Yuhina gularis*	Stripe-throated Yuhina
720	*Yuhina nigrimenta*	Black-chinned Yuhina
721	*Yuhina occipitalis*	Rufous-vented Yuhina
722	*Zoothera citrina*	Orange-headed Thrush
723	*Zoothera dauma*	Scaly Thrush
724	*Zoothera dixoni*	Long-tailed Thrush
725	*Zoothera mollissima*	Plain-backed Thrush
726	*Zoothera monticola*	Long-billed Thrush
727	*Zosterops palpebrosus*	Oriental White-eye
728	*Turdus dissimilis*	Black-breasted Thrush
729	*Cyanoptila cyanomelana*	Black-and-White Flycatcher
730	*Erythrura prasina*	Pin-tailed Parrotfinch
731	*Chlidonias hybrida*	Whiskered Tern
732	*Muscicapa ruficauda*	Rusty-tailed Flycatcher
733	*Psittacula cyanocephala*	Plum-headed Parakeet
734	*Todiramphus cloris*	Collared Kingfisher
735	*Pluvialis squatarola*	Grey Plover
736	*Eremophila alpestris*	Horned Lark
737	*Bucephala clangula*	Common Goldeneye
738	*Pellorneum tickelli*	Buff-breasted Babbler
739	*Botaurus stellaris*	Great Bittern
740	*Geokichla wardii*	Pied Thrush
741	*Sternula albifrons*	Little Tern
742	*Pitta brachyura*	Indian Pitta
743	*Rallina eurizonoides*	Slaty-legged Pitta

Annexure XV: Reptiles of Bhutan[7]

SN	Scientific name	Common name
1	*Ahaetulla nasuta*	common vine snake
2	*Ahaetulla prasina*	Asian vine snake
3	*Amphiesma parallelum*	
4	*Amphiesma platyceps*	Himalayan keelback
5	*Amphiesma sieboldii*	Sikkim keelback
6	*Amphiesma stolatum*	Buff striped keelback
7	*Boiga cyanea*	Green Cat Snake
8	*Boiga gokool*	Arrowback tree snake
9	*Boiga multifasciata*	Many-banded tree snake
10	*Boiga ochracea*	Tawny cat snake
11	*Chrysopelea ornata*	Flying tree snake
12	*Coelognathus radiatus*	Copperhead rat snake
13	*Dendrelaphis cyanochloris*	Wall's Bronzeback
14	*Dendrelephis pictus*	Painted bronzeback
15	*Dendrelaphis tristis*	Tree snake
16	*Dinodon gammiei*	Sikkim False Wolf Snake
17	*Dinodon septentrionalis*	Wolf snake
18	*Dryocalamus davisonii*	
19	*Enhydris enhydris*	Rainbow water snake
20	*Lycodon aulicus*	Indian wolf snake
21	*Lycodon fasciatus*	Banded wolf snake
22	*Lycodon jara*	Yellow-speckled wolf snake
23	*Oligodon albocinctus*	Light-barred kukri snake
24	*Oligodon cinereus*	Black cross-barred kukri snake, golden kukri snake
25	*Oligodon cyclurus*	Cantor's Kukri Snake
26	*Oligodon dorsalis*	Bengalese kukri snake or Gray's kukri snake
27	*Oligodon juglandifer*	Walnut kukri snake
28	*Oreocryptophis porphyracea*	Thai bamboo rat snake or red mountain racer
29	*Orthriophis cantoris*	
30	*Orthriophis taeniurus*	Beauty ratsnake
31	*Psammodynastes pulverulentus*	Common mock viper
32	*Psedoxenodon macrops*	Large-eyed bamboo snake or Chinese false cobra
33	*Ptyas korros*	Chinese ratsnake or Indo-Chinese rat snake
34	*Ptyas nigromarginata*	Green rat snake
35	*Ptyas mucosa*	Oriental ratsnake, Indian rat snake
36	*Rhabdophis himalayanus*	Orange-collared keelback
37	*Rhabdophis subminiatus*	Red-necked keelback
38	*Sibynophis collaris*	Common many-toothed snake
39	*Sibynophis sagittarius*	Cantor's black-headed snake.
40	*Trachischium leave*	Olive Oriental Slender Snake

41	*Trachischium guentheri*	Rosebelly worm-eating snake
42	*Trachischium tenuiceps*	Yellowbelly worm-eating snake
43	*Xenochrophis piscator*	Asiatic water snake
44	*Bungarus bungaroides*	Northeastern hill krait
45	*Bungarus fasciatus*	Banded krait
46	*Bungarus niger*	Greater black krait
47	*Naja kaouthia*	Monocellate cobra
48	*Naja naja*	Spectacled cobra, Asian cobra, or binocellate cobra
49	*Ophiophagus hannah*	King cobra
50	*Sinomicrurus macclellandii*	MacClelland's Coral Snake
51	*Python molurus*	Indian python or Indian rock python
52	*Python bivittatus*	Burmese python
53	*Ramphotyphlops braminus*	Brahminy Blindsnake
54	*Typhlops jerdonii*	Jerom's worm snake
55	*Typhlops diardii*	Diard's Blindsnake
56	*Daboia russelii*	Russel's viper
57	*Gloydius himalayanus*	Himalayan pit viper or Himalayan viper
58	*Ovophis monticola*	Mountain pit viper
59	*Protobothrops jerdonii*	Jerdon's Pit viper
60	*Trimeresurus jerdonii*	Pit viper
61	*Trimeresurus albolabris*	White-lipped pit viper
62	*Trimeresurus erythrurus*	Red-tailed bamboo pitviper
63	*Protobothrops himalayanus*	Himalayan pit viper
64	*Calotes bhutanensis*	Forest Lizard
65	*Calotes jerdonii*	Ind0-Chinese forest lizard or Jerdon's forest lizard
66	*Calotes versicolor*	Oriental garden lizard
67	*Japalura variegata*	Variegated Mountain Lizard
68	*Ophisaurus gracilis*	Asian glass lizard
69	*Cyrtodactylus khasiensis*	Khasi Hills bent-toed gecko
70	*Gekko gecko*	Tokay gecko
71	*Hemidactylus brookii*	Brooke's house gecko or spotted house gecko
72	*Hemidactylus frenatus*	Common house gecko
73	*Hemidactylus platyurus*	Flat-tailed house gecko
74	*Asymblepharus sikimmensis*	Sikkim ground skink or bronzy-brown skink
75	*Eutropis carinata*	Golden skink
76	*Eutropis macularia*	Bronze grass skink
77	*Eutropis quadratilobus*	
78	*Riopa punctata*	
79	*Sphenomorphus indicus*	Himalayan litter skink
80	*Sphenomorphus maculatus*	Spotted forest skink
81	*Varanus bengalensis*	Bengal monitor or common Indian monitor
82	*Varanus flavescens*	Yellow monitor or golden monitor

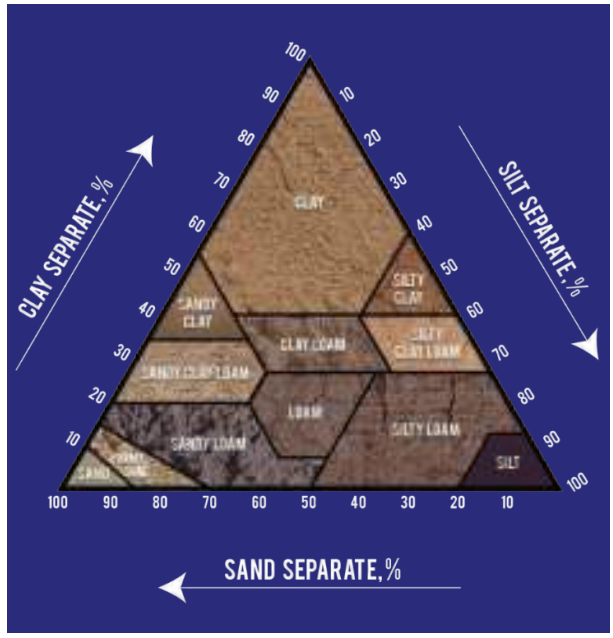
Annexure XVI: Forest Development Stages



Annexure XVII: Rough Guide for Identifying Soil Texture in the Field

Soil Texture	Feel to fingers and visual	Ball formation		Stickiness	Ribbon formation
		When dry	When moist		
Sand	Very gritty and individual grains visible, free flowing when dry	Does not form ball (falls apart when pressure is released)	Does not form ball (Ball crumbles when lightly touched)	Does not stain fingers	No ribbon formation
Sandy Loam	Moderately gritty (sand characteristic predominates)	Forms a ball which falls apart when lightly touched	Forms ball but easily broken	Stains the fingers	No ribbon formation
Loam	Neither very gritty nor very smooth	Forms ball but easily broken	Forms firm ball	Stains the fingers	No ribbon formation
Silt Loam	Smooth or slick "buttery "feel".	Forms ball but easily broken and has soft flour like feel	Forms firm ball	Stains the fingers	Slight tendency to ribbon with flaky surface
Silt	smooth feel	Forms firm ball	Forms firm ball		Slight tendency to ribbon with flaky surface

Clay Loam	Slightly gritty feel	Moderately hard ball	Forms firm ball which can be handled freely	Stains fingers	Ribbons on squeezing but ribbon breaks easily
Clay	Very smooth	Forms firm ball without breaking	Forms firm ball which can be handled freely and cannot be crushed with fingers when dry	Stains fingers	Squeezes out at right moisture into long ribbons

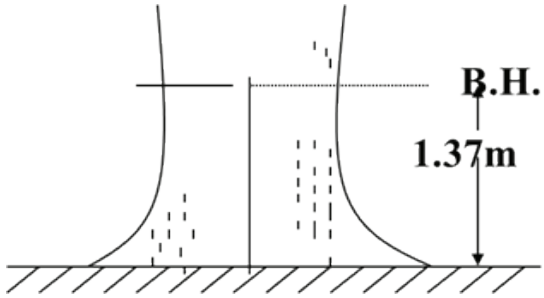


Source: https://www.grabco.co.uk/soil-guide/#sandy

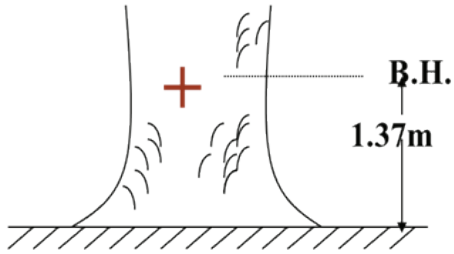
Annexure XVIII: Standard Rules for Measurement of Diameter at Breat Height (DBH)

Diameter at Breast Height is the diameter of a tree measured at 1.37m above ground. Diameter at Breast Height is abbreviated as DBH. The DBH over bark and under bark are abbreviated as DBH (O.B) and DBH (U.B) respectively. A few but very important rules one must follow while measuring DBH are;

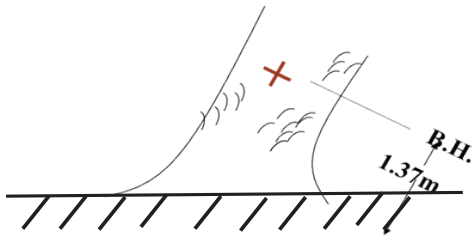
1. Loose bark/ creepers if found on the tree especially near breast height should be removed before measuring the diameter.
2. Mark BH by means of measuring stick or white paint or a soft nail (e.g., aluminum) driven into the bark or a scribe mark.



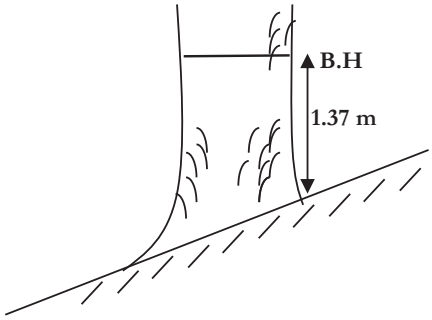
3. On a Flat ground and if the tree is straight, the DBH is taken as depicted in figure below;



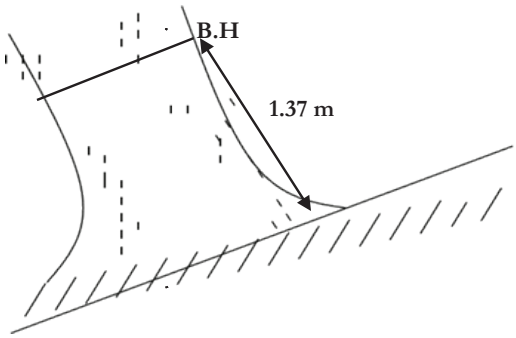
4. If the Ground is Flat but the tree is leaning, Measure DBH along the tree stem and not vertically, on the side of the lean in case the tree is leaning and the ground is flat.



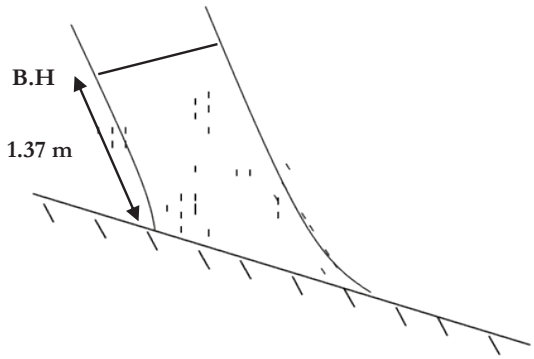
5. On a **sloping** ground with **Straight tree**, the DBH is measured from the up- hill side.



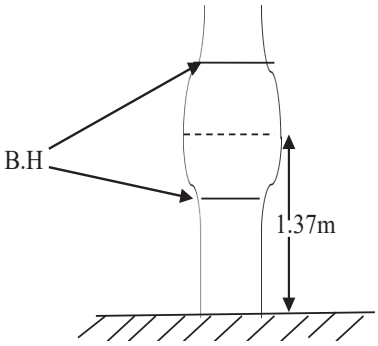
6. On a sloping ground with tree leaning against the direction of slope of the Ground, measure DBH along the tree stem and not vertically, on the side of the lean.



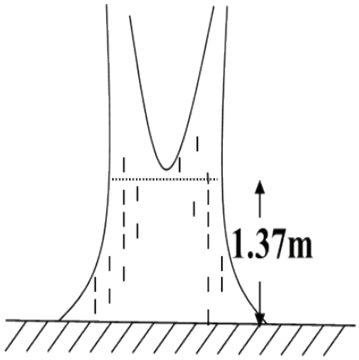
7. On sloping ground with tree leaning towards uphill slope, measure DBH along the tree stem and not vertically, on the side of the lean



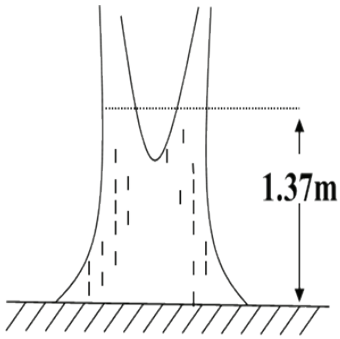
8. If the Tree stem is abnormal at Breast Height level, DBH is measured not at 1.37 m but mark shifted up or down ***(as little as possible)*** to a more normal position of the stem.



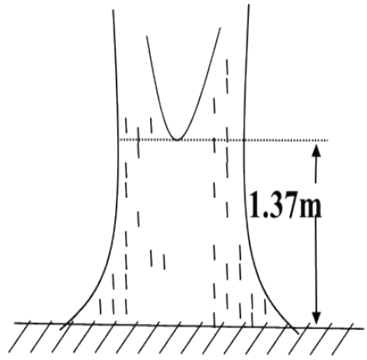
9. If the stem is Forked, then



Counted as One Trees

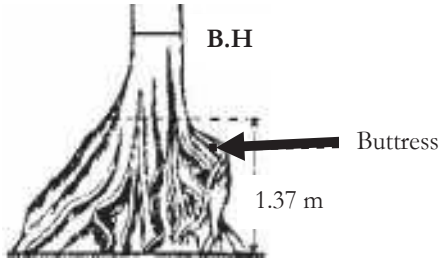


Counted as Two Trees



Counted as One or Two Trees depending on place of measurement

10. Tree stem is buttressed at breast height level, then DBH is measured at the lowest point above which the abnormal formation is not likely to extend.



Annexure XIX Aboveground Shrubs, Herb, Litter and Soil Carbon Sampling Plots

CP_No	Dzongkhag	Office	CP_No	Dzongkhag	Office
CP0656	Bumthang	DFO, Bumthang	CP0436	Trashiyangtse	BWS
CP0666	Bumthang	DFO, Bumthang	CP0441	Trashiyangtse	BWS
CP0716	Bumthang	DFO, Bumthang	CP0496	Trashiyangtse	BWS
CP0726	Bumthang	DFO, Bumthang	CP0501	Trashiyangtse	BWS
CP0776	Trongsa	DFO, Bumthang	CP0556	Trashiyangtse	BWS
CP0781	Bumthang	DFO, Bumthang	CP0561	Trashiyangtse	BWS
CP0786	Bumthang	DFO, Bumthang	CP0616	Trashiyangtse	BWS
CP0836	Trongsa	DFO, Bumthang	CP0621	Trashiyangtse	BWS
CP0841	Bumthang	DFO, Bumthang	CP0676	Trashiyangtse	BWS
CP0846	Bumthang	DFO, Bumthang	CP0736	Trashiyangtse	BWS
CP0901	Trongsa	DFO, Bumthang	CP0796	Lhuntse	BWS
CP0906	Bumthang	DFO, Bumthang	CP0991	Mongar	BWS
CP0911	Bumthang	DFO, Bumthang	CP1056	Mongar	BWS
CP0966	Trongsa	DFO, Bumthang	CP1486	Dagana	DFO, Dagana
CP0971	Bumthang	DFO, Bumthang	CP1566	Dagana	DFO, Dagana
CP0976	Bumthang	DFO, Bumthang	CP1646	Dagana	DFO, Dagana
CP1036	Trongsa	DFO, Bumthang	CP1726	Dagana	DFO, Dagana
CP1041	Bumthang	DFO, Bumthang	CP1731	Dagana	DFO, Dagana
CP1046	Bumthang	DFO, Bumthang	CP1801	Dagana	DFO, Dagana
CP1116	Trongsa	DFO, Bumthang	CP1806	Dagana	DFO, Dagana
CP1191	Trongsa	DFO, Bumthang	CP1881	Dagana	DFO, Dagana
CP1266	Trongsa	DFO, Bumthang	CP1886	Dagana	DFO, Dagana
CP1346	Trongsa	DFO, Bumthang	CP1961	Dagana	DFO, Dagana
CP1426	Trongsa	DFO, Bumthang	CP1966	Dagana	DFO, Dagana
CP0116	Lhuntse	BWS	CP2041	Dagana	DFO, Dagana
CP0166	Lhuntse	BWS	CP2046	Dagana	DFO, Dagana
CP0216	Trashiyangtse	BWS	CP2121	Dagana	DFO, Dagana
CP0266	Trashiyangtse	BWS	CP2196	Dagana	DFO, Dagana
CP0321	Trashiyangtse	BWS	CP2271	Dagana	DFO, Dagana
CP0326	Trashiyangtse	BWS	CP2331	Dagana	DFO, Dagana
CP0376	Lhuntse	BWS	CP2381	Dagana	DFO, Dagana
CP0381	Trashiyangtse	BWS	CP2406	Dagana	DFO, Dagana
CP1556	Chhukha	DFO, Gedu	CP0081	Gasa	JDNP
CP1636	Chhukha	DFO, Gedu	CP0086	Gasa	JDNP
CP1716	Chhukha	DFO, Gedu	CP0091	Gasa	JDNP
CP1721	Chhukha	DFO, Gedu	CP0096	Gasa	JDNP
CP1796	Chhukha	DFO, Gedu	CP0121	Gasa	JDNP
CP1871	Chhukha	DFO, Gedu	CP0126	Gasa	JDNP
CP1876	Chhukha	DFO, Gedu	CP0131	Gasa	JDNP
CP1951	Chhukha	DFO, Gedu	CP0171	Gasa	JDNP
CP1956	Chhukha	DFO, Gedu	CP0176	Gasa	JDNP
CP2031	Chhukha	DFO, Gedu	CP0181	Gasa	JDNP
CP2036	Chhukha	DFO, Gedu	CP0221	Gasa	JDNP

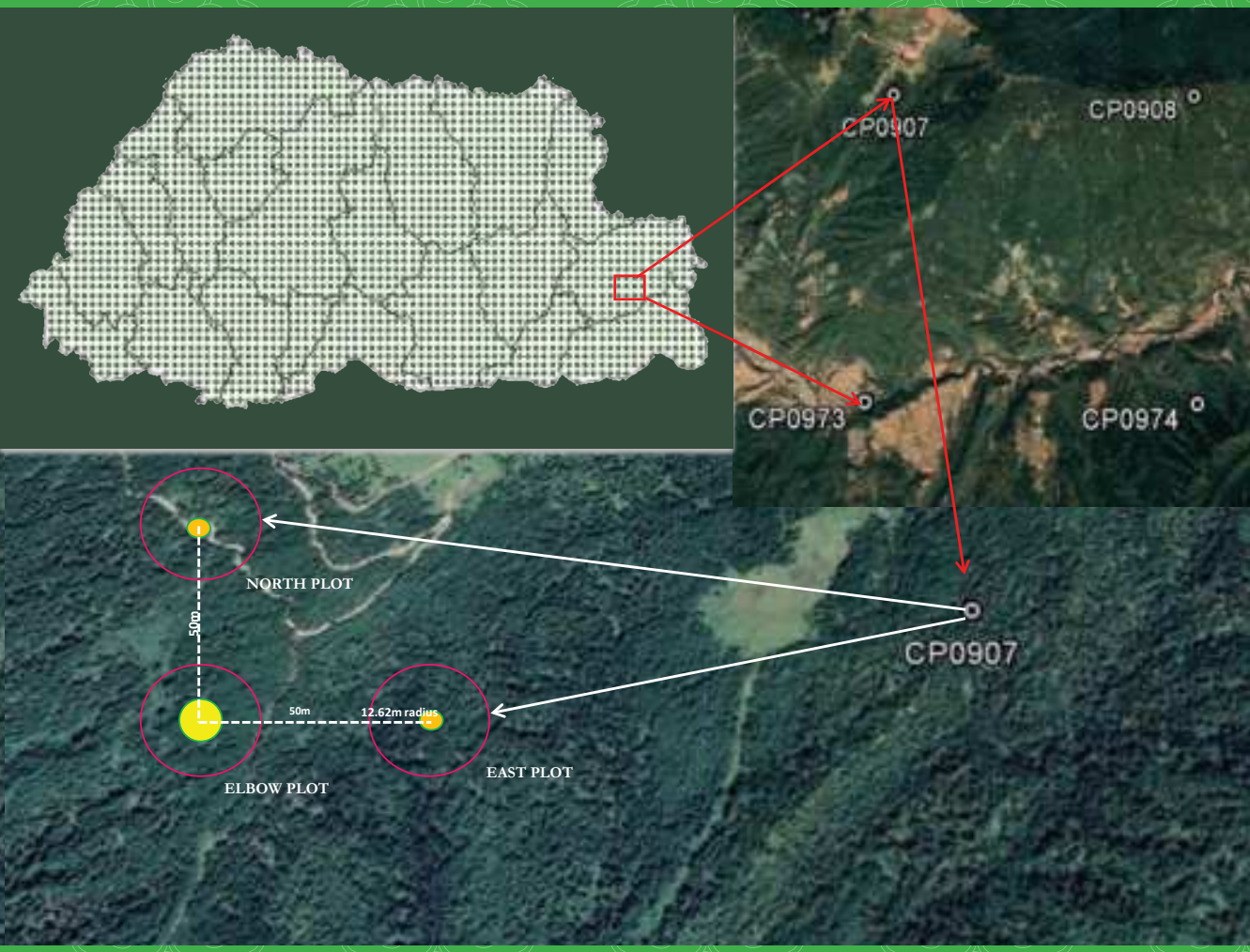
CP2111	Chhukha	DFO, Gedu	CP0226	Gasa	JDNP
CP2116	Chhukha	DFO, Gedu	CP0231	Gasa	JDNP
CP2186	Chhukha	DFO, Gedu	CP0271	Thimphu	JDNP
CP2191	Chhukha	DFO, Gedu	CP0276	Gasa	JDNP
CP2261	Chhukha	DFO, Gedu	CP0281	Gasa	JDNP
CP2266	Chhukha	DFO, Gedu	CP0286	Gasa	JDNP
CP2326	Chhukha	DFO, Gedu	CP0331	Thimphu	JDNP
CP2376	Chhukha	DFO, Gedu	CP0336	Gasa	JDNP
CP0001	Gasa	JDNP	CP0341	Punakha	JDNP
CP0006	Gasa	JDNP	CP0386	Thimphu	JDNP
CP0011	Gasa	JDNP	CP0391	Gasa	JDNP
CP0016	Gasa	JDNP	CP0396	Gasa	JDNP
CP0021	Gasa	JDNP	CP0401	Punakha	JDNP
CP0026	Gasa	JDNP	CP0446	Thimphu	JDNP
CP0031	Gasa	JDNP	CP0451	Gasa	JDNP
CP0036	Gasa	JDNP	CP0456	Gasa	JDNP
CP0041	Gasa	JDNP	CP0461	Punakha	JDNP
CP0046	Gasa	JDNP	CP0506	Paro	JDNP
CP0056	Gasa	JDNP	CP0511	Gasa	JDNP
CP0061	Gasa	JDNP	CP0516	Punakha	JDNP
CP0066	Gasa	JDNP	CP0521	Punakha	JDNP
CP0071	Gasa	JDNP	CP0566	Paro	JDNP
CP0571	Thimphu	JDNP	CP1501	Trongsa	JSWNP
CP0576	Punakha	JDNP	CP1576	Wangdue	JSWNP
CP0626	Paro	JDNP	CP1581	Trongsa	JSWNP
CP0631	Thimphu	JDNP	CP1661	Sarpang	JSWNP
CP0686	Paro	JDNP	CP1666	Zhemgang	JSWNP
CP0691	Thimphu	JDNP	CP1741	Sarpang	JSWNP
CP0751	Thimphu	JDNP	CP1746	Zhemgang	JSWNP
CP0866	Haa	JKSNR	CP1821	Sarpang	JSWNP
CP0931	Haa	JKSNR	CP1901	Sarpang	JSWNP
CP1001	Haa	JKSNR	CP1701	Samdrup Jongkhar	JWS
CP1076	Haa	JKSNR	CP1776	Samdrup Jongkhar	JWS
CP1151	Haa	JKSNR	CP1781	Samdrup Jongkhar	JWS
CP1306	Haa	JKSNR	CP1856	Samdrup Jongkhar	JWS
CP1386	Haa	JKSNR	CP1931	Samdrup Jongkhar	JWS
CP1466	Haa	JKSNR	CP1936	Samdrup Jongkhar	JWS
CP1546	Haa	JKSNR	CP2011	Samdrup Jongkhar	JWS
CP1551	Haa	JKSNR	CP2016	Samdrup Jongkhar	JWS
CP1626	Haa	JKSNR	CP2091	Samdrup Jongkhar	JWS
CP1631	Haa	JKSNR	CP2096	Samdrup Jongkhar	JWS
CP1711	Haa	JKSNR	CP2166	Samdrup Jongkhar	JWS
CP1786	Haa	JKSNR	CP2171	Samdrup Jongkhar	JWS
CP1791	Haa	JKSNR	CP2176	Samdrup Jongkhar	JWS
CP1031	Trongsa	JSWNP	CP2241	Samdrup Jongkhar	JWS
CP1111	Trongsa	JSWNP	CP2246	Samdrup Jongkhar	JWS
CP1181	Wangdue	JSWNP	CP2316	Samdrup Jongkhar	JWS

CP1186	Trongsa	JSWNP	CP2371	Samdrup Jongkhar	JWS
CP1256	Wangdue	JSWNP	CP0491	Lhuntse	DFO, Mongar
CP1261	Trongsa	JSWNP	CP0551	Lhuntse	DFO, Mongar
CP1336	Wangdue	JSWNP	CP0606	Lhuntse	DFO, Mongar
CP1341	Trongsa	JSWNP	CP0611	Lhuntse	DFO, Mongar
CP1416	Wangdue	JSWNP	CP0671	Lhuntse	DFO, Mongar
CP1421	Trongsa	JSWNP	CP0731	Lhuntse	DFO, Mongar
CP1496	Wangdue	JSWNP	CP0791	Lhuntse	DFO, Mongar
CP0856	Lhuntse	DFO, Mongar	CP1011	Paro	DFO, Paro
CP0921	Lhuntse	DFO, Mongar	CP1081	Haa	DFO, Paro
CP0986	Lhuntse	DFO, Mongar	CP1086	Paro	DFO, Paro
CP1051	Lhuntse	DFO, Mongar	CP1156	Haa	DFO, Paro
CP1131	Mongar	DFO, Mongar	CP1161	Paro	DFO, Paro
CP1206	Mongar	DFO, Mongar	CP1231	Haa	DFO, Paro
CP1211	Mongar	DFO, Mongar	CP1236	Paro	DFO, Paro
CP1281	Mongar	DFO, Mongar	CP1311	Haa	DFO, Paro
CP1286	Mongar	DFO, Mongar	CP1316	Paro	DFO, Paro
CP1361	Mongar	DFO, Mongar	CP1391	Haa	DFO, Paro
CP1436	Mongar	DFO, Mongar	CP1396	Paro	DFO, Paro
CP1441	Mongar	DFO, Mongar	CP1471	Haa	DFO, Paro
CP1516	Mongar	DFO, Mongar	CP1476	Paro	DFO, Paro
CP1521	Mongar	DFO, Mongar	CP1686	Pemagatshel	DFO, Pemagatshel
CP1596	Mongar	DFO, Mongar	CP1766	Pemagatshel	DFO, Pemagatshel
CP1601	Mongar	DFO, Mongar	CP1846	Pemagatshel	DFO, Pemagatshel
CP1681	Mongar	DFO, Mongar	CP1921	Pemagatshel	DFO, Pemagatshel
CP1756	Mongar	DFO, Mongar	CP2001	Pemagatshel	DFO, Pemagatshel
CP1761	Mongar	DFO, Mongar	CP2076	Pemagatshel	DFO, Pemagatshel
CP1836	Mongar	DFO, Mongar	CP2081	Pemagatshel	DFO, Pemagatshel
CP1841	Mongar	DFO, Mongar	CP2156	Pemagatshel	DFO, Pemagatshel
CP1916	Mongar	DFO, Mongar	CP2231	Pemagatshel	DFO, Pemagatshel
CP1996	Mongar	DFO, Mongar	CP2301	Pemagatshel	DFO, Pemagatshel
CP0681	Paro	DFO, Paro	CP2361	Pemagatshel	DFO, Pemagatshel
CP0741	Haa	DFO, Paro	CP2401	Pemagatshel	DFO, Pemagatshel
CP0746	Paro	DFO, Paro	CP0851	Lhuntse	PNP
CP0806	Haa	DFO, Paro	CP0916	Lhuntse	PNP
CP0811	Paro	DFO, Paro	CP0981	Bumthang	PNP
CP0871	Haa	DFO, Paro	CP1121	Bumthang	PNP
CP0876	Paro	DFO, Paro	CP1126	Lhuntse	PNP
CP0936	Haa	DFO, Paro	CP1196	Bumthang	PNP
CP0941	Paro	DFO, Paro	CP1201	Mongar	PNP
CP1006	Haa	DFO, Paro	CP1271	Zhemgang	PNP
CP1276	Mongar	PNP	CP1706	Samtse	DFO, Samtse

CP1351	Zhemgang	PNP	CP1861	Samtse	DFO, Samtse
CP1356	Mongar	PNP	CP1866	Samtse	DFO, Samtse
CP2336	Dagana	PWS	CP1941	Samtse	DFO, Samtse
CP2386	Sarpang	PWS	CP1946	Samtse	DFO, Samtse
CP2411	Dagana	PWS	CP2021	Samtse	DFO, Samtse
CP2416	Sarpang	PWS	CP2026	Samtse	DFO, Samtse
CP2421	Dagana	PWS	CP2101	Samtse	DFO, Samtse
CP1826	Zhemgang	RMNP	CP2106	Samtse	DFO, Samtse
CP1906	Zhemgang	RMNP	CP2181	Samtse	DFO, Samtse
CP1986	Zhemgang	RMNP	CP2251	Samtse	DFO, Samtse
CP2061	Sarpang	RMNP	CP2256	Samtse	DFO, Samtse
CP2066	Zhemgang	RMNP	CP2321	Samtse	DFO, Samtse
CP2141	Sarpang	RMNP	CP1816	Sarpang	DFO, Sarpang
CP2216	Sarpang	RMNP	CP1896	Sarpang	DFO, Sarpang
CP2221	Zhemgang	RMNP	CP1976	Sarpang	DFO, Sarpang
CP2286	Zhemgang	RMNP	CP1981	Sarpang	DFO, Sarpang
CP2291	Zhemgang	RMNP	CP2056	Sarpang	DFO, Sarpang
CP2346	Sarpang	RMNP	CP2131	Sarpang	DFO, Sarpang
CP2351	Zhemgang	RMNP	CP2136	Sarpang	DFO, Sarpang
CP2356	Pemagatshel	RMNP	CP2206	Sarpang	DFO, Sarpang
CP2391	Sarpang	RMNP	CP2211	Sarpang	DFO, Sarpang
CP2396	Zhemgang	RMNP	CP2281	Sarpang	DFO, Sarpang
CP2006	Samdrup Jongkhar	DFO, Samdrup Jongkhar	CP2341	Sarpang	DFO, Sarpang
CP2086	Samdrup Jongkhar	DFO, Samdrup Jongkhar	CP1071	Trashigang	SWS
CP2161	Samdrup Jongkhar	DFO, Samdrup Jongkhar	CP1146	Trashigang	SWS
CP2236	Samdrup Jongkhar	DFO, Samdrup Jongkhar	CP1221	Trashigang	SWS
CP2306	Samdrup Jongkhar	DFO, Samdrup Jongkhar	CP1226	Trashigang	SWS
CP2311	Samdrup Jongkhar	DFO, Samdrup Jongkhar	CP1301	Trashigang	SWS
CP2366	Samdrup Jongkhar	DFO, Samdrup Jongkhar	CP1376	Trashigang	SWS
CP1461	Samtse	DFO, Samtse	CP1381	Trashigang	SWS
CP1541	Samtse	DFO, Samtse	CP1456	Trashigang	SWS
CP1621	Samtse	DFO, Samtse	CP1536	Trashigang	SWS
CP0756	Thimphu	DFO, Thimphu	CP1061	Trashiyangtse	DFO, Trashigang
CP0816	Thimphu	DFO, Thimphu	CP1066	Trashiyangtse	DFO, Trashigang
CP0881	Thimphu	DFO, Thimphu	CP1136	Trashigang	DFO, Trashigang
CP0946	Thimphu	DFO, Thimphu	CP1141	Trashigang	DFO, Trashigang
CP1016	Thimphu	DFO, Thimphu	CP1216	Trashigang	DFO, Trashigang
CP1091	Thimphu	DFO, Thimphu	CP1291	Trashigang	DFO, Trashigang
CP1166	Thimphu	DFO, Thimphu	CP1296	Trashigang	DFO, Trashigang
CP1241	Thimphu	DFO, Thimphu	CP1366	Trashigang	DFO, Trashigang

CP1321	Thimphu	DFO, Thimphu	CP1371	Trashigang	DFO, Trashigang
CP1401	Thimphu	DFO, Thimphu	CP1446	Trashigang	DFO, Trashigang
CP1481	Thimphu	DFO, Thimphu	CP1451	Trashigang	DFO, Trashigang
CP1561	Thimphu	DFO, Thimphu	CP1526	Trashigang	DFO, Trashigang
CP1641	Thimphu	DFO, Thimphu	CP1531	Trashigang	DFO, Trashigang
CP0801	Trashiyangtse	DFO, Trashigang	CP1606	Trashigang	DFO, Trashigang
CP0861	Trashiyangtse	DFO, Trashigang	CP1611	Trashigang	DFO, Trashigang
CP0926	Trashiyangtse	DFO, Trashigang	CP1616	Trashigang	DFO, Trashigang
CP0996	Trashiyangtse	DFO, Trashigang	CP0641	Punakha	DFO, Wangdue
CP1691	Trashigang	DFO, Trashigang	CP0646	Wangdue	DFO, Wangdue
CP1696	Trashigang	DFO, Trashigang	CP0696	Punakha	DFO, Wangdue
CP1771	Trashigang	DFO, Trashigang	CP0701	Punakha	DFO, Wangdue
CP1851	Trashigang	DFO, Trashigang	CP0706	Wangdue	DFO, Wangdue
CP1926	Trashigang	DFO, Trashigang	CP0761	Punakha	DFO, Wangdue
CP1656	Tsirang	DFO, Tsirang	CP0766	Wangdue	DFO, Wangdue
CP1736	Tsirang	DFO, Tsirang	CP0821	Punakha	DFO, Wangdue
CP1811	Tsirang	DFO, Tsirang	CP0826	Wangdue	DFO, Wangdue
CP1891	Tsirang	DFO, Tsirang	CP0831	Wangdue	DFO, Wangdue
CP1971	Tsirang	DFO, Tsirang	CP0886	Punakha	DFO, Wangdue
CP2051	Tsirang	DFO, Tsirang	CP0891	Wangdue	DFO, Wangdue
CP2126	Tsirang	DFO, Tsirang	CP0896	Wangdue	DFO, Wangdue
CP2201	Tsirang	DFO, Tsirang	CP0951	Punakha	DFO, Wangdue
CP2276	Tsirang	DFO, Tsirang	CP0956	Wangdue	DFO, Wangdue
CP0581	Wangdue	DFO, Wangdue	CP0961	Wangdue	DFO, Wangdue
CP0636	Punakha	DFO, Wangdue	CP1326	Wangdue	DFO, Wangdue
CP1021	Wangdue	DFO, Wangdue	CP1331	Wangdue	DFO, Wangdue
CP1026	Wangdue	DFO, Wangdue	CP1406	Wangdue	DFO, Wangdue
CP1096	Wangdue	DFO, Wangdue	CP1411	Wangdue	DFO, Wangdue
CP1101	Wangdue	DFO, Wangdue	CP1491	Wangdue	DFO, Wangdue
CP1106	Wangdue	DFO, Wangdue	CP1571	Wangdue	DFO, Wangdue
CP1171	Wangdue	DFO, Wangdue	CP1651	Wangdue	DFO, Wangdue
CP1176	Wangdue	DFO, Wangdue	CP0051	Gasa	WCNP
CP1246	Wangdue	DFO, Wangdue	CP0076	Lhuntse	WCNP
CP1251	Wangdue	DFO, Wangdue	CP0306	Bumthang	WCNP
CP0101	Gasa	WCNP	CP0311	Lhuntse	WCNP
CP0106	Bumthang	WCNP	CP0316	Lhuntse	WCNP
CP0111	Lhuntse	WCNP	CP0346	Wangdue	WCNP
CP0136	Gasa	WCNP	CP0351	Wangdue	WCNP
CP0141	Wangdue	WCNP	CP0356	Wangdue	WCNP
CP0146	Bumthang	WCNP	CP0361	Bumthang	WCNP
CP0151	Lhuntse	WCNP	CP0366	Lhuntse	WCNP
CP0156	Lhuntse	WCNP	CP0371	Lhuntse	WCNP
CP0161	Lhuntse	WCNP	CP0406	Wangdue	WCNP

CP0186	Wangdue	WCNP	CP0411	Wangdue	WCNP
CP0191	Wangdue	WCNP	CP0416	Bumthang	WCNP
CP0196	Bumthang	WCNP	CP0421	Bumthang	WCNP
CP0201	Lhuntse	WCNP	CP0426	Lhuntse	WCNP
CP0206	Lhuntse	WCNP	CP0431	Lhuntse	WCNP
CP0211	Lhuntse	WCNP	CP0466	Wangdue	WCNP
CP0236	Wangdue	WCNP	CP0471	Wangdue	WCNP
CP0241	Gasa	WCNP	CP0476	Bumthang	WCNP
CP0246	Bumthang	WCNP	CP0481	Bumthang	WCNP
CP0251	Bumthang	WCNP	CP0486	Lhuntse	WCNP
CP0256	Lhuntse	WCNP	CP0526	Wangdue	WCNP
CP0261	Lhuntse	WCNP	CP0531	Wangdue	WCNP
CP0291	Wangdue	WCNP	CP0536	Bumthang	WCNP
CP0296	Wangdue	WCNP	CP0541	Bumthang	WCNP
CP0301	Bumthang	WCNP	CP1586	Zhemgang	DFO, Zhemgang
CP0546	Lhuntse	WCNP	CP1591	Zhemgang	DFO, Zhemgang
CP0586	Wangdue	WCNP	CP1671	Zhemgang	DFO, Zhemgang
CP0591	Wangdue	WCNP	CP1676	Zhemgang	DFO, Zhemgang
CP0596	Bumthang	WCNP	CP1751	Zhemgang	DFO, Zhemgang
CP0601	Bumthang	WCNP	CP1831	Zhemgang	DFO, Zhemgang
CP0651	Trongsa	WCNP	CP1911	Zhemgang	DFO, Zhemgang
CP0661	Bumthang	WCNP	CP1991	Zhemgang	DFO, Zhemgang
CP0711	Trongsa	WCNP	CP2071	Zhemgang	DFO, Zhemgang
CP0721	Bumthang	WCNP	CP2146	Zhemgang	DFO, Zhemgang
CP0771	Wangdue	WCNP	CP2151	Zhemgang	DFO, Zhemgang
CP1431	Zhemgang	DFO, Zhemgang	CP2226	Zhemgang	DFO, Zhemgang
CP1506	Zhemgang	DFO, Zhemgang	CP2296	Zhemgang	DFO, Zhemgang
CP1511	Zhemgang	DFO, Zhemgang			



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