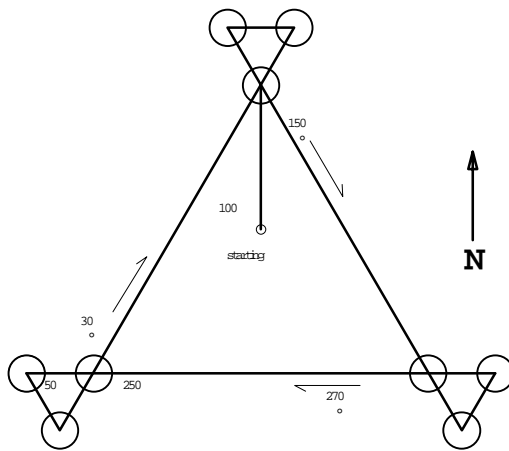


Reconnaissance Forest Inventory Field Manual



Bhutan-German Integrated Forest Management Project

By Werner Schindele
Forest Management Specialist
Thimpu, December 1995

Report on a
short term consultancy
on

FOREST RESOURCES MANAGEMENT

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Preface

The reconnaissance forest inventory (RFI) is one component of the **reconnaissance survey** which should provide decision makers with information whether it is worthwhile to open a particular forest area as a permanent forest management unit (FMU) or not.

The RFI was designed to provide in a relatively short time with a minimum input of human and financial resources fairly accurate estimates of:

- the total gross volume and increment per diameter class and species group;
- area statistics of different forest strata;
- the total exploitable commercial timber volume;
- the potential AAC based on total gross volume and increment

of a particular forest area. Based on these information economic cost-benefit calculations on forest management can then be implemented.

Additionally, in course of inventory implementation, observations on wildlife and human impacts on the forest resources should be collected. These are invaluable information for the preliminary environmental impact assessment and the socio-economic study, two other components of the reconnaissance survey.

Finally, based on the results of the RFI forest management planning can be undertaken with much higher efficiency.

The design itself and its justification are described in more detail in the „Guidelines for a Reconnaissance Forest Inventory“. The present Manual contains a detailed description for field survey and measurement of sample plots and has been prepared for the use of the inventory field crews. It concentrates on the essentials and is consciously briefly formulated as it should be permanently used as a reference during field survey.

More detailed and extensive description of inventory field work (except for relascope sampling and the use of GPS) is available in P. LAUMANS, 1994 „Guidelines for Forest Management Inventory Fieldwork“ which also should be consulted before starting field survey.

1 Inventory Team and Equipment

The inventory team should consist out of the following 6 members:

teamleader
assistant
3 workers
1 camp caretaker (cook)

The teamleader should already have some experience in forest inventory. In difficult terrain it might be necessary to increase the number of workers.

The cook should be responsible also for the set up of the camp and for organizing horses etc. For shifting the camp from one place to the other.

The team has to be provided with the following inventory equipment:

- 1 SILVA GPS-Compass
- several spare battery sets
- 1 Suunto Compass
- 1 relascope
- 1 pocket calculator
- 1 altimeter
- 1 diameter tape
- 1 caliper
- 1 measurement tape (25m length)
- 1 clip board, pens, rubber, etc.
- 2 copies of inventory base map
- 2 copies of survey description
- sufficient number of tally sheets
- 1 inventory manual
- 1 bear bell

Not included in this enumeration is the equipment required to stay outdoor, such as camping equipment, first aid kit, cutlass, etc.

2 Short Description of Inventory Design

The inventory design selected can be described as a

stratified satellite inventory based on randomly distributed cluster samples

The sampling design consists out of satellites of triangular shape with a triangular arrangement of relascope sampling clusters which are randomly distributed according to the size and coefficient of variation of each forest stratum (see figure 1). The main triangle (satellite) has a side length of 250 m; the triangular clusters in each corner of the satellite have a side length of 50 m. In each corner of the cluster triangle a relascope sample has to be taken.

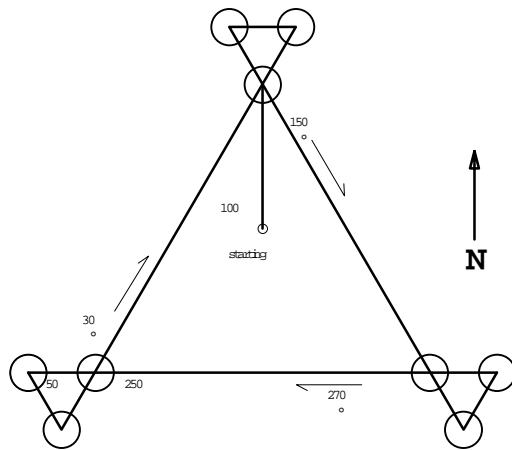


Figure 1: Sampling Design

3 Identification of Sample Plot Location

The preparation of the inventory, namely stratification and random distribution of samples, is done in the office by the Forest Management Planning Division. For the implementation of field work the inventory team will be provided with:

- an inventory base map,
- and a survey description.

The **inventory base map** has a scale of 1:25.000. It is an enlargement of the topographic map 1:50.000 and contains the distribution of the different forest strata and the location of inventory samples. Also 40 m altitude lines are indicated.

The **survey description** provides detailed information on the location of every sample in the field. It contains:

Sample No.:	i.e. AA10
Substratum No.:	i.e. 3.2
Longitude:	i.e. 89° 38.67'
Latitude:	i.e. 27° 30.89'
Altitude:	i.e. 2740 m
Description:	i.e. on steep slope of deep valley

The terrestrial coordinates specify the location of the **starting point** of the field survey which is about the center of the satellite triangle.

First the approximate location of the sample should be accessed with the help of the inventory base map, the survey description and by orientation on landscape and terrain features.

The exact location of the starting point has to be determined by using the SILVA GPS-Compass. It is advised that the coordinates of the inventory satellite locations are already stored as waypoints in the GPS at the headquarters. This can be done either manually or by using the SILVA Navimap. A description of the application of the SILVA GPS-Compass is available at FRDS and BG-IFMP. The starting point for the inventory satellite is reached, when you are close to 50 m to the inventory *waypoint* in *navigation*

mode (Note: the accuracy of the GPS is between 0 and 100 m (see GPS manual).

Even in difficult terrain in dense forests the SILVA GPS-Compass is able to receive position fixes at least in 2D mode. If no fix can be received, then move to the next opening and try again. The final distance to your satellite location can then be measured manually.

The altitude readings of the GPS are too unprecise. Therefore an altimeter has to be used for determination of the altitude. It is of utmost importance that the altimeter is adjusted every morning at the camp site. How to determine the altitude of the camp site is described in the following: Select a distinct reference point on the map which is closest to the camp and identify it in the field (you must be 100% sure to be at the correct point). Adjust your altimeter at this point and move back to the camp. Take the altimeter reading of the camp location and note it down. Another possibility is to identify the camp site with the GPS in 3D mode, PDOP „positional dilution of precision“ should be < 6). Transfer the camp location to the inventory base map and identify the altitude.

The survey of the individual sample plots (relascope samples) has to be done by field survey, using compass and measurement tape. For the measurement of the 100 m distance from the starting point to the first inventory plot, and for the measurement of the 250 m distance between the clusters slope reduction is only necessary in very steep terrain with slope $> 75\%$. For measuring the distance between the individual sample plots slope reduction has to be carried out for slopes $> 25\%$. (For slope reduction factors see Annex 1).

The center of the individual sample plots have to be marked clearly marked with a peg.

The survey usually starts with the first sample plot (i.e. AA11/1) of the first cluster (i.e. AA11) which is located 100m north (0°) of the starting point. If it is not possible to start with cluster 1 (because of lack of accessibility etc.) then start with cluster 2 (i.e. AA11/2) which should be then 100 m southeast (120°) or with cluster 3 (i.e. AA11/3) which is 100m southwest (240°).

The survey data for the identification of the individual sample plots are specified in Table 1 (see also Figure 1: Sampling Design). It is advised to do the survey clockwise but in special cases this can be changed.

from	to	horizontal distance	compass bearing
starting point	AA11/1	100m	0°
AA11/1	AA11/2	50m	30°
AA11/2	AA11/3	50m	270°
AA11/1	AA12/1	250m	150°
AA12/1	AA12/2	50m	150°
AA12/2	AA12/3	50m	30°
AA12/1	AA13/1	250m	270°
AA13/1	AA13/2	50m	270°
AA13/2	AA13/3	50m	150°

Table 1: Description for the survey of a satellite sample (example of satellite No. AA10)

4 Measurements and Observations

In the following the data recording of observations and measurements made are described in the sequence, how they should be assessed in the field. An example of a recorded tally sheet is attached at Annex 5 at the end of this manual.

For each cluster one tally sheet has to be filled. First the following data have to be recorded as shown in the example below:

- 1. inventory unit: Gogona (name of potential FMU area)
- 2. cluster number: AA11
- 3. crew leader: Prabhat Kumar
- 4. date: 120496

For each sample plot of a cluster there is a own column in the tally sheet. For each sample plot the following observations and measurements have to be made.

General Plot Information:

altitude:

i.e. 2350 ; it should be recorded in 10 m intervals

accessibility:

In case the plot cannot be reached from any side due to terrain condition mark (N) otherwise mark (Y).

slope:

Measure slope up and slope down and calculate the average.

Relascope Sample Information

The selection of sample trees is done with the help of the Bitterlich Mirror Relascope using a basal area factor of 4.

The relascope sweep should always be carried out clockwise starting from the direction of the survey line.

All those live trees with a dbh of 10+ cm are considered as sample trees whose breast height (or reference height) cross section exceeds the critical angle as presented by two small and one large white bands (see Figure 2 and 3). When aiming at a tree it is important to press the button in front of the relascope for automatic slope correction. If it cannot be clearly decided, whether a tree is „in“ or „out“ then a borderline check must be carried out as follows:

borderline check:

- measure the horizontal distance of the tree from the sample plot center
- measure the dbh
- determine the maximum allowable distance (d_{\max}) which is for factor 4:

$$d_{\max} \text{ (in m)} = \text{dbh (in cm)} * 0.25$$

If the measured horizontal distance is smaller than d_{\max} then the tree is „in“ and has to be measured.

To facilitate borderline checks a table of maximum allowable distances d_{\max} for different dbh is attached in Annex 2. Note: this table is only valid for basal area factor 4.

Note: In hilly terrain slope reduction has to be carried out when measuring the distance from sample plot center to the tree. Slope correction factors are specified in Annex 1. The horizontal distance can be calculated as follows: measure the distance from plot center to the tree center and measure the slope of the measurement tape. Then divide this distance by the correction factor. For slope measurement the relascope can be used.

Figure 2: Scales of the Bitterlich Relascope

On the right hand there are two white straight bands, that can be used for measuring the slope, with indications P(ercent) and D(egree).

Next to those bands there are two small white band and one wider band with a 4 in it. From the left edge of the white band with number 4 to the right edge of the small white band on the right side basal area factor 4 is represented (see also figure 3). The other bands represent different basal area factors, or are used for measuring upper diameters etc.

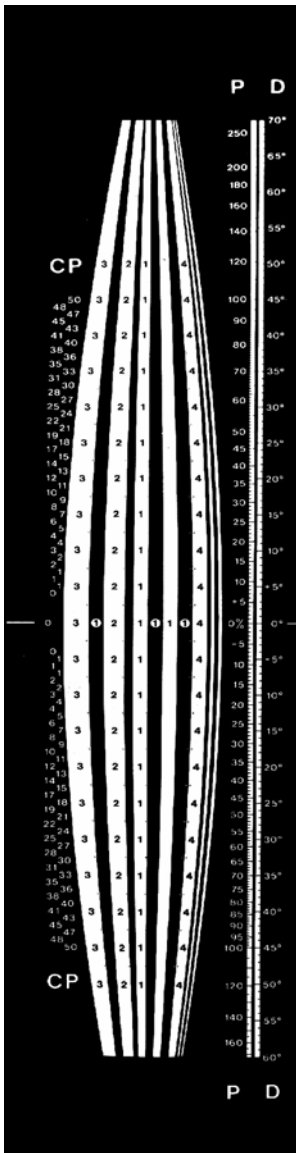
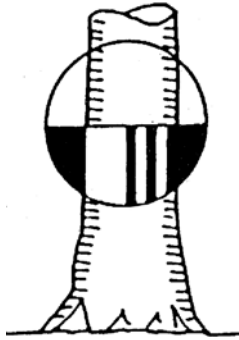
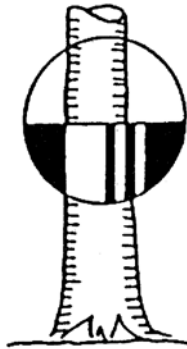


Figure 4: Selection of Sample Tree
(Basal Area Factor = 4)

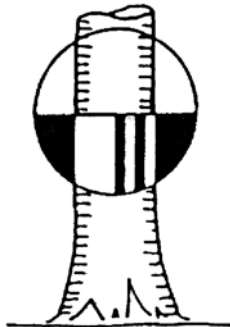
„in“



„out“



„check“



For each life sample tree the following information has to be recorded:

species code:

The species should be determined as accurately as possible and the four character species code should be entered in the tally sheet. In Annex 3, a species list is attached indicating the species code, botanical name and local name. The species code consists out of 4 characters, the first 3 indicate the genus, the last one the species. If a tree cannot be identified in the field encircle the serial number of the tree and describe it in the column general remarks. Please try to identify the genus (species code would then be the genus code followed by an question mark) or, indicate at least, whether it is a coniferous tree (CON?) or a broadleaf (BRL?).

dbh:

The diameter of the tree is measured at reference height with a caliper and recorded to the nearest full cm (i.e. 24.6 cm = 25 cm, 32.3 cm = 32 cm). When measuring the dbh with the caliper it is of utmost importance that the measurement is always done in the direction to or from the sample plot center.

Larger dbh should be measured with the diameter tape or the relascope (see Relascope Manual). Reference height is usually 1.3 m except for trees with abnormal bole form. The corresponding reference height can be derived from figure 4. Reference height has to be measured with a stick of 1.3 m length. For more details on dbh measurement consult the „Guidelines for Forest Management Field Inventory“.

height:

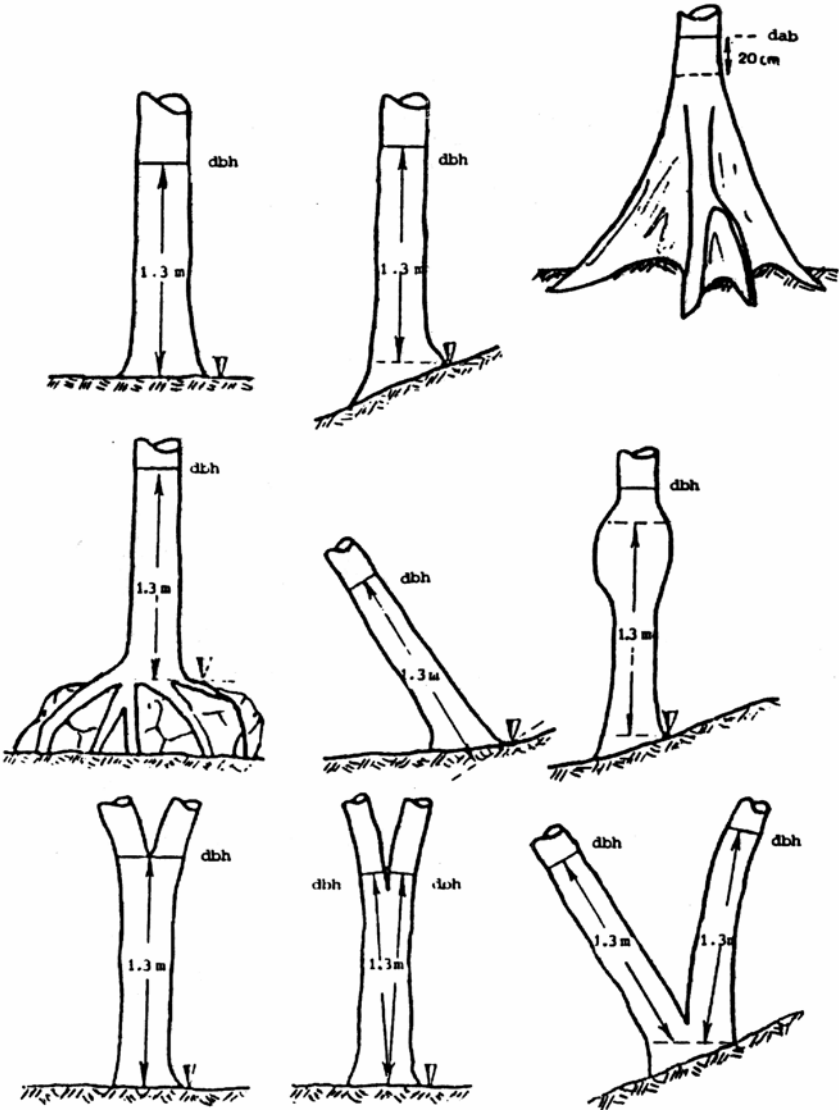
The total height of the sample trees have to be measured only at the third sample plot of each cluster. To determine the total height of a tree the following measurements have to be undertaken:

- measure a horizontal distance of approximately the height of the tree
- measure the slope in % to the top of the tree
- measure the slope in % to the bottom of the tree

Calculate the total tree height as follows (see also figure 5):

if the bottom of the tree is below the observer's eye-height both slope gradients have to be added. If it is above it has to be subtracted from the upper slope gradient. Then multiply the horizontal distance with the slope-% . The result is the total tree height, which should be rounded to the next meter.

Figure 4: Definition of Reference Height for DBH-Measurement

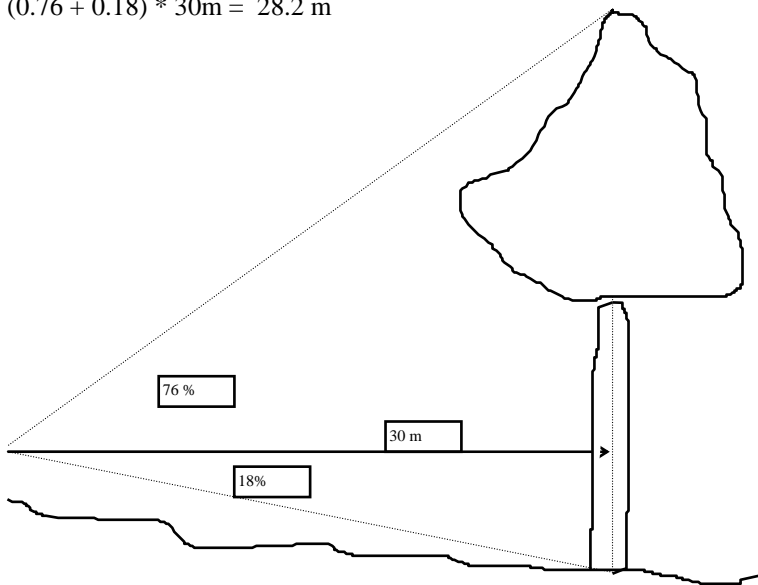


For slope measurement use the relascope. Position yourself at a location where you can clearly identify the top and the bottom of the tree. Preferably this position should be at the same altitude level or slightly above as the tree bottom, as then no slope reduction has to be carried out for the measurement of the horizontal distance. If the top of the tree is not visible or if the top is broken then no attempt should be made to measure the tree height. Further details of height measurement are described in the „Guidelines of Forest Management Field Inventory“.

Figure 5: Measurement of total tree height

tree height:

$$(0.76 + 0.18) * 30\text{m} = 28.2 \text{ m}$$



If all the relascope samples of one cluster are assessed the observations made within the whole cluster area on wildlife and human impacts have to be recorded.

observation of wildlife:

The purpose of this section of the tally sheet is to provide general information of the occurrence of wildlife throughout the inventory area which is a useful information for the environmental impact assessment. Attention is focused on a limited number of animal species considered as key indicator species.

The wildlife codes are specified in Annex 4. Indicate the name of the species (i.e. wild boar), the species code (i.e. BOAR), the type of evidence (i.e. tracks) and the evidence code (PATH). Altogether 5 observations can be indicated. If there are more, please mention under general remarks.

observation of human impact:

This section has been added to the inventory to get an idea how intensively the forest area is being used by the local population. This is a very valuable information for the persons who will carry out the socio-economic study of this area. Please encircle (Y) if you find any sign of the corresponding human impact.

general remarks:

In this section a detailed description of the stand should be given. Management options such as for example: *good potential for commercial logging, urgent need for rehabilitation etc.* should be given. Also all particularities have to be mentioned (i.e. not accessible because of rocks, die-back of fir, etc.).

Finally at the first section of the tally sheet the average of the following sample plot information have to be recorded:

5. average altitude:

This refers to the average altitude of the whole cluster, which is the arithmetic mean of the altitudes of the 3 sample plots. It is calculated as follows:

$$\text{alt}_{\text{clust}} = (\text{alt}_{\text{plot1}} + \text{alt}_{\text{plot2}} + \text{alt}_{\text{plot3}}) / 3$$

6. average slope:

This refers to the average slope of the whole cluster, which is the arithmetic mean of the slopes of the 3 sample plots. It is calculated as follows:

$$\text{slope}_{\text{clust}} = (\text{slope}_{\text{plot1}} + \text{slope}_{\text{plot2}} + \text{slope}_{\text{plot3}}) / 3$$

7. accessibility (if all samples = N then N, else Y):

If none of the individual sample plots is accessible, then (N) has to be encircled, else (Y).

Annex 1

Slope Reduction Table

Note: Slope reduction should be carried out for:

slope > 75%

100 m distance from starting point to first plot
250 m distance between to clusters

slope > 25%

50 m distance between sample plots

all slopes

borderline tree check
measurement of tree height

slope		horiz. dist.		slope		horiz. dist.	
%	factor	10 m	25 m	slope	factor	10 m	25 m
1	1,000	10,00	25,00	41	1,081	10,81	27,02
2	1,000	10,00	25,00	42	1,085	10,85	27,12
3	1,000	10,00	25,01	43	1,089	10,89	27,21
4	1,001	10,01	25,02	44	1,093	10,93	27,31
5	1,001	10,01	25,03	45	1,097	10,97	27,41
6	1,002	10,02	25,04	46	1,101	11,01	27,52
7	1,002	10,02	25,06	47	1,105	11,05	27,62
8	1,003	10,03	25,08	48	1,109	11,09	27,73
9	1,004	10,04	25,10	49	1,114	11,14	27,84
10	1,005	10,05	25,12	50	1,118	11,18	27,95
11	1,006	10,06	25,15	51	1,123	11,23	28,06
12	1,007	10,07	25,18	52	1,127	11,27	28,18
13	1,008	10,08	25,21	53	1,132	11,32	28,29
14	1,010	10,10	25,24	54	1,136	11,36	28,41
15	1,011	10,11	25,28	55	1,141	11,41	28,53
16	1,013	10,13	25,32	56	1,146	11,46	28,65
17	1,014	10,14	25,36	57	1,151	11,51	28,78
18	1,016	10,16	25,40	58	1,156	11,56	28,90
19	1,018	10,18	25,45	59	1,161	11,61	29,03
20	1,020	10,20	25,50	60	1,166	11,66	29,15
21	1,022	10,22	25,55	61	1,171	11,71	29,28
22	1,024	10,24	25,60	62	1,177	11,77	29,42
23	1,026	10,26	25,65	63	1,182	11,82	29,55
24	1,028	10,28	25,71	64	1,187	11,87	29,68
25	1,031	10,31	25,77	65	1,193	11,93	29,82
26	1,033	10,33	25,83	66	1,198	11,98	29,95
27	1,036	10,36	25,90	67	1,204	12,04	30,09
28	1,038	10,38	25,96	68	1,209	12,09	30,23
29	1,041	10,41	26,03	69	1,215	12,15	30,37
30	1,044	10,44	26,10	70	1,221	12,21	30,52
31	1,047	10,47	26,17	71	1,226	12,26	30,66
32	1,050	10,50	26,25	72	1,232	12,32	30,81
33	1,053	10,53	26,33	73	1,238	12,38	30,95
34	1,056	10,56	26,41	74	1,244	12,44	31,10
35	1,059	10,59	26,49	75	1,250	12,50	31,25
36	1,063	10,63	26,57	76	1,256	12,56	31,40
37	1,066	10,66	26,66	77	1,262	12,62	31,55
38	1,070	10,70	26,74	78	1,268	12,68	31,71
39	1,073	10,73	26,83	79	1,274	12,74	31,86
40	1,077	10,77	26,93	80	1,281	12,81	32,02

slope		horiz. dist.		slope		horiz. dist.	
%	factor	10 m	25 m	slope	factor	10 m	25 m
81	1,287	12,87	32,17	121	1,570	15,70	39,24
82	1,293	12,93	32,33	122	1,577	15,77	39,44
83	1,300	13,00	32,49	123	1,585	15,85	39,63
84	1,306	13,06	32,65	124	1,593	15,93	39,82
85	1,312	13,12	32,81	125	1,601	16,01	40,02
86	1,319	13,19	32,97	126	1,609	16,09	40,22
87	1,325	13,25	33,14	127	1,616	16,16	40,41
88	1,332	13,32	33,30	128	1,624	16,24	40,61
89	1,339	13,39	33,47	129	1,632	16,32	40,81
90	1,345	13,45	33,63	130	1,640	16,40	41,00
91	1,352	13,52	33,80	131	1,648	16,48	41,20
92	1,359	13,59	33,97	132	1,656	16,56	41,40
93	1,366	13,66	34,14	133	1,664	16,64	41,60
94	1,372	13,72	34,31	134	1,672	16,72	41,80
95	1,379	13,79	34,48	135	1,680	16,80	42,00
96	1,386	13,86	34,66	136	1,688	16,88	42,20
97	1,393	13,93	34,83	137	1,696	16,96	42,40
98	1,400	14,00	35,00	138	1,704	17,04	42,61
99	1,407	14,07	35,18	139	1,712	17,12	42,81
100	1,414	14,14	35,36	140	1,720	17,20	43,01
101	1,421	14,21	35,53	141	1,729	17,29	43,22
102	1,428	14,28	35,71	142	1,737	17,37	43,42
103	1,436	14,36	35,89	143	1,745	17,45	43,62
104	1,443	14,43	36,07	144	1,753	17,53	43,83
105	1,450	14,50	36,25	145	1,761	17,61	44,03
106	1,457	14,57	36,43	146	1,770	17,70	44,24
107	1,465	14,65	36,61	147	1,778	17,78	44,45
108	1,472	14,72	36,80	148	1,786	17,86	44,65
109	1,479	14,79	36,98	149	1,794	17,94	44,86
110	1,487	14,87	37,17	150	1,803	18,03	45,07
111	1,494	14,94	37,35	151	1,811	18,11	45,28
112	1,501	15,01	37,54	152	1,819	18,19	45,49
113	1,509	15,09	37,72	153	1,828	18,28	45,70
114	1,516	15,16	37,91	154	1,836	18,36	45,90
115	1,524	15,24	38,10	155	1,845	18,45	46,11
116	1,532	15,32	38,29	156	1,853	18,53	46,32
117	1,539	15,39	38,48	157	1,861	18,61	46,54
118	1,547	15,47	38,67	158	1,870	18,70	46,75
119	1,554	15,54	38,86	159	1,878	18,78	46,96
120	1,562	15,62	39,05	160	1,887	18,87	47,17

Annex 2

**Checking of Borderline Trees
(for basal area factor 4)**

d_{max} for various distances for basal area factor 4

dbh (cm)	dmax (m)	dbh (cm)	dmax (m)	dbh (cm)	dmax (m)	dbh (cm)	dmax (m)
10	2,50	40	10,00	70	17,50	100	25,00
11	2,75	41	10,25	71	17,75	101	25,25
12	3,00	42	10,50	72	18,00	102	25,50
13	3,25	43	10,75	73	18,25	103	25,75
14	3,50	44	11,00	74	18,50	104	26,00
15	3,75	45	11,25	75	18,75	105	26,25
16	4,00	46	11,50	76	19,00	106	26,50
17	4,25	47	11,75	77	19,25	107	26,75
18	4,50	48	12,00	78	19,50	108	27,00
19	4,75	49	12,25	79	19,75	109	27,25
20	5,00	50	12,50	80	20,00	110	27,50
21	5,25	51	12,75	81	20,25	111	27,75
22	5,50	52	13,00	82	20,50	112	28,00
23	5,75	53	13,25	83	20,75	113	28,25
24	6,00	54	13,50	84	21,00	114	28,50
25	6,25	55	13,75	85	21,25	115	28,75
26	6,50	56	14,00	86	21,50	116	29,00
27	6,75	57	14,25	87	21,75	117	29,25
28	7,00	58	14,50	88	22,00	118	29,50
29	7,25	59	14,75	89	22,25	119	29,75
30	7,50	60	15,00	90	22,50	120	30,00
31	7,75	61	15,25	91	22,75	121	30,25
32	8,00	62	15,50	92	23,00	122	30,50
33	8,25	63	15,75	93	23,25	123	30,75
34	8,50	64	16,00	94	23,50	124	31,00
35	8,75	65	16,25	95	23,75	125	31,25
36	9,00	66	16,50	96	24,00	126	31,50
37	9,25	67	16,75	97	24,25	127	31,75
38	9,50	68	17,00	98	24,50	128	32,00
39	9,75	69	17,25	99	24,75	129	32,25

Annex 3

Species Code

SPECIES	GENUS_NAME	SPE_NAME	LOCAL_NAME
BAM?	unspecified	bamboo	unspecified bamboo
BRL?	unspecified	broadleaf	unspecified broadleaf
CON?	unspecified	conifer	unspecified conifer
FER?	unspecified	tree fern	unspecified tree fern
PAL?	unspecified	erect palm	unspecified erect palm
RAT?	unspecified	rattan, cane	unspecified rattan, cane
ABID	Abies	densa	fir,dungshing,gobre salla
ACAA	Acacia	auriculiformis	(exotic) akasmoni
ACAC	Acacia	catechu	khair,toeja
ACAM	Acacia	mearnsii	(exotic) black wattle
ACA?	Acacia	sp.	unspecified
ACEC	Acer	campbellii	maple,chalum, kapasi
ACEL	Acer	laevigatum	putli
ACE?	Acer	sp.	unspecified,maple,kapasi
ACRF	Acrocarpus	fraxinifolius	mandane
ACTO	Actinodaphne	obovata	runchey
ADIC	Adina	cordifolia	haldu,karan
AEAB	Aesandra	butyracea	chiwari,pinshing,yikashing
AECA	Aesculus	assamica	horse chestnut,satpati,pangre
AILE	Ailanthus	excelsa	(exotic) maharukh
AILI	Ailanthus	integrifolia	gokul
AIL?	Ailanthus	sp.	unspecified
ALAA	Alangium	alpinum	galasune
ALAC	Alangium	chinense	akhane, luma shing
ALA?	Alangium	sp.	unspecified
ALBF	Albizia	falcataria	(exotic) albizia,siris
ALBJ	Albizia	julibrissin	
ALBE	Albizia	lebbeck	kalo siris
ALBU	Albizia	lucidior	rato siris
ALBO	Albizia	odoratissima	karkur siris
ALBP	Albizia	procera	seto siris
ALB?	Albizia	sp.	unspecified,siris
ALCC	Alcimandra	cathcartii	tite champ
ALNN	Alnus	nepalensis	alder,utis,gama
ALSS	Alstonia	scholaris	chatiwan,chatium

ALTE	Altingia	excelsa	seti kath,jhikri,jutuli
AMOW	Amoora	wallichii	lali,amari
ANOL	Anogeissus	latifolius	(exotic) banghi
ANTC	Anthocephalus	cadamba	kadam
APHP	Aphanomixis	polystachya	lahasune,wagorey doroshing
AQUM	Aquilaria	malaccensis	eaglewood,agoor
ARTC	Artocarpus	chama	lathar,yitsu sing
ARTE	Artocarpus	heterophyllus	ruk kathal,jack,damtsi,demlin
ARTI	Artocarpus	hirsuta	aini,koko
ARTL	Artocarpus	lacucha	barrar,dewa
ART?	Artocarpus	sp.	unsp.,athor,chaplash,kathal,sani
AZAI	Azadirachta	indica	(exotic) neem
BACR	Baccaurea	ramiflora	kusum
BAMB	Bambusa	balcooa	bhalu bans,dhanu bans
BAUP	Bauhinia	purpurea	tanki,pegpeyposhing,zibzibshing
BAU?	Bauhinia	sp.	unspecified,tanki
BAUV	Bauhinia	variegata	koiralo,ruchashing
BEID	Beilschmiedia	dalzellii	tarshing
BEIG	Beilschmiedia	gammieana	golo shing, tarshing
BEIR	Beilschmiedia	roxburghiana	thulo tarshing
BEI?	Beilschmiedia	sp.	unspecified,tarsing
BENC	Benthamidia	capitata	phetche
BETA	Betula	alnoides	saur,tap
BET?	Betula	sp.	unspecified,birch
BETU	Betula	utilis	bhojpatra,latap
BISJ	Bischofia	javanica	kanjal,uriam,goileshing
BOER	Boehmeria	rugulosa	dar,dongtsong
BOMC	Bombax	ceiba	simal,simul,pemageyershing
BRAA	Brassaiopsis	hainla	chuletro
BRAI	Brassaiopsis	hispida	phutta
BRAM	Brassaiopsis	mitis	chuletro
BRA?	Brassaiopsis	sp.	unspecified,chuletro
BRIR	Bridelia	retusa	gayo,gaumbha,kuhir,kulir
BRI?	Bridelia	sp.	unspecified
BRIT	Bridelia	tomentosa	muse gayo
CAAA	Calamus	acanthospathus	gauri bet
CAAE	Calamus	erectus	
CAA?	Calamus	sp.	ri,khe,beth
CAAT	Calamus	tenuis	kukhre bet

CALA	Callicarpa	arborea	guyelo
CAOP	Calophyllum	polyanthum	rate
CAMK	Camellia	kissii	hinguwa
CANS	Canarium	sikkimense	gokul dhup,dhuna
CAPV	Carpinus	viminea	hornbeam,rutoshing,lungshing
CAYU	Caryota	urens	dung dung kha
CASF	Cassia	fistula	rajbrikha,sonalu,dongkashing
CASS	Cassia	siamea	(exotic) minjuri
CAS?	Cassia	sp.	unspecified
CATH	Castanopsis	hystrix	katus, tshe shing
CATI	Castanopsis	indica	aule katus,dalne katus,sokey
CATL	Castanopsis	lanceifolia	patle katus
CAT?	Castanopsis	sp.	unspecified,katus
CATT	Castanopsis	tribuloides	musre katus,patle katus,tongpa shi
CELA	Celtis	australis	khari,phantang
CEPF	Cephalostachyum	fuchsianum	ghopi bans
CHIC	Chimonobambusa	callosa	khare bans
CHOA	Choerospondias	axillaris	lapsi
CHUT	Chukrasia	tabularis	chikrasi,bogipoma
CINB	Cinnamomum	bejolghota	bale sin kauli, drongdo
CING	Cinnamomum	glaucescens	malagiri,ganserai
CINI	Cinnamomum	impressinerviu	sissi, korsane
CINJ	Cinnamomum	jaylanicum	dalchini
CIN?	Cinnamomum	sp.	unspecified
CINT	Cinnamomum	tamala	tejpat
CODG	Cordia	grandis	asare
CODO	Cordia	obliqua	bohari
COD?	Cordia	sp.	unspecified
COIN	Coriaria	napalensis	nimbo, limphu shi
COOH	Corylopsis	himalayana	
COUF	Corylus	ferox	
CROH	Croton	himalaicus	lapche bis
CRYJ	Cryptomeria	japonica	(exotic) dhupi
CUPC	Cupressus	corneyana	cypress,chenden shing
CUP?	Cupressus	sp.	unspecified
CYAS	Cyathea	spinulosa	
DALL	Dalbergia	latifolia	(exotic) satsal,rosewood
DALE	Dalbergia	sericea	pchang,bandre siris
DALI	Dalbergia	sissoo	sissu,jesengshing

DAL?	Dalbergia	sp.	unspecified
DAPC	Daphniphyllum	chartaceum	lal chandan
DAPH	Daphniphyllum	himalense	chandan
DAP?	Daphniphyllum	sp.	unspecified
DELR	Delonix	regia	(exotic) guld mohar
DEAH	Dendrocalamus	hamiltonii	tama bans,patsa,choya bans
DEAN	Dendrocalamus	nutans	mal bans
DEA?	Dendrocalamus	sp.	unspecified
DEAS	Dendrocalamus	strictus	(exotic) lathi bans
DENS	Dendrocide	sinuata	morangay
DILI	Dillenia	indica	panchphale
DILP	Dillenia	pentagyna	tantri
DIL?	Dillenia	sp.	unspecified
DIPM	Dipterocarpus	macrocarpus	(exotic) hollong
DREI	Drepanostachyum	intermedium	tite nigalo
DRE?	Drepanostachyum	sp.	unspecified
DRIR	Drimycarpus	racemosus	khag bhalayo
DRYI	Drypetes	indica	hare
DUAG	Duabanga	grandiflora	lampate,khokan,samgata
ELAI	Elaeocarpus	sikkimensis	bhadrase
ELA?	Elaeocarpus	sp.	unspecified,gobre
ELAP	Elaeocarpus	sphaericus	rhudrax
ELAV	Elaeocarpus	varuna	bhadrase
ENGS	Engelhardtia	spicata	mauwa
ENKD	Enkianthus	deflexus	
ERIP	Eriobotrya	petiolata	maya kath
ERYA	Erythrina	arborescens	phaledo,chassee
ERY?	Erythrina	sp.	unspecified,phaledo
ERYT	Erythrina	stricta	phaledo
ERYU	Erythrina	suberosa	phaledo
EUCC	Eucalyptus	camaldulensis	(exotic) red gum,masala,tobdashing
EUCG	Eucalyptus	globulus	(exotic) blue gum,masala,tobdashing
EUC?	Eucalyptus	sp.	(exotic) unspecified,eucalypt
EUO?	Euonymus	sp.	unspecified
EURC	Eurya	cavinervis	jhingni
EXBP	Exbucklandia	populnea	pipli,chenjushing
FARB	Fargesia	bhutanensis	rhui,baa
FAR?	Fargesia	sp.	unspecified
FICA	Ficus	auriculata	fig,chongma,nebharo

FICC	Ficus	glaberrima	karpoa
FICH	Ficus	hispida	khasreto
FICL	Ficus	lacor	kabra
FICN	Ficus	neriifolia	dudhila
FICE	Ficus	semicordata	khanew
FIC?	Ficus	sp.	unspecified,fig
FICU	Ficus	subincisa	berule
FRAX	Fraxinus	xanthoxyloides	ash,lankuri
GAMC	Gamblea	ciliata	kursimla
GACS	Garcinia	stipulata	dur lampate
GAUP	Garuga	pinnata	dabdabe
GLOA	Glochidion	assamicum	lati mauwa
GLOB	Glochidion	bhutanicum	kotokmo shing
GLO?	Glochidion	sp.	unspecified
GLOT	Glochidion	thomsonii	lathi kath
GMEA	Gmelina	arborea	khamari,kholomshing
GRVR	Grevillea	robusta	(exotic) silver oak
GRWA	Grewia	asiatica	syal fusre
GYNO	Gynocardia	odorata	lentem,gante
HELN	Helicia	nilagirica	bandarey,bandre
HETF	Heteropanax	fragrans	bale totola
HOLI	Holoptelia	integrifolia	kanju
HOVA	Hovenia	acerba	pumplota,bange kath,ruto shing
HYME	Hymenodictyon	excelsum	lalikaram
ILLG	Illicium	griffithii	
ITEM	Itea	microphylla	tilki
JUGR	Juglans	regia	walnut,tashing,okhar
JUNP	Juniperus	pseudosabina	shup, black juniper
JUNR	Juniperus	recurva	shup shing, weeping blue juniper
JUN?	Juniperus	sp.	unspecified,juniper
JUNS	Juniperus	squamata	
KYDC	Kydia	calycina	kubinde,pichala,chamaktangshing
LAGH	Lagerstroemia	hirsuta	jarul
LAGP	Lagerstroemia	parviflora	sidha,buradhoyaro
LAG?	Lagerstroemia	sp.	unspecified,buramshing
LARG	Larix	griffithiana	larch,zashing,barge salla
LEUL	Leucaena	leucocephala	(exotic) ipil-ipil
LINP	Lindera	pulcherrima	sissi,sinhal
LIN?	Lindera	sp.	unspecified

LIHD	Lithocarpus	dealbatus	
LIHE	Lithocarpus	elegans	shakor shing
LIHF	Lithocarpus	fenestratus	arkhaura
LIHP	Lithocarpus	pachyphyllus	sungure katus
LIH?	Lithocarpus	sp.	unspecified,phalanth
LISH	Litsea	hookeri	dudhe lampati, thulo pahenle
LISM	Litsea	monopetala	litsa,kutmeri,seychhanglushing
LIS?	Litsea	sp.	unspecified
LYOO	Lyonia	ovalifolia	angeri
LYO?	Lyonia	sp.	unspecified,angeri
LYOV	Lyonia	villosa	lek angeri
MAAD	Macaranga	denticulata	malata
MAAP	Macaranga	pustulata	malata
MAA?	Macaranga	sp.	unspecified,malata
MARU	Macropanax	undulatus	chinde
MAGC	Magnolia	campbellii	ghoge champ
MAGG	Magnolia	globosa	kokre champ
MAG?	Magnolia	sp.	unspecified
MALP	Mallotus	philippinensis	rohini
MAL?	Mallotus	sp.	unspecified
MANI	Mangifera	indica	am, aamli chukuli
MAN?	Mangifera	sp.	unspecified
MANS	Mangifera	sylvatica	chuche amp
MELA	Melia	azadarach	lilac,bakaina,jashing,ngerashing
MESF	Mesua	ferrea	(exotic) ironwood,nageswar
MICC	Michelia	champaca	aule champ
MICD	Michelia	doltsopa	rani champ, seto champ
MICK	Michelia	kisopa	
MIC?	Michelia	sp.	unspecified,khashing
MICV	Michelia	velutina	phusre, guay champ
MORM	Morus	macroura	kimbu,bola,tshende
MYRE	Myrica	esculenta	kaphal,chisishing
NELF	Neolitsea	foliosa	bhal sissi
NEMR	Neomicrocalamus	ringshu	ringchu,hima,ula,langmaa,bangchung
NYSJ	Nyssa	javanica	lekh chilaune,pasjamshing
OROI	Oroxylum	indicum	totola,champakashing
OSTP	Ostodes	paniculata	bepari
PANN	Pandanus	nepalensis	taari ka
PANS	Pandanus	sikkimensis	taari ka

PAN?	Pandanus	sp.	unspecified pandan
PENR	Pentapanax	racemosus	chinde
PERF	Persea	fructifera	lapche phal
PER?	Persea	sp.	unspecified,kawla
PHBA	Phoebe	attenuata	angare
PHBH	Phoebe	hainesiana	bonsum
PHBL	Phoebe	lanceolata	jhakri kath
PHB?	Phoebe	sp.	unspecified
PHNR	Phoenix	rupicola	
PHYE	Phyllanthus	emblica	amla,churooshing
PICB	Picea	brachytyla	
PIC?	Picea	sp.	unspecified,spruce
PICS	Picea	spinulosa	spruce,seshing,kalo salla
PIEF	Pieris	formosa	
PINB	Pinus	bhutanica	thongphu
PINR	Pinus	roxburghii	chir pine,thaetong
PIN?	Pinus	sp.	unspecified
PINW	Pinus	wallichiana	blue pine,tongphu
PLEH	Plectocomia	himalayana	
POLS	Polyalthia	simiarum	
POPC	Populus	ciliata	kashing
POPR	Populus	rotundifolia	kashing
POP?	Populus	sp.	unspecified,poplar
PRUA	Prunus	carmesina	
PRUE	Prunus	cerasoides	paiyun
PRUN	Prunus	napaulensis	arupate
PRU?	Prunus	sp.	unspecified
PSEP	Pseudostachyum	polymorphum	dai,philim
PTOA	Pterospermum	acerifolium	hatipaile
PTYA	Pterygota	alata	badam
PYRP	Pyrus	pashia	pear,naspati,litong,lee
QUEL	Quercus	glauca	thonp, musure phalant
QUER	Quercus	griffithii	sisi,kasru
QUEM	Quercus	lamellosa	buk,bangka,bajrath
QUEN	Quercus	lanata	gum,banj
QUES	Quercus	semecarpifolia	jishing,khasru
QUE?	Quercus	sp.	unspecified,oak
RHOA	Rhododendron	arboreum	etometo, gurans
RHO?	Rhododendron	sp.	unspecified

RHUC	Rhus	chinensis	datick,bhakimlo
RHUH	Rhus	hookeri	bhalayo
RHUP	Rhus	paniculata	khyr khobtang
RHU?	Rhus	sp.	unspecified
RHUS	Rhus	succedanea	say shing,rani bhalayo
ROBP	Robinia	pseudoacacia	(exotic) locust
SALB	Salix	babylonica	weeping willow,bais
SAL?	Salix	sp.	unspecified,willow,bais,chamashing
SANR	Sapindus	rarak	ritha,nakapni
SAMB	Sapium	baccatum	seleng,akhataruwa
SAME	Sapium	eugeniifolium	phirphire,pipalpate
SAMI	Sapium	insigne	shushi
SAM?	Sapium	sp.	unspecified
SARA	Sarcosperma	arboreum	kalikath
SAUN	Saurauja	napaulensis	gogun,mingdormashing
SCHW	Schima	wallichii	chilaune,puyam,gogra,zalashing
SHOR	Shorea	robusta	sal
SLOD	Sloanea	decicarpus	gobre
SLO?	Sloanea	sp.	unspecified
SLOS	Sloanea	sterculiacea	gobre
SORG	Sorbus	griffithii	pasi
SORM	Sorbus	microphylla	tsema shing, sanu pasi
SOR?	Sorbus	sp.	unspecified
SPOP	Spondias	pinnata	amaro, ambar shing
STC?	Sterculia	sp.	unspecified
STCV	Sterculia	villosa	odal,godgudal,phrangshing
STEP	Stereospermum	personatum	parari
SYMG	Symplocos	glomerata	kharane
SYML	Symplocos	lucida	kharane
SYMP	Symplocos	paniculata	gumilo,pangtsheshing,zimshing
SYM?	Symplocos	sp.	unspecified
SYMS	Symplocos	spicata	kharane,kholme
SYZF	Syzygium	formosum	ambake
SYZL	Syzygium	claviflorum	harre jammuna
SYZU	Syzygium	cumini	jammun,mitsu shing
SYZ?	Syzygium	sp.	unspecified
TALH	Talauma	hodgsonii	balukath
TAMI	Tamarindus	indica	titiri
TAXB	Taxus	baccata	yew,dengre salla,keyrangshing

TECG	Tectona	grandis	teak,sagun
TERL	Terminalia	alata	pakhasaj,sain
TERR	Terminalia	arjuna	(exotic) arjun
TERB	Terminalia	belerica	barra, baroo
TERT	Terminalia	catappa	badam
TERH	Terminalia	chebula	harra, aroo
TERM	Terminalia	myriocarpa	panisaj,hollock
TER?	Terminalia	sp.	unspecified
TEDF	Tetradium	fraxinifolius	khanakpa
TEMN	Tetrameles	nudiflora	maina,bhelu
THAA	Thamnocalamus	aristatus	hum, rato nigalo
TOOC	Toona	ciliata	tooni,poma,indian mahogany,chunshi
TOO?	Toona	sp.	unspecified
TOOS	Toona	sureni	toon
TREN	Trewia	nudiflora	pitali, ramritta
TSUD	Tsuga	dumosa	hemlock,bashing,tengre salla
TURP	Turpinia	pomifera	thali
ULML	Ulmus	lanceifolia	elm
VIB?	Viburnum	sp.	unspecified
VITH	Vitex	heterophylla	panchpate
WALD	Wallichia	densiflora	rang bhang
WAST	Walsura	tubulata	phalame
YUSH	Yushania	hirsuta	hima
YUSA	Yushania	maling	malingo
YUSI	Yushania	microphylla	malingo
YUS?	Yushania	sp.	unspecified
ZANA	Zanthoxylum	armatum	
ZANR	Zanthoxylum	rhetsa	
ZAN?	Zanthoxylum	sp.	unspecified,timur,thingeyshing

Annex 4

Wildlife Codes

Animal Codes

Animal Code	Descript
ELEP	Elephant
HIMB	Himalayan Black Bear
LEOP	Leopard
REDP	Red Panda
TIGE	Tiger
BARD	Barking Dear
BOAR	Wild Boar
GAUR	Gaur
GORA	Goral
MUSD	Musk Deer
SAMD	Sambhar Deer
SERO	Serow
TAKI	Takin
COML	Common Langur
GOLL	Golden Langur
RHES	Rhesus Macaque
HORN	Hornbill
PHEA	Pheasant

Codes of evidence

Evidence	Descript
SIGH	direct sight
SOUN	sound
DUNG	dung
SKEL	skeleton/cadaver
ANTL	horns/antlers
FOOT	footprints
PATH	tracks/path
BURR	burrow, den
BROW	browsing
DEBA	debarking
FRAY	fraying/beating

Annex 5

Example of Tally Sheet