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**GOVERNMENT OF INDIA**

**MINISTRY OF AGRICULTURE & IRRIGATION**

**(DEPARTMENT OF AGRICULTURE)**

**U. P.**

**(BHAGIRATHI, BHILLANGANA AND YAMUNA CATCHMENTS)**

**VOLUME - II**

**THE METHODOLOGY**



**PRE-INVESTMENT SURVEY OF FOREST RESOURCES**

**DEHRA DUN.**

**1976**

GOVERNMENT OF INDIA  
MINISTRY OF AGRICULTURE AND IRRIGATION  
( DEPARTMENT OF AGRICULTURE)

U.P.  
( BHAGIRATHI, BHILLANGANA & YAMUNA CATCHMENTS )

VOLUME-II

THE METHODOLOGY

PREINVESTMENT SURVEY OF FOREST RESOURCES  
DEHRA DUN.

# C O N T E N T S .

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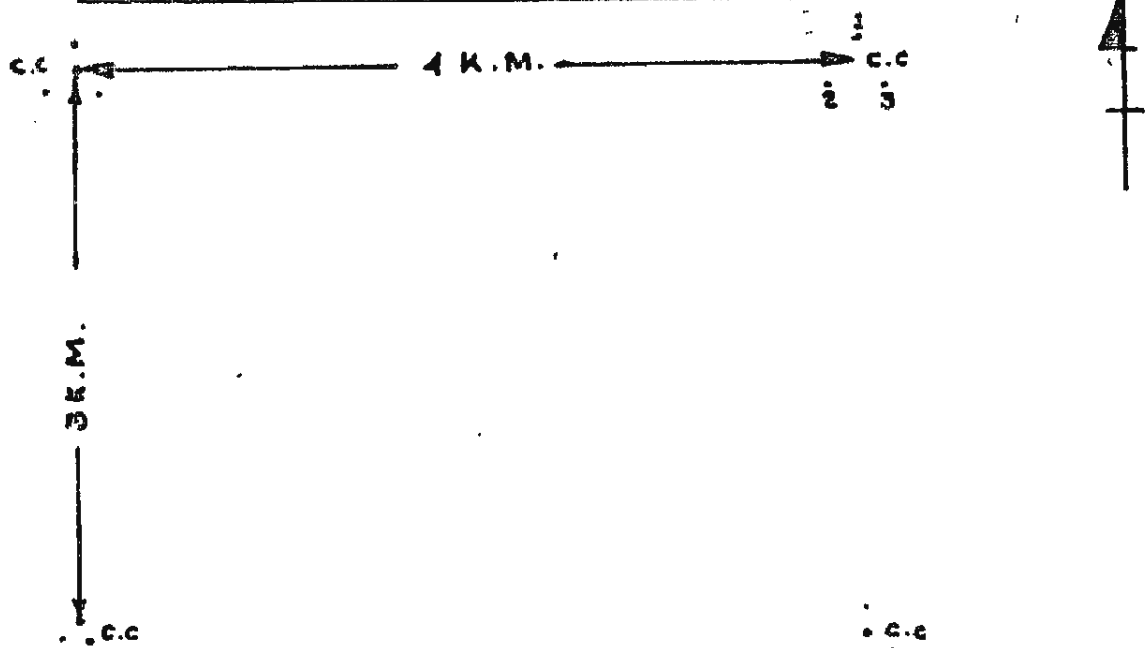
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PART-I.

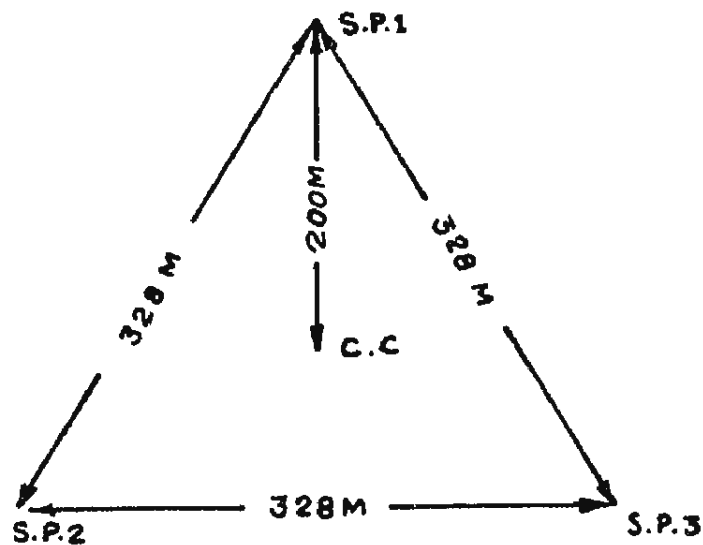
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## SAMPLING DESIGN FOR U.P AREA

### DISTRIBUTION OF CLUSTER CENTRES



### POSITION OF SAMPLING POINTS



## SECTION II.

### INSTRUCTIONS TO CREW LEADERS.

1. A Crew Leader is overall incharge of the party and is responsible for correct location and collection of data. You should, therefore, read the instructions very carefully.

#### 2. SAMPLING DESIGN:

2.1. Sampling shall be done in systematically spaced clusters at 3 Kms. (N.S) by 4 Kms (E.W). Each cluster, therefore, will represent approximately 12 Sq. Kms. Around each cluster there will be three sampling points in such a manner that if these sampling points are joined together they will form an equilateral triangle whose centre will be the cluster centre. The distance between the cluster centre and the sampling points shall be 200 meters and the distance between the sampling points shall be 328 meters.

2.2. The cluster is to be referred to by the grid reference of the cluster centre. Grid reference is an eight digit number e.g. 33441003 ( it is always an eight digit number). The first four digits refer to the X-Coordinate in grid Kilometers and the last four digits refer to the Y-Coordinate in grid Kilometers. On 1:50,000 sheets the grids are shown in red lines one grid Kilometers apart and the grid values on the border of the sheet is shown in grid meters.

2.3. Sample point number within a cluster, is to be referred to by one digit. The Northern point is numbered 1, the South-Western point is numbered 2 and the South-Eastern point is numbered 3. See the diagram on the first page.

2.4. Cluster centre and the sampling points are marked on the aerial photographs. The cluster centres are also marked on the 1:50,000 scale map sheets. Appendix -I contains a list showing the cluster number, C.C.G. R., map sheet reference and photo. reference.

#### 3. LOCATION OF SAMPLE POINT:

3.1. Before starting from the camp you should locate the cluster and sampling points, on the map as well as on photographs, to be surveyed. Reference of map sheet and photographs are given in appendix 1 and hence location should not be difficult.

3.2. Now decide the approach to the sampling point from the camp. In each cluster first proceed to the sample point No. 3, because sample tree data is to be collected from this point only. Where sample point No. 3 is non-forested, sample tree data is to be collected from sample point No. 2. Whenever this is non-forested it is to be collected from sample point No. 1. Therefore, it is advisable to choose the route in such a manner that sample point 3 is visited first. However, before leaving from the camp the route to be followed must be clearly understood by the study of the map and the photographs should also be studied carefully to locate the sample point correctly.

3.3. The location of sample point should not present any difficulty because of the available photographs as well as maps. The Crew Leader is solely responsible

for the correct location of the sample point. It is very important that the sample points are located correctly because any shift in its location will make all the data collected of no practical use. The crew leader should convince himself about the correct location before proceeding ahead for data collection. He should keep a detailed account in his note book about the route followed to locate the sample point. A brief description of approach should also be given on the P.D.F. (Point Description Form).

3.4. After locating the sample point put a peg 50 cms in length and 10 cms in diameter. Blaze it at the top facing the direction from which you have approached the sample point. Write the cluster centre grid reference and the number of the sample point in copying pencil in nine digits. The last digit indicating the number of the sample point. For example a reference like 348010211 indicates that the grid reference if the cluster centre is 34801021 and in this cluster it is the sample point number 1. Select two prominent trees for referencing the sample point. Measure the distance and the direction from each reference tree to the sample point. Blaze the reference trees 25 cms. below breast height facing the sample point and write with copying pencil (a) sample point reference (b) distance to sample point (c) direction to sample point. These references should also be recorded on the field note book and on the P.D.F.

#### 4. DATA COLLECTION:

4.1. You should be very precise and accurate in recording the information. The information should be recorded legibly. If you have any doubt about the information to be filled in a particular column leave the column blank in the form, record all the information in detail and your own doubts in the field note-book and contact the Officer-in-Charge for guidance.

4.2. Whenever one form is not sufficient for recording all the tree data, a second form as a continuation sheet may be used. Whenever a continuation sheet is used all the columns from 1 to 8 and 67-78 should be filled up in both the forms which should be stapled together.

4.3. To facilitate the data collection without waste of energy following sequence for data collection is advised.

4.4. Proceed to the sample point three where in addition to other data sample tree form is also to be filled in. Locate the point with the help of map and photographs. Put a peg on the point. Write the sample point grid reference also write the reference on two trees and write the approach. Standing at the sample point take a tally for B.A.F.-2. Put a serial number on each 'IN' trees and record in your note book the total number of 'IN' trees.

4.5. You can now start filling the point description form (Ref: See instructions for P.D.F.) in the mean time you can direct the Assistant Crew Leader to take diameter measurement for all the 'IN' trees and note it in his diary in the serial order.



4.6. Now the assistant crew leader can number all in 'IN' trees greater than or equal to 20 cms D.B.H. O.B. serially from the North direction in a sweep. All these trees are the " Sample Trees" ( This need be done only on the point from where sample tree data is to be collected). Also blaze the trees at about 25 cms. Below breast height facing the sample point and write the sample tree number on it in copying pencil.

4.7. By now, you would have completed the point description form. If not, go ahead. In the mean time the assistant crew leader can continue to collect 'sample tree data' and record it in the sample tree cards, tagged on each 'IN' tree.

4.8. After completing the point description form you can fill up the tally sheet ( refer instructions for Tally sheet). (Don't forget to check whether you have recorded the information for all the 'IN' trees).

4.8.1. By this time the 'sample tree data' must have been recorded on the sample tree card. When all the information has been collected and recorded on the sample tree cards, you should take up the sample tree form go to each tree and transfer the data from sample tree card on to the form. While doing so you would have an opportunity to look at the tree and also, in a way, check that part of the information which has been collected and recorded by the assistant crew leader.

## 5. GENERAL INSTRUCTIONS:

5.1. You are overall incharge of the party and shall be responsible for the progress of the work allotted to you.

5.2. Before proceeding on tour ensure that your party is fully equipped with camp and survey equipment.

5.3. Ensure that your party members are equipped with field dress and appropriate clothing and bedding. It is desirable that the personal luggage should be light in weight and small in volume. Heavy and superfluous baggage will add to your transport problem.

5.4. You shall also ensure that you have collected the maps and photographs of the area to be surveyed from the office. The maps and the photographs no longer required should immediately be returned. These are meant for survey work only. The photographs and maps are restricted and on no account should these be/Foreign shown to any one not connected with the Organisation, or to any/... whoever he may be. The maps and photographs should always be kept in your personal custody. Loss of maps or photographs is a criminal offence. Damage or loss of these should immediately be reported to the Zonal Coordinator, Northern Zone and to the Officer-in-Charge.

5.5. You shall collect the data with the help of the crew and record on the prescribed forms properly coded.

5.6. The code numbers should be legibly written in the forms. The digits should invariably be written as under:-

' 1 2 3 4 5 6 7 8 9 0 '

5.7. Before leaving the plot, make sure

- (a) that all your instruments are properly packed in the ruck-sack.
- (b) Look around the plot to be sure that you are not leaving any thing behind.
- (c) that the plot, when you leave, is as clean as you found it. Leaving any kind of litter or pack-lunch left overs scattered, is not a good habit. You can bury it.

5.8. On return to the camp:-

- (a) Check up your instruments.
- (b) Write on the plot description form the route to the cluster centre from the camp and other information from the field note book ( do it now, don't leave it for to-morrow).
- (c) Re-check all the forms filled during the day and file these properly.

@\*@@\*@@\*@@\*

SECTION III

INSTRUCTIONS FOR

FILLING UP VARIOUS FIELD FORMS.

1. PLOT DESCRIPTION FORM

<u>Col. No.</u>	<u>Code No.</u>	
1-3		Job )
4-5		Card Design ) Leave it blank.
6-7		Report Number )
8		Sub-report number ) Leave it blank.
9-10		Crew Leader- Two digits. Write your code number (app. III). You ought to remember this by now.
11		<u>Plot classification-</u> One digit. Write the suitable code number depending upon the classification given as under:-
	1.	The sample point falls outside the survey area.
	2.	Sample point not visited, rejected by aerial reconnaissance or by the study of maps or photographs.
	3.	Sample point could not be approached due to inaccessibility.
	4.	Sample point or its vicinity visited but tally and measurement not taken.
		<u>NOTE:-</u> This will include those sample points which are found in blank or cultivation, point which could not be reached due to obstructions but are visible clearly. It will also include the sample points where tally could not be taken due to sudden fall or any obstruction.
	5.	Sample point visited and all the data collected.
12-13		<u>State-</u> Two digit. Write code 27 for U.P.
14		<u>Revenue District-</u> One digit. Write the code number of the revenue district in which the plot lies. This could be one of the following.
	1.	Dehra Dun.
	2.	Tehri-Garhwal.
	3.	Uttar-Vashi.
15-16		<u>Forest Division-</u> Two digits. Write the number of the Forest Division in which the plot lies. This could be one of the following:-

Col. No.

Code No.

Name.

- |    |                 |
|----|-----------------|
| 01 | Chakarata.      |
| 02 | Tons            |
| 03 | Yamuna          |
| 04 | Uttar Kashi     |
| 05 | Tehri           |
| 06 | Dehra Dun West. |

17.

Catchment- One digit. The sample points are distributed in the following three catchments only. Write the code number of the catchment in which the plot lies. This should be checked from the map sheet on which the catchment boundaries are marked.

Name:

- |    |             |
|----|-------------|
| 1. | Bhagirathi. |
| 2. | Bhilangana  |
| 3. | Yamuna.     |

18.

Land class- One digit. Consider the present land use of the area represented by the sample point and classify in the appropriate land class. Remember, a sample point represents a land class which contains an area of atleast two hectares enclosing the sample point. Write the suitable code number of the land class in this column.

Description:

- |    |                           |
|----|---------------------------|
| 1. | Forest land.              |
| 2. | Agricultural crop land.   |
| 3. | Non Forestry Plantations. |
| 4. | Pasture land.             |
| 5. | Barren land.              |
| 6. | Other lands.              |

The following definitions of the above referred classes will help you in determining the category of land class to which the plot belongs.

Forest land:- It includes all lands with forest cover (including bamboo and Palm) of any density i.e. areas with trees and/or scrub growth and where land surface is not used primarily for purpose other than forestry. In addition, the following types of land should also be included in this category:-

- (a) Lands from which forests have been clear cut or burned out which will be reforested in the foreseeable future.
- (b) Public and private forests.

- (c) Planted forests including Walnut plantation.
- (d) Forest Roads surrounded by forests.
- (e) Nurseries surrounded by forests.
- (f) Temporarily unstocked or understocked areas.
- (g) Shelterbelts, wind breaks, trees in rows or narrow strips along roads and canal, banks.
- (h) Land surface covered with scrub growth.

NOTE:- In 'BAIRUNI' areas badly lopped oak forests are found where the main stem is less than 3 metre in height. Such areas should be classified as "FOREST-LAND". The main stem being too low D.B.H. cannot be measured. Do not take such sample point for the collection of sample tree data. Fill up P.D.F. only.

Land:-

- 2. Agricultural crop:- This includes all areas which are primarily used for growing agricultural crop. It will also include farm forests, where trees are grown together with agricultural crop. Shifting cultivation areas will also come under this category of land class.
- 3. Non-Forestry Plantations:- This includes areas with trees growth primarily planted for purpose other than forestry. For example: All fruit plantations (orchards) will come under this category except Walnut plantations.
- 4. Pasture land:- This includes all areas used primarily for the production of grasses and for grazing purpose e.g. high level grass lands or village pastures.
- 5. Barren land:- This includes areas devoid of any soil on which are incapable of holding any vegetative growth e.g. rocky outcrop or permanently snow covered areas.
- 6. Other lands:- This includes areas in habitation and industrial sites, river beds, water, roads, other than forest roads. This also includes those lands which cannot be classified in any of the above land classes.

EXPLANATIONS:

- (i) Grassy blanks less than 2 hectares in the Forest areas should be classified as Forest land.
- (ii) Plantation raised primarily for soil conservations and Aesthetic purposes should be classified as Forest land.

(iii) Areas under Tangya cultivation, where agricultural crop is grown along with the Forest Crop will be classified as forest land. In such cases a remark should be given that the area is presently being used for tangya cultivation.

19.

Legal Status:- One digit. This column is to be filled only for those sample points in which the classification under land class is Forest Land. For the remaining land classes this is to be left blank. Classify the forest in which the sample point lies in one of the following categories of forests. For this purpose an area of at least 2 hectares should be considered.

Category:-

1. Reserved Forests:- includes areas declared as such under the IFA/SFA.

2. Protected:- includes area declared as such under the IFA/SFA. It also includes unclassified forests under Forest Department. It also includes areas notified under section 4, where settlement proceedings are in progress.

3. National Parks and Wood Preserves:- includes forest areas where fellings are restricted by legislation. It also includes forest tree growth, planted or natural maintained primarily for purposes other than marketable wood production w.g. Tree preserves, Parks, Municipal wood lands for aesthetic purposes etc. Game sanctuaries will not come under this category. They will be either in reserved Forests or protected forests depending upon the legal status of the forest.

4. Other Govt. Forests:- It includes forest area under the control of Revenue Department.

5. Community Forests:- includes forest areas owned by the local bodies, trusts etc; e.g. Panchayat, Municipality etc.

6. Private Forests:- It includes areas owned by private individual or firms.

7. Undetermined:- It includes all forest lands which cannot be classified in any of the above categories.

Vegetation:- One digit. This column is to be filled up only for those sample point which have been classified as Forest Land under the land class column. Observe the growth in the region to an extent of 2 hectares or more and classify it in one of the following classes.

Description:

1. Forest.
2. Scrub.
3. Trees in line
4. Others.

1. Forest:- It includes all areas having tree cover of any density excluding trees in line. The following types of land will also be included in this category.

(a) Temporarily understocked or unstocked areas e.g. recently worked areas.

(b) Young natural stands and forest plantations at any stage of growth.

(c) Abandoned cultivation having forest cover.

(d) Forest roads, streams, small open areas in the forests and Nurseries of less than 2 hectares which form an integral part of the forests.

2. Scrub:- It includes areas having scrub growth, less than three metres in height. Abandoned cultivation and plantations having scrub growth will come under this category. Stunted tree growth where the trees have not attained the height upto three metres will also come under the category e.g. Dwarf Rhododendron or junipers growing at higher elevation.

3. Trees in line:- It includes row or rows or trees planted on road sides, canal banks or along railway tracks.

4. Others:- Anything that is not covered by the Forest Scrub or trees in line according to the definitions given above will be put in this category.

Forest type:- One digit. Observe the area represented by sample point classify the crop in one of the following forest types, provided that it is not less than 2 hectares in extent. Write the code of the forest type in this column:-



Col. No.

Code No.

Description:

1. Fir including spruce
2. Blue pine ( Kail)
3. Deodar
4. Chir
5. Upland hardwoods
6. Oaks
7. Mixed conifers
8. Low land hardwoods.

If a species constitutes 50% or more of the crop it will form its own forest type. In case of mixed conifers the mixture of conifers should be 50% or more of the total crop present. If there is a forest having upland hardwood as well as mixed conifers its forest type will be decided on the basis of total percentage of mixed conifers and upland hardwoods. If conifers are 50% or more it will be classified under code 7 if hardwoods are 50% or more it will be 5. The hardwood mixture may also include oaks provided oaks do not form 50% or more of the total crop.

SPECIES STOCKING IN FOREST:

Write the code number of the main species that constitute the crop. If there are more than three species write the code numbers of the ones that are in greater abundance and group the rest as 'others' for which species code col. is not provided.

NOTE:- If number of species are less than three write '000' in rest of the species column.

Species stocking percentage in forest:- One digit. Observe the Forest type in which the sample point lies. Assess the percentage composition of each species by number of stems, and classify the percentage for each species in one of the following classes:-

Description:

1. Less than 20%
2. 20% to less than 30%
3. 30% to less than 40%
4. 40% to less than 50%
5. 50% to less than 60%
6. 60% to less than 70%
7. 70% to less than 80%
8. More than or equal to 80%.

22-24 }  
26-28 }  
30-32 }

Col. No.

Code No.

25)  
29)  
33)  
34)

Write the code for stocking percentage, (based on number of stems) for the species indicated in cols. (22-24) (26-28) (30-32) in col. 25, 29 and 33 respectively. In col. 34 write the stocking % code for species grouped as 'others'. The sum of columns 25, 29, 33 and 34 should be minimum 8 and maximum 10.

NOTE:- When '000' is written under the species column, write '0' under the corresponding % column e.g. 1)  
A crop of Fir-spruce-bluepine has these species in the proportion of 15%, 35% and 50% respectively. Write the code number of Fir in column 22-24 and code of percentage stocking of Fir in column 25, write code number of spruce in column 26-28 and the code for percentage stocking of spruce in column 29. Write the code number of blue pine in column 30-32 and code for the % of Blue-pine in column 33. Write '0' in column 34.

EXAMPLE:- If it is pure crop of Blue pine write code number of Bluepine in col. 22-24 and code of blue pine percentage in col. 25. Write 000 in column 26-28 and 30-32 and write '0' in column 29, 33 and 34.

35.

Origin of stand:- One digit. Assess the origin of the stand in the field and classify the information in one of the following classes and write the code in the appropriate column.

1. Natural
2. Man made
3. Partially natural and partially man made e.g. natural forests supplemented with plantation or natural regeneration supplemented with artificial regeneration.

36-37

Average height:- Two digits. Measure the height to the nearest metre of 5 trees out of 10 trees to be selected for deciding the size class. Calculate the average height to the nearest metre and record in this column. The average height of the trees will be rounded to the nearest metre and shall be recorded in two digits in the appropriate column e.g. if the average tree height comes 39.7 m. it will be written as 40. If the average is 8.3 it will be written as 08.

38.

Size class:- One digit. Measure the diameters to the nearest centimetre of 10 trees representing the average size (diameter) of the crop in the forest type to which the point belong. Calculate the average diameter and classify it in one of the following size class and

Col. No.

Code No.

write the appropriate code in this column.

	Size Class	D.B.H. O.B. in cms. for conifers.	D.B.H. O.B. in cms. for broad species.
1.	V	Below 30	Less than 5
2.	IV	30 to less than 40	5 to less than 10
3.	III	40 to less than 50	10 to less than 20
4.	II	50 to less than 60	20 to less than 30
5.	I	60 or more	30 or more.

Spacing:- One digit. Measure the spacing of trees in the vicinity of the sample point to obtain the average spacing of trees in the forest. At least six measurements should be taken for the purpose. Classify the spacing in the following classes and write the code in the appropriate column.

Spacing in mtrs.

1.	Less than 1.5
2.	1.5 to less than 3.0
3.	3.0 to less than 4.5
4.	4.5 to less than 6.0
5.	6.0 to less than 7.5
6.	7.5 to less than 9.0
7.	9.0 to less than 10.5
8.	10.5 to less than 12.0
9.	More than or equal to 12.0

Regeneration:- One digit. All saplings less than 5 cms in diameter at breast height (over bark) are to be considered as regeneration. Draw a circle of 2 metres radius around the sample point and count the number of seedlings and put the appropriate code.

Col. No.

CODE NO.

Description:

1. More than 15-profuse.
2. 8 to less than 15-adequate
3. 1 to less than 8-scanty.
4. None-Nil.

Crown Density:- One digit. The crown density of the crop in which is represented by the sample point will be studied and the appropriate code will be written.

Description:

1. 0 to .2
2. More than .2 to .4
3. More than .4 to .6
4. More than .6 to .8
5. More than .8

Forest Potential:- All those forests where the crown density is more than 0.4 forest potential is not of any significance and hence the code pertaining to not applicable is to be written. In all other cases the land class to which the sample point belongs will be studied and it will be observed whether it is a potential land for growing forest or not. While determining the potentiality of the land class give due consideration to aspect, soil depth, drainage, crop in the surrounding area and other biotic and climatic factors. This column is to be filled in one of the following codes.

Description:

- 1 Potential
- 2 Non potential
- 3 Not applicable.

Slope:- One digit. Measure slope in uphill and down hill direction over a stretch as long as possible. Take the average of the two and classify as under and record in the proper code.

COL. NO.      CODE NO.

Slope in degrees.

1. 70 and above.
2. 60 to less than 70
3. 45 to less than 60
4. 25 to less than 45
5. Less than 20.

Stoniness:- One digit. Observe an area of 2 hectares or more around the plot and consider the extent of rocks/boulders greater than 25 cms. in diameter. Anything less than 25 cms. in diameter weighs less than about 40 kg. and can easily be moved manually. Hence keeping in view stones boulders greater than 25 cms. classify the plot in one of the following classes and write the code in the appropriate column.

1. More than 60% of the land surface is covered with stones/boulders.
2. 30% to 60% of the land surface is covered with stones boulder.
3. Less than 30% of the land surface is covered with stones/boulders.
4. Stones/boulders are absent.

Humus:- One digit. Humus is the decomposed organic matter (leaves, needles, twigs etc.) which has become a part of the upper most soil horizon. This should be clearly distinguished from unde-composed leaf litter. Remove the unde composed leaf litter from the soil surface before taking measurements. Dig a small pit 5 cms. deep in the representative area near the sample point. Now measure the depth of humus and write the code of the class in which it falls.

Description:

1. 5 cms. or more
2. 2 cms. to less than 5 cms.
3. less than 2 cms.
4. Humus absent.

COL. NO.

CODE NO.

46

Soil Depth:- One digit. Dig a pit with "shuri" in the representative area up to a depth of more than 30 cms. and measure the depth of the soil below the undecomposed leaf litter (i.e. dry leaves or needles or twigs) upto the parent rock or slightly more than 30 cms. whichever is less. Classify the soil depth in one of the following categories and write the code number in the appropriate column.

Description:

1. Equal to or greater than 30 cms.
2. 20 cms. to less than 30 cms.
3. 10 cms. to less than 20 cms.
4. 5 cms. to less than 10 cms.
5. less than 5 cms.
6. No soil.

47-48

Altitude:- Two digits. From the topo sheets 1" = 1 mile or 1/50,000 find the altitude of the sample point in metres. Write the altitude in four digits. Round off the last two digits into the nearest hundredth digit. Drop last two digits and write the remaining two digits in the appropriate column, e.g. an altitude of 550 metres should be written as 0550. This should be rounded off to the nearest hundred i.e. 0.600. Drop the last two digits and fill up the remaining two digits in this column. Likewise 4500 M. will be 45 Remember while rounding the last two digits into nearest hundredth 50 or more will become hundred and less than 50 will be omitted.

Terrain:- One digit. This refers to the topography in the vicinity of the sample point. You should refer to a topographic map or to a photograph as a guide to determining this classification. Examine the General topography over an area of 6-8 K. sq. kms. in the type of terrain in which the plot lies and classify the terrain in which the plot lies and classify the terrain in one of the following classes.

Description:

- 1 Precipitous:- Steep areas where logging is not possible.
- 2 Steep slopes:- Areas where logging is possible but with difficulty.

COL. NO.

CODE NO.

3

Gently Rollings:- Areas with series of rounded hill top and gentle slopes with the valleys in between where logging is easy.

4

Flat:-

EXAMPLE:- A hillock 100-200 M. high covering an area of about 1 sq. km. surrounded by 4-5 Sq. Km. of gently undulating area is to be classified as gently rolling. Fill up this column from the list available with the Officer-in-Charge.

Aspect:- One digit. Aspect refers to the direction of the slope. General aspect of the area wherein the sample point lies is to be studied on the map or photograph.

Aspect:

- |   |             |
|---|-------------|
| 1 | North       |
| 2 | Noth-East   |
| 3 | East        |
| 4 | South-East. |
| 5 | South       |
| 6 | South-West  |
| 7 | West        |
| 8 | North-West  |
| 9 | None        |

Fill up this column from the list available with the Officer-in-Charge.

Number of Forms:- Depending upon the forms attached with the P.D.F. Write the following codes.

Description:

- |   |   |
|---|---|
| 1 | Tally sheet only.                               |
| 2 | Tally sheet and sample tree form.               |
| 3 | Tally sheet and sample tree form not necessary. |

NOTE:- Tally is to be taken only when land class is forest land ( col. 18, code 1) and vegetation class is Forest ( col. 20 code 1). In all other cases Tally as well as S.T.F. will not be necessary and need not be filled up. When tally sheet is not necessary ( and not filled up) write 3 in this column.

COL. NO.

CODE NO.

Of all the forested points where tally has been taken the sample tree data is to be collected only for one point in the cluster. For other points of the cluster S.T.F. is not necessary. Thus when there is tally sheet only write 1 in this column and when tally sheet and S.T.F. both have been filled up write 2.

66

Sample point number:- One digit. Write the number of the sample point which is being measured. There are three sampling points in each cluster. The Northern sampling point is number 1, South-Western sampling point is number 2 and South-Eastern sampling point is number 3.

67-69

Cluster No. Three digits. Write the cluster number in three digits.

70

Grid Zones:- One digit. The grid zones are mentioned at the bottom of the map sheet. The codes pertaining to various grid zones are given in appendix II B. Write the suitable code in the appropriate column.

71-78

Cluster centre Grid Reference:- Eight digits. Cluster centre grid reference or C.C.G.R. has to be taken from the map sheet. On 1/50,000 sheets the grid are shown in red lines, one grid kilometer apart and the grid value on the border of the sheet is shown in grid metres. The block is to be referred to by the grid reference is always an eight digits number (e.g. 13357091). The first four digits refer to the X-Coordinate of the grid in grid kilometer and the last four digits refer to Y-Coordinate of the grid in grid kilometers. The value given on either ends of the vertical lines in the maps denote the value of X-Coordinate and value given on ends of the horizontal lines denote the value of Y-Coordinate.

Fill in the C.C.G.R. column in the form as explained above.

79-80

Inventory Design:- Two digits. Leave it blank.



## 2. TALLY SHEET ( B.A.F.- 2 )

This form is to be filled up only when the land class is Forest Land and the vegetation class is Forest in the point description form. In all other categories of land class and Vegetation class this form is not to be filled. If the land class is Forest Land and the vegetation class is Forest fill the tally sheet as per the instructions given below:-

Fill up columns 65 to 78 pertaining to Forest type, Point number, cluster number, Grid zone and Cluster Centre Grid Reference as done in the case of point description form. Now stand at the sample point and take tally with the Relaskop for Basal Area Factor " 2 " in a sweep starting from the North and moving in a clock-wise direction making a full circle. Ignore dead trees and trees less than 5 cms. D.B.H.O.B. Count the total number of "IN" trees and write in column 63-64. Also make a record of total number of "IN" trees in your field note book. Remember whenever tally is taken column 63-64 must be filled up. If there are no trees in the tally then write '00' and if tally could not be taken due to obstruction or inaccessibility write "99" in the column 63-64.

### DIAMETER MEASUREMENT:

Measure the diameter, over bark, at breast height ( at a point 1.37 m. above the base of the tree from the uphill side), with callipers to the nearest centimeter. ( Round off 0.5cm to the nearest even number). Take only one measurement along the diameter pointing towards the sample point.

If there is considerable abnormality at the breast height then take the measurement above or below such abnormality. In case of trees forking below B.H. measure and record diameter at 1.37 m(B.H) considering each stem as separate tree.

### " IN TREES".

Look at the B.H. point of the tree through the 'Relaskop'. If the tree is definitely bigger than the angle projected it is "IN". If the tree is smaller than the angle projected it is "OUT". If you cannot decide by observation whether the tree is bigger or smaller than the angle projected, it is " Marginal Tree".

Marginal trees should be checked by actual measurements of diameter at B.H. and the horizontal distance between the tree and the sample point. Measure the D.B.H.O.B. in cms. and multiply it by .3536 and let this value be x. Now measure the distance between the sample point and the tree and let it be y metres. The tree is "IN" if x is equal to or more than y. The tree is out if x is less than y. A table showing the D.B.H.O.B and plot radius in metre is given below:

TABLE II

SIZE OF PLOTS FOR TREES OF VARIOUS  
DIAMETERS

dbh cm	Plot radius M.	dbh cm	Plot radius M
5	1.6780	65	22.9840
10	3.5360	70	24.7520
15	5.3040	75	26.5200
20	7.0720	80	28.2080
25	8.8400	85	30.0560
30	10.6080	90	31.8240
35	12.3760	95	33.5920
40	14.1440	100	35.3600
45	15.9120	105	37.1280
50	17.6800	110	38.8960
55	19.4480	115	40.6640
60	21.2160	120	42.4320

After measuring D.B.H.O.B. read the corresponding plot radius from the table. If the distance measured from the tree to the plot centre is less or equal to the plot radius it is a "IN" tree and if the measured distance is more than the plot radius it is an "OUT" tree. Every marginal tree must be verified by actual measurement of distance and diameter.

### 3. SAMPLE TREE FORM.

This form is to be filled up for one sample point in each cluster. It will be normally the sample point 3 but when S.P. 3 is non-forested fill up sample tree form for S.P. 2. if even S.P. 2 is non-forested then fill up sample tree form for S.P.1. Remember, S.T.F. is to be filled up for only those points which have been classified as Forest under the vegetation class ( code 1) and land class code 1. For other points S.T.F. is not necessary.

Fill up columns 65 to 78 pertaining to Forest type, sample point number, cluster number, Grid zone and cluster centre Grid Reference as done in the point description form. You must have already taken the tally in this sample point for filling up the tally sheet. Take tally again standing at sample point in a sweep starting from north. All 'IN' trees of 20 cms. and above D.B.H. O.B. are your sample trees. Fix up a sample tree card on all the sample trees. Make a small blaze on the tree stem about 20 cms. below the breast height point facing the sample point and write the tree number, in serial order starting from the north, in two digits. Dead trees are not be taken as sample trees. Write the total number of sample trees in column 63-64. If there are no sample tree write '00' and if tally could not be taken due to obstruction or inaccessibility write '99' in column 63-64. Also make a record of total number of sample trees in your field note book. The data about each sample tree is to be recorded on the sample tree card ( fix to the tree ) by the crew members and when it is measured. This data would then be transferred on to the sample tree form by you after completing the P.D.F. and Tally sheet. While transferring the sample tree data you will have an opportunity to check the details filled in by the assistant crew Leader.

The instruction for filling up columnwise detail is given below, which you should read carefully and understand before filling the information.

1. Species local name or Botanical name- Write the name of the species for which you are filling up the S.T.F. write only the botanical name but if the botanical name is not known to you write the local name. However, whenever local name is written the corresponding botanical name should be found out through the local forest officer or ascertain from your officers.

2. Serial number- Write the serial number of the tree in two digits ( Col. 9-10),

3. Species code- Write the code number of the species in three digits ( Col. 11-13) for this refer to appendix IV.

4. Dominance ( Col. 14)- Classify the tree in one of the following classes and write the appropriate code number.

Code

1. Dominant
2. Dominated
3. Suppressed
4. Tree of under storey
5. Solitary
6. Abnormal and damaged tree.

DOMINANT:- Tree is defined as the tall tree whose crown reaches the general level of the upper canopy.

DOMINATED:- Tree is one which does not form the upper most canopy but the leading shoot of which is not overtopped by the neighbouring trees. Its height is about  $3/4$  of the dominant trees.

SUPPRESSED:- Tree is one which reaches only about half the height of the dominant trees and its leading shoot is definitely over topped by the neighbouring trees.

NOTE:- A stunted tree or suppressed tree standing with its leader free in a chance gap should not be classed as dominant.

TREE OF UNDER STOREY- is a tree which is part of the understorey.

SOLITARY- a tree, standing alone in a blank.

ABNORMAL AND DAMAGED TREE- it includes wolf trees, trees of abnormal form and damaged trees.

D.B.H.O.B. ( Col. 15-17 )- towards the sample point. Measure the diameter, over bark with callipers, at a point 1.37 m. from the base on the uphill side, to the nearest 0.5 m to be rounded off to the nearest even number. Measure only one diameter point towards the sample point and record the diameter in centimeters ( three digits). If the tree is forking below B.H. ( i.e. 1.37 M point ) then each stem is to be considered as a separate tree.

TOTAL HEIGHT ( Col. 18-19 )- Measure the height of the tree from the base on the uphill side of the tree to the top of the leading shoot with Blume Leiss Hypsometer to nearest meter 0.5 meter is to be rounded to the nearest even number. Write height of the tree in metres in two digits in the column headed " Total Height". Do not forget to supply correction factor while measuring tree height on slopes.

CLEAR BOLE ( Col. 20-21 )- Measure the height along the stem of the tree from the base, on the uphill side, to the beginning of the regular crown with Blume Leiss Hypsometer, to the nearest metre ( Round off 0.5 M to the nearest even number ) and record the data in two digits in the column headed " Clear Bole".

Beginning of regular crown in conifers is the point where the first complete whorl starts. For broad leaved species this point may be recognised as the place from where the 1st major branch takes off or from where the main stem forks.

DEFECT NATURAL ( Col. 22 )- Examine the stem of the tree and classify as under on the basis of the extent of " Natural Defects" and write the code in the column headed " Defect Natural".

<u>Code</u>	<u>Description.</u>
1	Complete stem length free of natural defects.
2	One third stem length with natural defects.
3	Two third stem length with natural defects.
4	Full stem length with natural defects.

NATURAL DEFECTS:- Under this category all those abnormalities are included which are very natural and normal for the tree e.g. Knots, Callus formation, Twisted or spiral grain ( of Chir ) etc.

While deciding the defects ( Natural ) and their extent, do not consider knots as defects for deodar.

DEFECT OTHERS ( Col. 23 )- Examine the stem and classify as under on the basis of the extent of defects caused by 'External Agencies' and write the code in the column headed " Defect-Others".

<u>Code</u>	<u>Description.</u>
1	Complete stem free of any defects.
2	One third of stem length with defects.
3	Two third of stem length with defects.
4	Full stem length with defects.

"EXTERNAL AGENCIES DEFECTS"- Include damage caused to the tree stem by pathological entomological, climatic or biotic factors. Damage by these agencies may result in loss of cellulose material and weakening of the strength properties of the timber. These include, borer attack, fungal attack, fire damage, hollowness and snow and wind damage etc.

CROWN WIDTH TOWARDS SAMPLE POINT ( Col. 24-25 )- Measure the crown width in a direction pointing towards the sample point in decimeter and record in three digits in these columns.

BARK THICKNESS TOWARDS S.P. ( Col. 27-28 )- Blaze the tree and remove the bark making a neat cut at the breast height point. Measure the bark thickness with a scale having millimeter marking to the nearest millimeter and write in this column in two digits.

RADIAL INCREMENT TOWARDS S.P. ( Col. 29-30, 31-32 )- Collect a core with the increment borer at breast height point. Count the number of annual rings from the periphery towards the pith with the help of magnifying glass and measure the increment in millimeter for

- the last 10 years.
- the last 20 years.

Record the increments in two digits in the appropriate columns.

NOTE:-

- (i) For counting the annual rings apply Fluoroglucose or water on the core before counting. This will make the rings look distinct.
- (ii) For species where annual rings are not distinct write '00' in the columns.
- (iii) Use a transparent scale for the measurement of increment.

Bark thickness opposite to S.P. ( Col. 33-34 )- Measure the bark thickness at breast height opposite to sample point as done above and record in the appropriate columns.

Radial Increment opposite to S.P. (Col. 35-36, 37-38)- Measure the increment in a direction opposite to S.P. in the same manner as done earlier and record the increments in the appropriate columns. Data for the next tree is to be written in the next row and so on. If due to any reason certain information is not collected write the reason for not collecting the particular information on the margin of the form. Also write the reason in detail in your field note book.

INSTRUCTIONS FOR PHOTOINTERPRETATION WORK TO BE DONE BY  
THE INVENTORY CREWS

The field crews will be provided with aerial photographs for the location of sample points. These photographs will also be used for the photo-interpretation work to be done by the crews.

Before leaving the camp, you will look into the area, to be traversed, on the map as well as on the photographs. You will carry with you the photographs of the area which fall on your way. These photographs will be studied under the lens stereoscope and the different land classes seen on the ground will be transferred on to the photograph. The following classification and symbols will be used for the purpose:-

1. Land Classes- The following land classes will be identified:-

- (a) Forest Land.
- (b) Agricultural crop land-denote by symbol
- (c) Pasture land -do-
- (d) Barren land -do-
- (e) Non-forestry plantations.
- (f) Others

0

The forest land will be further classified into following categories for identification purpose:-

Forest	-	Denoted by	F
Scrub	-	-do-	S
Tree inline	-	-do-	T
Others			R

## 2. PROCEDURE:

Observe the area which is clearly visible and identify the various land uses and its extent. Also study the same area on the aerial photographs under a pocket stereoscope. When the stereoscope vision is clear demarcate the various land classes on the photographs by comparing with the ground details observed by you. The boundary of a particular type will be marked by a continuous line with stable pencil and the land class will be denoted by the specified code.

Texture, shade, shape of the crown etc; will be taken advantage of in determining the limits of various types.

For the information and guidance of the crew leader a brief detail is given below to indicate as to how the various Forest will look like on the photographs.

"Chir, for example, will give a medium light gray shade with the crown image round but not distinct and having a light tone. Kail will give a crown image that is round, more distinct, lighter in tone than Fir, Spruce, and Deodar. At times spruce appears similar to Blue Pine except that the crown of the later is more defused and less defined. The image of blue pine and Chir pine may, however, appear similar. Oak stands give a darker tone with uniformity in light and density, individual crowns in these stands are not discernible due to closed canopy".

The details given above is only as guide line for transferring details on the photographs. However, since the photographs are of the year 1960 there may be some areas from where the forest have been cleared or where plantations have been raised. In such case the details seen on the ground will not tally with the details available on the photographs. Therefore, the crew leaders are advised to keep this in mind while fixing the limits of areas under various land classes. More importance should be given to the details seen on the ground.

5. As the photographs are of the scale of 1:65,000 and the stereoscopic study is restricted to pocket stereo study only it is not possible to go in for detailed photo-interpretation. The purpose is only to broadly recognise the areas under various land use after observing them on the ground and to delineate them on the photographs. With this study nearly 70% of the study Zone will be covered and it will be possible to separate out the Forest area and non-forest area with greater accuracy. This will also help the crew leaders to get some practice in the study of aerial photographs. On return to headquarter the crew leaders should examine the photographs under the Type-Mirror stereoscope and give finishing touches to the boundaries marked in the field.



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APPENDIX- I.

Cluster No.	Cluster Centre Grid Reference	1" / 1:50,000 Map sheet No.	Aerial photographs on which catchment is marked Specification	Strip No.	Photo No.
1	2	3	4	5	6
1.	3678 0770	53F/13	00/9/60	31	20
2.	3678 0767	53 F/13	-do-	-do-	-do-
3.	3678 0764	53F/13	-do-	-do-	-do-
4.	3678 0761	53F/14	-do-	32	13
5.	3682 0770	53F/13	-do-	31	21
6.	3682 0767	53F/13	-do-	-do-	-do-
7.	3682 0764	53F/13	-do-	-do-	-do-
8.	3682 0761	53F/14	-do-	32	14
9.	3682 0758	53F/14	-do-	-do-	-do-
10.	3682 0755	53F/14	-do-	-do-	-do-
11.	3682 0752	53F/14	-do-	33	19
12.	3682 0749	53F/14	-do-	-do-	-do-
13.	3682 0746	53F/14	-do-	-do-	-do-
14.	3686 0770	53F/13	-do-	31	22
15.	3686 0767	53F/13	-do-	-do-	-do-
16.	3686 0764	53F/14	-do-	32	15
17.	3686 0761	53F/14	-do-	-do-	-do-
18.	3686 0758	53F/14	-do-	-do-	-do-
19.	3686 0755	53F/14	-do-	-do-	-do-
20.	3686 0752	53F/14	-do-	33	20
21.	3686 0749	53F/14	-do-	-do-	-do-
22.	3686 0746	53F/14	-do-	-do-	-do-
23.	3686 0743	53F/14	-do-	36	15
24.	3686 0740	53F/14	-do-	-do-	-do-
25.	3686 0737	53F/14	-do-	-do-	-do-
26.	3690 0770	53F/13	-do-	31	23
27.	3690 0767	53F/13	00/9/60	-do-	-do-
28.	3690 0764	53F/14	-do-	32	16
29.	3690 0761	53F/14	-do-	-do-	-do-
30.	3690 0758	53F/14	-do-	-do-	-do-
31.	3690 0755	53F/14	-do-	-do-	-do-
32.	3690 0752	53F/14	-do-	-do-	-do-
33.	3690 0749	53F/14	-do-	33	21
34.	3690 0746	53F/14	-do-	-do-	-do-
35.	3690 0743	53F/14	-do-	-do-	-do-
36.	3690 0740	53F/14	-do-	36	16
37.	3690 0737	53F/14	-do-	-do-	-do-
38.	3690 0734	53F/15	-do-	-do-	-do-
39.	3694 0773	53F/13	-do-	29	28
40.	3694 0770	53F/13	-do-	31	24
41.	3694 0767	53F/13	-do-	-do-	-do-
42.	3694 0764	53F/14	-do-	32	17
43.	3694 0761	53F/14	-do-	-do-	-do-
44.	3694 0758	53F/14	-do-	-do-	-do-
45.	3694 0755	53F/14	-do-	-do-	-do-
46.	3694 0752	53F/14	-do-	33	22
47.	3694 0749	53F/14	-do-	-do-	-do-
48.	3694 0746	53F/14	-do-	-do-	-do-
49.	3694 0743	53F/14	-do-	36	17
50.	3694 0740	53F/14	-do-	-do-	-do-
51.	3694 0737	53F/15 & 53F/14	-do-	-do-	-do-
52.	3694 0734	53F/15	-do-	-do-	-do-

1	2	3	4	5	6
53.	3698 0836	53 I/3	00/9/60	16	6
54.	3698 0782	53 J/1	-do-	29	30
55.	3698 0779	53 J/1	-do-	-do-	-do-
56.	3698 0776	53 J/1	-do-	-do-	-do-
57.	3698 0773	53J/1 & 53F/13	-do-	31	26
58.	3698 0770	53 F/13 & 53J/1	-do-	31	25
59.	3698 0767	53 J/1 & 53F/13	-do-	-do-	-do-
60.	3698 0764	53F/14	-do-	32	18
61.	3698 0761	53F/14	-do-	-do-	-do-
62.	3698 0758	53F/14	-do-	-do-	-do-
63.	3698 0755	53F/14	-do-	-do-	-do-
64.	3698 0752	53F/14	-do-	33	23
65.	3698 0749	53F/14	-do-	-do-	-do-
66.	3698 0746	53F/14	-do-	-do-	-do-
67.	3698 0743	53F/14	-do-	36	18
68.	3698 0740	53F/14	-do-	-do-	-do-
69.	3698 0737	53F/15	-do-	36	18
70.	3702 0836	53I/3	-do-	16	7
71.	3702 0785	53J/1	-do-	29	32
72.	3702 0782	53J/1	-do-	-do-	-do-
73.	3702 0779	53J/1	-do-	-do-	-do-
74.	3702 0776	53J/1	-do-	-do-	-do-
75.	3702 0773	53J/1	-do-	31	27
76.	3702 0770	53J/1	-do-	-do-	-do-
77.	3702 0767	53J/1	-do-	-do-	-do-
78.	3702 0764	53J/2	-do-	32	19
79.	3702 0761	53J/2	-do-	-do-	-do-
80.	3702 0758	53 J/2	-do-	-do-	-do-
81.	3702 0755	53J/2	-do-	33	24
82.	3702 0752	53J/2	-do-	-do-	-do-
83.	3702 0749	53J/2	-do-	-do-	-do-
84.	3702 0746	53J/2	-do-	36	19
85.	3702 0743	53J/2	-do-	-do-	-do-
86.	3702 0740	53J/2	-do-	-do-	-do-
87.	3702 0737	53J/3	-do-	-do-	-do-
88.	3702 0734	53J/3	-do-	37	14
89.	3706 0833	53I/3	-do-	-do-	-do-
90.	3706 0788	53J/1	-do-	16	8
91.	3706 0785	53J/1	-do-	26	24
92.	3706 0782	53J/1	-do-	29	34
93.	3706 0779	53J/1	-do-	-do-	-do-
94.	3706 0776	53 J/1	-do-	-do-	-do-
95.	3706 0773	53J/1	-do-	-do-	-do-
96.	3706 0770	53J/1	-do-	31	28
97.	3706 0767	53J/1	-do-	-do-	-do-
98.	3706 0764	53J/2	-do-	-do-	-do-
99.	3706 0761	53J/2	-do-	32	20
100.	3706 0758	53J/2	-do-	-do-	-do-
101.	3706 0755	53J/2	-do-	32	20
102.	3706 0752	53J/2	-do-	33	24
103.	3706 0749	53J/3	-do-	-do-	-do-
104.	3706 0746	53J/2	-do-	-do-	-do-
105.	3706 0743	53J/2	-do-	36	21
106.	3706 0740	53J/2	-do-	-do-	-do-
107.	3706 0737	53J/3	-do-	-do-	-do-
108.	3706 0734	53J/3	-do-	37	15
109.	3710 0830	53I/3	-do-	-do-	-do-
110.	3710 0788	53J/1	-do-	26	25
				-do-	-do-

1	2	3	4	5	6
111.	3710 0785	53J/1	00/9/60	29	36
112.	3710 0782	53J/1	-do-	-do-	-do-
113.	3710 0779	53J/1	-do-	-do-	-do-
114.	3710 0776	53J/1	-do-	-do-	-do-
115.	3710 0773	53J/1	-do-	-do-	-do-
116.	3710 0770	53J/1	-do-	31	29
117.	3710 0767	53J/1	-do-	-do-	-do-
118.	3710 0764	53J/1	-do-	-do-	-do-
119.	3710 0761	53J/2	-do-	32	22
120.	3710 0758	53J/2	-do-	-do-	-do-
121.	3710 0755	53J/2	-do-	-do-	-do-
122.	3710 0752	53J/2	-do-	33	25
123.	3710 0749	53J/3	-do-	-do-	-do-
124.	3710 0746	53J/2	-do-	-do-	-do-
125.	3710 0743	53J/2	-do-	36	22
126.	3710 0740	53J/2	-do-	-do-	-do-
127.	3710 0737	53J/2	-do-	-do-	-do-
128.	3710 0734	53J/3	-do-	-do-	-do-
129.	3714 0830	53J/3	-do-	37	16
130.	3714 0827	53I/3	-do-	-do-	-do-
131.	3714 0791	53I/3	-do-	-do-	-do-
132.	3714 0788	53J/1	-do-	26	26
133.	3714 0785	53J/1	-do-	-do-	-do-
134.	3714 0782	53J/1	-do-	29	38
135.	3714 0779	53J/1	-do-	-do-	-do-
136.	3714 0776	53J/1	-do-	24	36
137.	3714 0773	53J/1	-do-	-do-	-do-
138.	3714 0770	53J/1	-do-	31	30
139.	3714 0767	53J/1	-do-	-do-	-do-
140.	3714 0764	53J/1 & 53J/2	-do-	-do-	-do-
141.	3714 0761	53J/2	-do-	-do-	-do-
142.	3714 0758	53J/2	-do-	32	23
143.	3714 0755	53J/2	-do-	-do-	-do-
144.	3714 0752	53J/2	-do-	32	23
145.	3714 0749	53J/2	-do-	33	26
146.	3714 0746	53J/2	-do-	-do-	-do-
147.	3714 0743	53J/2	-do-	-do-	-do-
148.	3714 0740	53J/2	-do-	36	23
149.	3714 0737	53J/2	-do-	-do-	-do-
150.	3714 0734	53J/3	-do-	-do-	-do-
151.	3718 0830	53J/3	-do-	37	17
152.	3718 0827	53I/7	-do-	-do-	-do-
153.	3718 0824	53I/7	-do-	17	39
154.	3718 0794	53I/7	-do-	-do-	-do-
155.	3718 0791	53J/1	-do-	-do-	-do-
156.	3718 0788	53J/1	-do-	26	27
157.	3718 0785	53J/1	-do-	-do-	-do-
158.	3718 0782	53J/1	-do-	-do-	-do-
159.	3718 0779	53J/1	-do-	29	40
160.	3718 0776	53J/1	-do-	-do-	-do-
161.	3718 0773	53J/1	-do-	-do-	-do-
162.	3718 0770	53J/1	-do-	-do-	-do-
163.	3718 0767	53J/1	-do-	31	31
164.	3718 0764	53J/2	-do-	-do-	-do-
165.	3718 0761	53J/2	-do-	32	24
166.	3718 0758	53J/2	-do-	-do-	-do-
167.	3718 0755	53J/2	-do-	-do-	-do-
168.	3718 0752	53J/2	-do-	33	27
169.	3718 0749	53J/2	-do-	-do-	-do-
170.	3718 0746	53J/2	-do-	-do-	-do-
			-do-	36	24

1	2	3	4	5	6
171.	3718 0743	53 J/2	00/9/60	36	24
172.	3718 0740	53J/2	-do-	-do-	-do-
173.	3718 0737	53J/3	-do-	37	18
174.	3718 0734	53J/3	-do-	-do-	-do-
175.	3722 0827	53I/7	-do-	17	41
176.	3722 0824	53I/7	-do-	-do-	-do-
177.	3722 0797	53I/8	-do-	25	08
178.	3722 0794	53J/5	-do-	26	29
179.	3722 0791	53J/5	-do-	-do-	-do-
180.	3722 0788	53J/5	-do-	29	42
181.	3722 0785	53J/5	-do-	-do-	-do-
182.	3722 0782	53J/5	-do-	30	03
183.	3722 0779	53J/5	-do-	-do-	-do-
184.	3722 0776	53J/5	-do-	-do-	-do-
185.	3722 0773	53J/5&53J/1	-do-	-do-	-do-
186.	3722 0770	53J/1 & 53J/5	-do-	31	33
187.	3722 0767	53J/2	-do-	31	32
188.	3722 0764	53J/2	-do-	32	25
189.	3722 0761	53J/2	-do-	-do-	-do-
190.	3722 0758	53J/2	-do-	-do-	-do-
191.	3722 0755	53J/2	-do-	33	28
192.	3722 0752	53J/2	-do-	-do-	-do-
193.	3722 0749	53J/2	-do-	-do-	-do-
194.	3722 0746	53J/2	-do-	-do-	-do-
195.	3722 0743	53J/2	-do-	36	25
196.	3722 0740	53J/2&53J/3	-do-	-do-	-do-
197.	3722 0737	53J/3	-do-	-do-	-do-
198.	3722 0734	53J/3	-do-	37	19
199.	3726 0827	53I/7	-do-	-do-	-do-
200.	3726 0824	53I/7	-do-	17	41
201.	3726 0821	53I/8	-do-	-do-	-do-
202.	3726 0800	53I/8	-do-	18	08
203.	3726 0797	53I/8	-do-	25	03
204.	3726 0794	53J/5	-do-	-do-	-do-
205.	3726 0791	53J/5	-do-	26	30
206.	3726 0788	53J/5	-do-	-do-	-do-
207.	3726 0785	53J/5	-do-	29	45
208.	3726 0782	53J/5	-do-	-do-	-do-
209.	3726 0779	53J/5	-do-	30	04
210.	3726 0776	53J/5	-do-	-do-	-do-
211.	3726 0773	53J/5	-do-	-do-	-do-
212.	3726 0770	53J/5	-do-	31	33
213.	3726 0767	53J/6	-do-	-do-	-do-
214.	3726 0764	53J/6	-do-	32	26
215.	3726 0761	53J/6	-do-	-do-	-do-
216.	3726 0758	53J/6	-do-	-do-	-do-
217.	3726 0755	53J/6	-do-	33	30
218.	3726 0752	53J/6	-do-	-do-	-do-

1	2	3	4	5	6
219.	3726 0749	53J/6	CC /a /60	33	30
220.	3726 0746	53J/6	-do-	36	28
221.	3726 0743	53J/6	-do-	-do-	-do-
222.	3726 0740	53J/7 & 53J/6	-do-	37	20
223.	3726 0737	53J/7	-do-	-do-	-do-
224.	3726 0734	53J/7	-do-	-do-	-do-
225.	3730 0827	53I/7	-do-	17	43
226.	3730 0824	53I/7& 53I/8	-do-	18	07
227.	3730 0821	53I/8	-do-	-do-	-do-
228.	3730 0818	53I/8	-do-	23	17
229.	3730 0800	53I/8	-do-	25	03
230.	3730 0797	53I/8 & 53J/5	-do-	-do-	-do-
231.	3730 0794	53J/5	-do-	26	31
232.	3730 0791	53J/5	-do-	-do-	-do-
233.	3730 0788	53J/5	-do-	29	47
234.	3730 0785	53J/5	-do-	-do-	-do-
235.	3730 0782	53J/5	-do-	30	05
236.	3730 0779	53J/5	-do-	-do-	-do-
237.	3730 0776	53J/5	-do-	-do-	-do-
238.	3730 0773	53J/5	-do-	31	35
239.	3730 0770	53J/5	-do-	-do-	-do-
240.	3730 0767	53J/6	-do-	32	28
241.	3730 0764	53J/6	-do-	-do-	-do-
242.	3730 0761	53J/6	-do-	-do-	-do-
243.	3730 0758	53J/6	-do-	33	30
244.	3730 0755	53J/6	-do-	-do-	-do-
245.	3730 0752	53J/6	-do-	-do-	-do-
246.	3730 0749	53J/6	-do-	-do-	-do-
247.	3730 0746	53J/6	-do-	-do-	-do-
248.	3730 0743	53J/6	-do-	36	28
249.	3730 0740	53J/7	-do-	-do-	-do-
250.	3730 0737	53J/7	-do-	37	21
251.	3730 0734	53J/7	-do-	-do-	-do-
252.	3730 0731	53J/7	-do-	-do-	-do-
253.	3734 0824	53I/8&53I/7	-do-	38	15
254.	3734 0821	53I/8	-do-	18	08
255.	3734 0818	53I/8	-do-	-do-	-do-
256.	3734 0815	53I/8	-do-	23	17
257.	3734 0803	53I/8	-do-	-do-	-do-
258.	3734 0800	53I/8	-do-	25	05
259.	3734 0797	53I/8 & 53J/5	-do-	-do-	-do-
260.	3734 0794	53J/5	-do-	-do-	-do-
261.	3734 0791	53J/5	-do-	26	32
262.	3734 0788	53J/5	-do-	-do-	-do-
263.	3734 0785	53J/5	-do-	29	49
264.	3734 0782	53J/5	-do-	-do-	-do-
265.	3734 0779	53J/5	-do-	30	07
266.	3734 0776	53J/5	-do-	-do-	-do-
267.	3734 0773	53J/5	-do-	-do-	-do-
268.	3734 0770	53J/5	-do-	31	36
269.	3734 0767	53J/6	-do-	-do-	-do-
270.	3734 0764	53J/6	-do-	32	28
271.	3734 0761	53J/6	-do-	-do-	-do-
272.	3734 0758	53J/6	-do-	-do-	-do-
273.	3734 0755	53J/6	-do-	33	32
			-do-	-do-	-do-

1	2	3	4	5	6
274.	3734 0752	53J/6	00/a/60	33	32
275.	3734 0749	53J/6	-do-	36	30
276.	3734 0746	53J/6	-do-	-do-	-do-
277.	3734 0743	53J/6	-do-	-do-	-do-
278.	3734 0740	53J/7	-do-	37	22
279.	3734 0737	53J/7	-do-	-do-	-do-
280.	3734 0734	53J/7	-do-	-do-	-do-
281.	3738 0821	53I/8	-do-	18	08
282.	3738 0818	53I/8	-do-	23	18
283.	3738 0815	53I/8	-do-	-do-	-do-
284.	3738 0812	53I/8	-do-	24	24
285.	3738 0806	53I/8	-do-	-do-	-do-
286.	3738 0803	53I/8	-do-	25	06
287.	3738 0800	53I/8	-do-	-do-	-do-
288.	3738 0797	53I/6&53J/5	-do-	26	33
289.	3738 0794	53J/5	-do-	-do-	-do-
290.	3738 0791	53J/5	-do-	-do-	-do-
291.	3738 0788	53J/5	-do-	29	52
292.	3738 0785	53J/5	-do-	30	08
293.	3738 0782	53J/5	-do-	-do-	-do-
294.	3738 0779	53J/5	-do-	-do-	-do-
295.	3738 0776	53J/5	-do-	-do-	-do-
296.	3738 0773	53J/5	-do-	31	37
297.	3738 0770	53J/5	-do-	-do-	-do-
298.	3738 0767	53J/6	-do-	32	30
299.	3738 0764	53J/6	-do-	-do-	-do-
300.	3738 0761	53J/6	-do-	-do-	-do-
301.	3738 0758	53J/6	-do-	33	32
302.	3738 0755	53J/6	-do-	-do-	-do-
303.	3738 0752	53J/6	-do-	-do-	-do-
304.	3738 0749	53J/6	-do-	36	32
305.	3738 0746	53J/6	-do-	-do-	-do-
306.	3738 0743	53J/6	-do-	-do-	-do-
307.	3738 0740	53J/7	-do-	37	23
308.	3738 0737	53J/7	-do-	-do-	-do-
309.	3738 0734	53J/7	-do-	-do-	-do-
310.	3738 0731	53J/7	-do-	38	16
311.	3742 0818	53I/12	-do-	19	11
312.	3742 0815	53I/12	304-A	14	11
313.	3742 0812	53I/8 & 53I/12	-do-	-do-	-do-
314.	3742 0809	53I/8 & 53I/12	-do-	24	25
315.	3742 0806	53I/8	-do-	-do-	-do-
316.	3742 0803	53I/8	-do-	25	07
317.	3742 0800	53I/8	-do-	-do-	-do-
318.	3742 0797	53J/5	00/a/60	26	34
319.	3742 0794	53J/5	-do-	-do-	-do-
320.	3742 0791	53J/5	-do-	-do-	-do-
321.	3742 0788	53J/5	-do-	29	52
322.	3742 0785	53J/5	-do-	30	09
323.	3742 0782	53J/5	-do-	-do-	-do-
324.	3742 0779	53J/5	-do-	-do-	-do-
325.	3742 0776	53J/5	-do-	-do-	-do-
326.	3742 0773	53J/5	-do-	31	38
327.	3742 0770	53J/5	-do-	-do-	-do-

1	2	3	4	5	6
328.	3742.0767	53J/6	00/9/60	32	31.
329.	3742 0764	53J/6	-do-	-do-	-do-
330.	3742 0761	53J/6	-do-	-do-	-do-
331.	3742 0758	53J/6	-do-	33	34
332.	3742 0755	53J/6	-do-	-do-	-do-
333.	3742 0752	53J/6	-do-	-do-	-do-
334.	3742 0749	53J/6	-do-	36	32
335.	3742 0746	53J/6	-do-	-do-	-do-
336.	3742 0743	53J/6	-do-	-do-	-do-
337.	3742 0740	53J/7	-do-	37	24
338.	3742 0737	53J/7	-do-	-do-	-do-
339.	3742 0733	53J/7	-do-	-do-	-do-
340.	3742 0731	53J/7	-do-	38	17
341.	3742 0728	53J/7	-do-	-do-	-do-
342.	3742 0725	53J/7	-do-	-do-	-do-
343.	3742 0722	53J/7	-do-	39	18
344.	3742 0719	53J/7	-do-	-do-	-do-
345.	3746 0818	53I/12	-do-	19	12
346.	3746 0815	53I/12	394-A	14	11
347.	3746 0812	53I/12	-do-	-do-	-do-
348.	3746 0809	53I/12	-do-	-do-	-do-
349.	3746 0806	53I/12	-do-	15	12
350.	3746 0803	53I/12	-do-	-do-	-do-
351.	3746 0800	53I/12	-do-	-do-	-do-
352.	3746 0797	53J/9	00/9/60	26	35
353.	3746 0794	53J/9	-do-	-do-	-do-
354.	3746 0791	53J/9	-do-	-do-	-do-
355.	3746 0788	53J/9	-do-	29	55
356.	3746 0785	53J/9	-do-	-do-	-do-
357.	3746 0782	53J/9	-do-	29	55
358.	3746 0779	53J/9	-do-	-do-	-do-
359.	3746 0776	53J/9	-do-	31	39
360.	3746 0773	53J/9	-do-	-do-	-do-
361.	3746 0770	53J/10			
362.	3746 0767	J/5, J/6 & J/9	-do-	32	32
363.	3746 0764	53J/6	-do-	-do-	-do-
364.	3746 0761	53J/6	-do-	-do-	-do-
365.	3746 0758	53J/6	-do-	33	34
366.	3746 0755	53J/6	-do-	-do-	-do-
367.	3746 0752	53J/6	-do-	-do-	-do-
368.	3746 0749	53J/6	-do-	-do-	-do-
369.	3746 0746	53J/6	-do-	36	34
370.	3746 0743	53J/6	-do-	-do-	-do-
371.	3746 0740	53J/7	-do-	-do-	-do-
372.	3746 0737	53J/7	-do-	37	25
373.	3746 0734	53J/7	-do-	-do-	-do-
374.	3746 0731	53J/7	-do-	-do-	-do-
375.	3746 0728	53J/7	-do-	38	18
376.	3746 0725	53J/7	-do-	-do-	-do-
377.	3746 0722	53J/7	-do-	39	18
378.	3746 0719	53J/7	-do-	-do-	-do-
379.	3746 0716	53J/7	-do-	-do-	-do-
380.	3746 0713	53J/8	-do-	-do-	-do-

1	2	3	4	5	6
381.	3750 0821	53I/12	0C/a/60	10	13
382.	3750 0818	52I/12	-do-	-do-	-do-
383.	3750 0815	53I/12	394-A	14	12
384.	3750 0812	53I/12	-do-	-do-	-do-
385.	3750 0809	53I/12	-do-	-do-	-do-
386.	3750 0806	53I/12	-do-	15	12
387.	3750 0803	53I/12	-do-	-do-	-do-
388.	3750 0800	53I/12	-do-	-do-	-do-
389.	3750 0797	53J/9	0/a/60	26	37
390.	3750 0794	53J/9	-do-	-do-	-do-
391.	3750 0791	53J/9	-do-	-do-	-do-
392.	3750 0788	53J/9	-do-	30	11
393.	3750 0785	53J/9	-do-	-do-	-do-
394.	3750 0782	53J/9	-do-	-do-	-do-
395.	3750 0779	53J/9	-do-	-do-	-do-
396.	3750 0776	53J/9	-do-	31	41
397.	3750 0773	53J/9	-do-	31	41
398.	3750 0770	53J/10	-do-	32	33
399.	3750 0767	53J/10	-do-	-do-	-do-
400.	3750 0764	53J/10	-do-	-do-	-do-
401.	3750 0761	53J/10	-do-	-do-	-do-
402.	3750 0758	53J/10	-do-	33	35
403.	3750 0755	53J/10	-do-	-do-	-do-
404.	3750 0752	53J/10	-do-	-do-	-do-
405.	3750 0749	53J/10	-do-	36	35
406.	3750 0746	53J/10	-do-	-do-	-do-
407.	3750 0743	53J/10	-do-	-do-	-do-
408.	3750 0740	53J/11	-do-	37	27
409.	3750 0737	53J/11	-do-	-do-	-do-
410.	3750 0734	53J/11	-do-	-do-	-do-
411.	3750 0731	53J/11 & 53J/7	-do-	-do-	-do-
412.	3750 0728	53J/7 & 53J/11	-do-	38	19
413.	3750 0725	53J/7 & 53J/11	-do-	39	19
414.	3750 0722	53J/7	-do-	-do-	-do-
415.	3750 0719	53J/7	-do-	-do-	-do-
416.	3750 0716	53J/7	-do-	-do-	-do-
417.	3750 0713	53J/8	-do-	39	18
418.	3750 0710	53J/8	-do-	-do-	-do-
419.	3754 0821	53I/12	-do-	19	13
420.	3754 0818	53I/12	394-A	14	13
421.	3754 0815	53I/12	-do-	-do-	-do-
422.	3754 0812	53I/12	-do-	-do-	-do-
423.	3754 0809	53I/12	-do-	-do-	-do-
424.	3754 0806	53I/12	-do-	15	13
425.	3754 0803	53I/12	-do-	-do-	-do-
426.	3754 0800	53I/12	-do-	-do-	-do-
427.	3754 0797	53J/9	0C/a/60	26	37
428.	3754 0794	53J/9	-do-	-do-	-do-
429.	3754 0791	53J/9	-do-	-do-	-do-
430.	3754 0788	53J/9	-do-	30	12
431.	3754 0785	53J/9	-do-	-do-	-do-
432.	3754 0782	53J/9	-do-	-do-	-do-
433.	3754 0779	53J/9	-do-	-do-	-do-
434.	3754 0776	53J/9	-do-	31	42



1	2	3	4	5	6
435.	3754 0773	53J/9	00/9/60	31	42
436.	3754 0770	53J/10	-do-	32	34
437.	3754 0767	53J/10	-do-	-do-	-do-
438.	3754 0764	53J/10	-do-	-do-	-do-
439.	3754 0761	53J/10	-do-	33	36
440.	3754 0758	53J/10	-do-	-do-	-do-
441.	3754 0755	53J/10	-do-	-do-	-do-
442.	3754 0752	53J/10	-do-	-do-	-do-
443.	3754 0749	53J/10	-do-	36	36
444.	3754 0746	53J/10	-do-	-do-	-do-
445.	3754 0743	53J/11 & 53J/10	-do-	37	27
446.	3754 0740	53J/11	-do-	-do-	-do-
447.	3754 0737	53J/11	-do-	-do-	-do-
448.	3754 0734	53J/11	-do-	38	20
449.	3754 0731	53J/11 & 53J/10	-do-	-do-	-do-
450.	3754 0728	53J/11	-do-	-do-	-do-
451.	3754 0725	53J/11	-do-	-do-	-do-
452.	3754 0722	53J/11	-do-	39	20
453.	3754 0719	53J/11	-do-	-do-	-do-
454.	3754 0716	53J/11	-do-	-do-	-do-
455.	3754 0713	53J/12	-do-	39	19
456.	3754 0710	53J/12	-		
457.	3754 0707	53J/12			
458.	3758 0821	53I/12	394-A	13	13
459.	3758 0818	53I/12	-do-	-do-	-do-
460.	3758 0815	53I/12	-do-	-do-	-do-
461.	3758 0812	53I/12	-do-	14	14
462.	3758 0809	53I/12	-do-	-do-	-do-
463.	3758 0806	53I/12	-do-	15	14
464.	3758 0803	53I/12	-do-	-do-	-do-
465.	3758 0800	53I/12	-do-	-do-	-do-
466.	3758 0797	53J/9	-do-	26	39
467.	3758 0794	53J/9	-do-	-do-	-do-
468.	3758 0791	53J/9	-do-	-do-	-do-
469.	3758 0788	53J/9	-do-	30	14
470.	3758 0785	53J/9	-do-	-do-	-do-
471.	3758 0782	53J/9	-do-	-do-	-do-
472.	3758 0779	53J/9	-do-	-do-	-do-
473.	3758 0776	53J/9	-do-	31	43
474.	3758 0773	53J/9	-do-	-do-	-do-
475.	3758 0770	53J/10	-do-	32	35
476.	3758 0767	53J/10	-do-	-do-	-do-
477.	3758 0764	53J/10	-do-	-do-	-do-
478.	3758 0761	53J/10	-do-	33	37
479.	3758 0758	53J/10	-do-	-do-	-do-
480.	3758 0755	53J/10	-do-	-do-	-do-
481.	3758 0752	53J/10	-do-	33	37
482.	3758 0749	53J/10	-do-	36	37

1	2	3	4	5	6
381	3758 0746	53J/10	384-A	384-A	384
382	3758 0743	53J/11	384-A	384-A	384
383	3758 0740	53J/11	384-A	384-A	384
384	3758 0737	53J/11	384-A	384-A	384
385	3758 0734	53J/11	384-A	384-A	384
386	3758 0731	53J/11	384-A	384-A	384
387	3758 0728	53J/11	384-A	384-A	384
388	3758 0725	53J/11	384-A	384-A	384
389	3758 0722	53J/11	384-A	384-A	384
390	3758 0719	53J/11	384-A	384-A	384
391	3758 0716	53J/11	384-A	384-A	384
392	3758 0713	53J/12	384-A	384-A	384
393	3758 0710	53J/12	384-A	384-A	384
394	3758 0707	53J/12	384-A	384-A	384
395	3758 0704	53J/12	384-A	384-A	384
396	3762 0818	53I/12	384-A	384-A	384
397	3762 0815	53I/12	384-A	384-A	384
398	3762 0812	53I/12	384-A	384-A	384
399	3762 0809	53I/12	384-A	384-A	384
400	3762 0806	53I/12	384-A	384-A	384
401	3762 0803	53I/12	384-A	384-A	384
402	3762 0800	53I/12	384-A	384-A	384
403	3762 0797	53J/9	384-A	384-A	384
404	3762 0794	53J/9	384-A	384-A	384
405	3762 0791	53J/9	384-A	384-A	384
406	3762 0788	53J/9	384-A	384-A	384
407	3762 0785	53J/9	384-A	384-A	384
408	3762 0782	53J/9	384-A	384-A	384
409	3762 0779	53J/9	384-A	384-A	384
410	3762 0776	53J/9	384-A	384-A	384
411	3762 0773	53J/9	384-A	384-A	384
412	3762 0770	53J/10	384-A	384-A	384
413	3762 0767	53J/10	384-A	384-A	384
414	3762 0764	53J/10	384-A	384-A	384
415	3762 0761	53J/10	384-A	384-A	384
416	3762 0758	53J/10	384-A	384-A	384
417	3762 0755	53J/10	384-A	384-A	384
418	3762 0752	53J/10	384-A	384-A	384
419	3762 0749	53J/10	384-A	384-A	384
420	3762 0746	53J/10	384-A	384-A	384
421	3762 0743	53J/11	384-A	384-A	384
422	3762 0740	53J/11	384-A	384-A	384
423	3762 0737	53J/11	384-A	384-A	384
424	3762 0734	53J/11	384-A	384-A	384
425	3762 0731	53J/11	384-A	384-A	384
426	3762 0728	53J/11	384-A	384-A	384
427	3762 0725	53J/11	384-A	384-A	384
428	3762 0722	53J/11	384-A	384-A	384

1	2	3	4	5	6
531.	3762 0719	53J/11	00/9/60	30	22
532.	3762 0716	53J/11 & 53J/12	-do-	-do-	-do-
533.	3762 0713				
534.	3762 0710	53J/12			
535.	3762 0707	53J/12			
536.	3762 0704	53J/12			
537.	3766 0821	53I/16			
538.	3766 0818	53I/16			
539.	3766 0815	53I/16			
540.	3766 0812	53I/12 & 53I/16			
541.	3766 0809	53I/12	394-A	14	16
542.	3766 0806	53I/12	-do-	15	16
543.	3766 0803	53I/12	-do-	-do-	-do-
544.	3766 0800	53I/12	-do-	-do-	-do-
545.	3766 0797	53J/9	00/9/60	26	41
546.	3766 0794	53J/9	-do-	-do-	-do-
547.	3766 0791	53J/9	-do-	-do-	-do-
548.	3766 0788	53J/9	-do-	30	16
549.	3766 0785	53J/9	-do-	-do-	-do-
550.	3766 0782	53J/9	-do-	-do-	-do-
551.	3766 0779	53J/9	-do-	-do-	-do-
552.	3766 0776	53J/9	-do-	31	45
553.	3766 0773	53J/9	-do-	-do-	-do-
554.	3766 0770	53J/10	-do-	32	37
555.	3766 0767	53J/10	-do-	-do-	-do-
556.	3766 0764	53J/10	-do-	-do-	-do-
557.	3766 0761	53J/10	-do-	-do-	-do-
558.	3766 0758	53J/10	-do-	33	39
559.	3766 0755	53J/10	-do-	-do-	-do-
560.	3766 0752	53J/10	-do-	-do-	-do-
561.	3766 0749	53J/10	-do-	36	40
562.	3766 0746	53J/10	-do-	-do-	-do-
563.	3766 0743	53J/11	-do-	-do-	-do-
564.	3766 0740	53J/11	-do-	36	39
565.	3766 0737	53J/11	-do-	-do-	-do-
566.	3766 0734	53J/11	-do-	38	23
567.	3766 0731	53J/11	-do-	-do-	-do-
568.	3766 0728	53J/11	-do-	-do-	-do-
569.	3770 0821	53I/16	-do-	-do-	-do-
570.	3770 0818	53I/16	-do-	-do-	-do-
571.	3770 0815	53I/16	-do-	-do-	-do-
572.	3770 0812	53I/16	-do-	-do-	-do-
573.	3770 0809	53I/16	-do-	-do-	-do-
574.	3770 0806	53I/16	-do-	-do-	-do-
575.	3770 0803	53I/16	-do-	-do-	-do-
576.	3770 0800	53I/16 & 53J/13	394-A	15	17
577.	3770 0797	53J/13	00/9/60	26	42
578.	3770 0794	53J/13	-do-	-do-	-do-
579.	3770 0791	53J/13	-do-	-do-	-do-
580.	3770 0788	53J/13	-do-	50	17

1	2	3	4	5	6
581.	3770 0785	53J/13	00/9/60	30	17
582.	3770 0782	53J/13	-do-	-do-	-do-
583.	3770 0779	53J/13	-do-	31	46
584.	3770 0776	53J/13	-do-	-do-	-do-
585.	3770 0773	53J/13	-do-	-do-	-do-
586.	3770 0770	53J/10	-do-	32	38
587.	3770 0767	53J/10	-do-	-do-	-do-
588.	3770 0764	53J/10	-do-	-do-	-do-
589.	3770 0761	53J/10	-do-	33	40
590.	3770 0758	53J/10	-do-	-do-	-do-
591.	3770 0755	53J/10	-do-	33	40
592.	3770 0752	53J/10	-do-	36	41
593.	3770 0749	53J/10	-do-	-do-	-do-
594.	3770 0746	53J/10	-do-	-do-	-do-
595.	3770 0743	53J/11	-do-	-do-	-do-
596.	3770 0740	53J/11	-do-	-do-	-do-
597.	3770 0737	53J/11	-do-	38	24
598.	3770 0734	53J/11	-do-	-do-	-do-
599.	3770 0731	53J/11	-do-	-do-	-do-
600.	3774 0815	53I/16		-do-	-do-
601.	3774 0812	53I/16			
602.	3774 0809	53I/16			
603.	3774 0806	53I/16			
604.	3774 0803	53I/16			
605.	3774 0800	53J/13	394-A	15	18
606.	3774 0797	53J/13	-do-	-do-	-do-
607.	3774 0794	53J/13	00/9/60	29	72
608.	3774 0791	53J/13	-do-	-do-	-do-
609.	3774 0788	53J/13	-do-	-do-	-do-
610.	3774 0785	53J/13	-do-	-do-	-do-
611.	3774 0782	53J/13	-do-	30	18
612.	3774 0779	53J/13	-do-	-do-	-do-
613.	3774 0776	53J/13	-do-	31	47
614.	3774 0773	53J/13	-do-	-do-	-do-
615.	3774 0770	53J/14	-do-	-do-	-do-
616.	3774 0767	53J/14	-do-	32	40
617.	3774 0764	53J/14	-do-	-do-	-do-
618.	3774 0761	53J/14	-do-	33	41
619.	3774 0758	53J/14	-do-	-do-	-do-
620.	3774 0755	53J/14	-do-	-do-	-do-
621.	3774 0752	53J/14	-do-	35	06
622.	3774 0749	53J/14	-do-	36	42
623.	3774 0746	53J/14	-do-	-do-	-do-
624.	3774 0743	53J/15	-do-	37	32
625.	3774 0740	53J/15	-do-	-do-	-do-
626.	3774 0737	53J/15	-do-	38	25
627.	3774 0734	53J/15	-do-	-do-	-do-
628.	3774 0731	53J/15	-do-	38	24
629.	3778 0812	53I/16			
630.	3778 0809	53I/16			

1	2	3	4	5	6
631.	3778 0806	53I/16.			
632.	3778 0803	53I/16			
633.	3778 0800	53J/13	394-A	15	19
634.	3778 0797	53J/13	-do-	-do-	-do-
635.	3778 0794	53J/13	CC /a/60	29	73
636.	3778 0791	53J/13	-do-	-do-	-do-
637.	3778 0788	53J/13	-do-	30	19
638.	3778 0785	53J/13	-do-	-do-	-do-
639.	3778 0782	53J/13	-do-	-do-	-do-
640.	3778 0779	53J/13	-do-	31	49
641.	3778 0776	53J/13	-do-	-do-	-do-
642.	3778 0773	53J/14	-do-	32	41
643.	3778 0770	53J/14	-do-	-do-	-do-
644.	3778 0767	53J/14	-do-	-do-	-do-
645.	3778 0764	53J/14	-do-	33	42
646.	3778 0761	53J/14	-do-	-do-	-do-
647.	3778 0758	53J/14	-do-	-do-	-do-
648.	3778 0755	53J/14	-do-	-do-	-do-
649.	3778 0752	53J/14	-do-	35	07
650.	3778 0749	53J/14	-do-	36	43
651.	3778 0746	53J/14	-do-	-do-	-do-
652.	3778 0743	53J/15	-do-	37	33
653.	3778 0740	53J/15	-do-	-do-	-do-
654.	3778 0737	53J/15	-do-	38	26
655.	3778 0734	53J/15	-do-	-do-	-do-
656.	3778 0731	53J/15	-do-	-do-	-do-
657.	3782 0838	53I/15			
658.	3782 0838	53I/15			
659.	3782 0830	53I/15			
660.	3782 0812	53I/16			
661.	3782 0809	53I/16			
662.	3782 0806	53I/16			
663.	3782 0803	53I/16			
664.	3782 0800	53J/13	394-A	15	20
665.	3782 0797	53J/13	-do-	-do-	-do-
666.	3782 0794	53J/13	CC /a/60	29	75
667.	3782 0791	53J/13	-do-	-do-	-do-
668.	3782 0788	53J/13	-do-	30	20
669.	3782 0785	53J/13	-do-	-do-	-do-
670.	3782 0782	53J/13	-do-	-do-	-do-
671.	3782 0779	53J/13	-do-	31	50
672.	3782 0776	53J/13	-do-	-do-	-do-
673.	3782 0773	53J/14	-do-	32	42
674.	3782 0770	53J/14	-do-	-do-	-do-
675.	3782 0767	53J/14	-do-	-do-	-do-
676.	3782 0764	53J/14	-do-	33	42
677.	3782 0761	53J/14	-do-	-do-	-do-
678.	3782 0758	53J/14	-do-	-do-	-do-

1	2	3	4	5	6
679.	3782 0755	53J/14	CC /a/60	33	42
680.	3782 0752	53J/14	-do-	35	08
681.	3782 0749	53J/14	-do-	36	44
682.	3782 0746	53J/14	-do-	-do-	-do-
683.	3782 0737	53J/15	-do-	38	27
684.	3786 0839	53I/15			
685.	3786 0836	53I/15			
686.	3786 0833	53I/15			
687.	3786 0830	53I/15			
688.	3786 0827	53I/16			
689.	3786 0812	53I/16			
690.	3786 0809	53I/16			
691.	3786 0806	53I/16			
692.	3786 0803	53I/16			
693.	3786 0800	53J/13	394-A	15	21
694.	3786 0797	53J/13	-do-	-do-	20
695.	3786 0794	53J/13	CC /a/60	29	78
696.	3786 0791	53J/13	-do-	-do-	-do-
697.	3786 0788	53J/13	-do-	30	21
698.	3786 0785	53J/13	-do-	-do-	-do-
699.	3786 0782	53J/13	-do-	-do-	-do-
700.	3786 0779	53J/13	-do-	31	51
701.	3786 0776	53J/13	-do-	-do-	-do-
702.	3786 0773	53J/14	-do-	32	43
703.	3786 0770	53J/14	-do-	-do-	-do-
704.	3786 0767	53J/14	-do-	-do-	-do-
705.	3786 0764	53J/14	-do-	33	42
706.	3786 0761	53J/14	-do-	-do-	-do-
707.	3790 0848	53M/3			
708.	3790 0845	53M/3			
709.	3790 0842	53M/3			
710.	3790 0839	53M/3			
711.	3790 0836	53M/3	-do-	12	29
712.	3790 0833	53M/3	-do-	-do-	-do-
713.	3790 0830	53M/3,4	-do-	-do-	-do-
714.	3790 0827	53M/4	-do-	13	22
715.	3790 0824	53M/4	-do-	-do-	-do-
716.	3790 0821	53M/4	-do-	-do-	-do-
717.	3790 0818	53M/4	-do-	14	22
718.	3790 0812	53I/16	-do-	-do-	-do-
719.	3790 0809	53I/16			
720.	3790 0806	53I/16			
721.	3790 0803	53I/16			
722.	3790 0800	53J/13	394-A	15	22
723.	3790 0797	53J/13	CC /a/60	29	78
724.	3790 0794	53J/13	-do-	-do-	-do-
725.	3790 0791	53J/13	-do-	-do-	-do-
726.	3790 0788	53J/13	-do-	30	22
727.	3790 0885	53J/13	-do-	-do-	-do-
728.	3790 0782	53J/13	-do-	31	53

1	2	3	4	5	6
29.	3790 0779	53J/13	00/9/60	31	53
30.	3790 0776	53J/13	-do-	-do-	-do-
31.	3790 0773	53J/14	-do-	32	44
32.	3794 0851	53M/3			
33.	3794 0848	53M/3			
34.	3794 0845	53M/3			
35.	3794 0842	53M/3			
36.	3794 0839	53M/3			
37.	3794 0836	53M/3	-do-	12	30
38.	3794 0833	53M/3	-do-	-do-	-do-
39.	3794 0830	53M/4	-do-	-do-	-do-
40.	3794 0827	53M/4	-do-	13	23
41.	3794 0824	53M/4	-do-	-do-	-do-
42.	3794 0821	53M/4	-do-	-do-	-do-
43.	3794 0818	53M/4	-do-	14	23
44.	3794 0815	53M/4	-do-	-do-	-do-
45.	3794 0812	53M/4	-do-	-do-	-do-
46.	3794 0809	53M/4	-do-	15	23
47.	3794 0806	53M/4	-do-	-do-	-do-
48.	3794 0803	53M/4	-do-	-do-	-do-
49.	3794 0800	53N/1	394-A	15	23
50.	3794 0797	53N/1	00/9/60	29	82
51.	3794 0794	53N/1	-do-	-do-	-do-
52.	3794 0791	53N/1	-do-	-do-	-do-
53.	3794 0788	53N/1	-do-	30	24
54.	3794 0785	53N/1	-do-	-do-	-do-
55.	3794 0782	53N/1	-do-	31	55
56.	3794 0779	53N/1	-do-	-do-	-do-
57.	3794 0776	53N/1	-do-	-do-	-do-
58.	3798 0851	53M/3			
59.	3798 0848	53M/3			
60.	3798 0845	53M/3			
61.	3798 0842	53M/3			
62.	3798 0839	53M/3			
63.	3798 0836	53M/3	-do-	12	31
64.	3798 0833	53M/3	-do-	-do-	-do-
65.	3798 0830	53M/4			
66.	3798 0827	53M/4	-do-	13	24
67.	3798 0824	53M/4	-do-	-do-	-do-
68.	3798 0821	53M/4	-do-	-do-	-do-
69.	3798 0818	53M/4	-do-	-do-	-do-
70.	3798 0815	53M/4	-do-	14	24
71.	3798 0812	53M/4	-do-	-do-	-do-
72.	3798 0809	53M/4	-do-	-do-	-do-
73.	3798 0806	53M/4	-do-	15	24
74.	3798 0803	53M/4 + 53N/1	394-A	-do-	-do-
75.	3798 0800	53M/4	-do-	15	24
76.	3798 0797	53N/1	00/9/60	-do-	-do-
77.	3798 0794	53N/1	-do-	29	84
778.	3798 0791	53N/1	-do-	-do-	-do-
779.	3798 0788	53N/1	-do-	-do-	-do-
780.	3798 0785	53N/1	-do-	30	24
			-do-	-do-	-do-

1	2	3	4	5	6
781.	3798 0782	53N/1	00/9/60	31	56
782.	3802 0845	53M/3			
783.	3802 0843	53M/3			
784.	3802 0839	53M/3			
785.	3802 0836	53M/3	-do-	12	31
786.	3802 0833	53M/3	-do-	-do-	-do-
787.	3802 0830	53M/4	-do-	-do-	-do-
788.	3802 0827	53M/4	-do-	13	26
789.	3802 0824	53M/4	-do-	-do-	-do-
790.	3802 0821	53M/4	-do-	-do-	-do-
791.	3802 0818	53M/4	-do-	14	25
792.	3802 0815	53M/4	-do-	-do-	-do-
793.	3802 0812	53M/4	-do-	-do-	-do-
794.	3802 0809	53M/4	-do-	15	25
795.	3802 0806	53M/4	-do-	-do-	-do-
796.	3802 0803	53N/1	394-A	-do-	-do-
797.	3802 0800	53N/1	-do-	-do-	-do-
798.	3802 0797	53N/1	00/9/60	29	86
799.	3802 0794	53N/1	-do-	-do-	-do-
800.	3802 0791	53N/1	-do-	-do-	-do-
801.	3802 0788	53N/1	-do-	30	26
802.	3802 0785	53N/1	-do-	-do-	-do-
803.	3802 0782	53N/1	-do-	31	57
804.	3802 0779	53N/1	-do-	-do-	-do-
805.	3806 0842	53M/3			
806.	3806 0839	53M/3			
807.	3806 0836	53M/3	-do-	12	31
808.	3806 0833	53M/3	-do-	-do-	-do-
809.	3806 0830	53M/4	-do-	-do-	-do-
810.	3806 0827	53M/4	-do-	13	26
811.	3806 0824	53M/4	-do-	-do-	-do-
812.	3806 0821	53M/4	-do-	-do-	-do-
813.	3806 0818	53M/4	-do-	14	26
814.	3806 0815	53M/4	-do-	-do-	-do-
815.	3806 0812	53M/4	-do-	-do-	-do-
816.	3806 0809	53M/4	-do-	15	26
817.	3806 0806	53M/4	-do-	-do-	-do-
818.	3806 0803	53N/1	394-A	15	26
819.	3806 0800	53N/1	-do-	29	88
820.	3806 0797	53N/1	00/9/60	-do-	-do-
821.	3806 0794	53N/1	-do-	-do-	-do-
822.	3806 0791	53N/1	-do-	-do-	-do-
823.	3806 0788	53N/1	-do-	-do-	-do-
824.	3806 0785	53N/1	-do-	30	27
825.	3806 0782	53N/1	-do-	-do-	-do-
826.	3806 0779	53N/1	-do-	31	58
827.	3810 0839	53M/3	-do-	-do-	-do-
828.	3810 0836	53M/3			
829.	3810 0833	53M/3			
830.	3810 0830	53M/4			
831.	3810 0827	53M/4	-do-	13	26
832.	3810 0824	53M/4	-do-	-do-	-do-
833.	3810 0821	53M/4	-do-	-do-	-do-
834.	3810 0818	53M/4	-do-	14	26



1	2	3	4	5	6
835.	3810 0815	53M/4	00/9/60	14	26
836.	3810 0812	53M/4	-do-	-do-	-do-
837.	3810 0809	53M/4	-do-	15	27
838.	3810 0806	53M/4	-do-	-do-	-do-
839.	3810 0803	53N/1	394-A	-do-	-do-
840.	3810 0800	53N/1	-do-	29	90
841.	3810 0797	53N/1	00/9/60	-do-	-do-
842.	3810 0794	53N/1	-do-	-do-	-do-
843.	3810 0791	53N/1	-do-	-do-	-do-
844.	3810 0788	53N/1	-do-	-do-	-do-
845.	3810 0785	53N/1	-do-	30	23
846.	3810 0782	53N/1	-do-	-do-	-do-
847.	3810 0779	53N/1	-do-	31	58
848.	3814 0830	53M/7	-do-	-do-	-do-
849.	3814 0827	53M/7			
850.	3814 0824	53M/7			
851.	3814 0821	53M/7			
852.	3814 0818	53M/7			
853.	3814 0815	53M/7	-do-	15	29
854.	3814 0812	53M/4	-do-	15	29
855.	3814 0809	53M/4	-do-	-do-	28
856.	3814 0806	53M/4	-do-	-do-	-do-
857.	3814 0803	53N/1	304-A	-do-	-do-
858.	3814 0800	53N/1			
859.	3814 0797	53N/1			
860.	3814 0794	53N/1			
861.	3814 0791	53N/1			
862.	3814 0788	53N/1	00/9/60	30	29
863.	3814 0785	53N/1	-do-	-do-	-do-
864.	3814 0782	53N/1	-do-	-do-	-do-
865.	3814 0779	53N/1	-do-	-do-	-do-
866.	3814 0776	53N/2	-do-	-do-	-do-
867.	3818 0827	53M/8			
868.	3818 0824	53M/8			
869.	3818 0821	53M/8			
870.	3818 0818	53M/8			
871.	3818 0815	53M/8	-do-	15	30
872.	3818 0812	53M/8	-do-	-do-	-do-
873.	3818 0809	53M/8	-do-	-do-	-do-
874.	3818 0806	53M/8	-do-	-do-	-do-
875.	3818 0803	53N/5	-do-	-do-	-do-
876.	3818 0797	53N/5	-do-		
877.	3818 0794	53N/5	-do-	30	30

1	2	3	4	5	6
878.	3818 0791	53N/5	00 /a/60	30	30
879.	3818 0779	53N/5	-do-		
880.	3818 0776	53N/6	-do-		
881.	3822 0818	53M/8			
882.	3822 0815	53M/8	-do-	15	30
883.	3822 0812	53M/8	-do-	-do-	-do-
884.	3822 0809	53M/8	-do-	15	30
885.	3822 0806	53M/8	-do-	-do-	-do-
886.	3822 0803	53N/5	-do-		
887.	3826 0818	53M/8			
888.	3826 0815	53M/8	-do-	15	31
889.	3826 0812	53M/8	-do-	-do-	-do-

APPENDIX - III -

Grid Zones

		<u>Coda</u>
O	—	1
	..	
I A	..	2
IB	—	3
	.	
II A	—	4
	.	
IIB	—	5
	.	
III A	—	6
	.	
IIIB	—	7
	.	
IV A	—	8
	.	
IV B	—	9

A P P E N D I X - I I I .

Crew Leader Coda.

Shri M.S. Bisht.	02
Shri M.S. Mehta.	03
Shri M.S. Negi.	04
Shri M.C. Dharmani.	05
Shri R.P. Singh Bisht.	06
Shri J.S. Kanwar.	07
Shri P.C. Joshi.	08
Shri R.L. Gandhi.	09
Shri O.P. Gaba	10
Shri D.P. Singh.	11
Shri Piara Singh.	12
Shri D.S. Bist.	13
Shri Gnan Singh.	14
Shri Y.P. Gupta.	15

APPENDIX -IV-

Code Numbers for Northern Zone Species

<del>Shorea robusta</del>	001
Pinus roxburghii	002
Pinus roxburghii (Twisted grain)	003
Pinus wallichiana	004
Cedrus deodara	005
Picea smithiana	006
Abies pindrow	007
Taxus baccata	008
Quercus <del>ericotrichophora</del>	009
Quercus hinalayana	010
Quercus semecarpifolia	011
Betula utilis	012
Alnus nitida	013
Populus ciliata	014
Juglans regia	015
Acer spp.	016
Aesculus indica	017
Prunus cornata	018
Rhododendron arboreum	019
Lyonia ovalifolia	020
Celtis australis	021
Ulmus wallichiana	022
Rhus spp.	023
Morus spp.	024
Corylus colurna	025
Salix spp.	026
Pistacia integerrima	027
Terminalia alata	028

<i>Lannea coromandelica</i>	029
<i>Anogeissus latifolia</i>	030
<i>Mallotus philippinensis</i>	031
<i>Grewia</i> spp.	032
<i>Bauhinia</i> spp.	033
<i>Buchanania lanzon.</i>	034
<i>Syzygium cumini</i>	035
<i>Acacia catechu</i>	036
<i>Ficus</i> spp.	037
<i>Boswellia serrata</i>	038
<i>Erythrina suberosa</i>	039
<i>Pyrus pashia</i>	040
<i>Diospyros</i> spp.	041
<i>Ougeinia ougeinensis</i>	042
<i>Bombax eciba</i>	043
<i>Terminalia bellirhoa</i>	044
<i>Cassia fistula</i>	045
<i>Flacourtia indica</i>	046
<i>Kydia calycina</i>	047
<i>Mitragyna parvifolia</i>	048
<i>Ehretia laevis</i>	049
<i>Ziziphus</i> spp.	050
<i>Nyctanthes arbor-tristis</i>	051
<i>Emblica officinalis</i>	052
<i>Aegle marmelos</i>	053
<i>Boehmeria</i> spp.	054
<i>Cassaria tomentosa</i>	055
<i>Limonia</i> spp.	056
<i>Toona ciliata</i>	057
<i>Holoptelea integrifolia</i>	058

<i>Madhuca latifolia</i>	059
<i>Terminalia chebula</i>	060
<i>Lagerstroemia parvifolia</i>	061
<i>Adina cordifolia</i>	062
<i>Butea monosperma</i>	063
<i>Cordia dichotoma</i>	064
<i>Schleichera oleosa</i>	065
<i>Moringa oleifera</i>	066
<i>Albizia lebbek</i>	067
<i>Artocarpus lakoocha</i>	068
<i>Bridelia retusa</i>	069
<i>Dalbergia sissoo</i>	070
<i>Garuga pinnata</i>	071.
<i>Phoebe lanceolata</i>	072
<i>Phoenix sylvestris</i>	073
<i>Prosopis spp.</i>	074
<i>Quercus glauca</i> /	075
<i>Machilus odoratissima</i>	076
<i>Cupressus spp.</i>	077
<i>Thuja compacta</i>	078
<i>Toona serrata</i>	079
<i>Melia azedarach</i>	080
<i>Kigelia africana</i>	081
<i>Mangifera indica</i>	082
<i>Gardenia spp.</i>	083
Other miscellaneous	098
<i>Fraxinus spp.</i>	099
<i>Robinia pseudoacacia</i>	100
<i>Parotia spp.</i>	101

APPENDIX- V.

Definition of Technical terms used in the manual.

BARK	Tissue of stem and root of a tree outside the cambium layer, in older trees usually divisible into inner (living) and outer ( dead) bark.
BREAST HEIGHT	Almost universally adopted as the standard height for measuring girth, diameter and basal area of standing trees. It is taken as 4 feet 6 inches (1.37m) above ground level. On slopes breast height is taken on the uphill side.
CALLIPER	An instrument for measuring tree or log diameters by taking their rectilinear projections on a graduated scale.
CALLUS	Tissue that develops after a plant is wounded and tends to cover the wound.
CAMBIUM	The actively dividing layer of cells, which lies between and gives rise to xylem and phloem, i.e. wood and inner bark.
CANOPY	The cover of branches and foliage formed by the crowns of trees in a wood.
CROWN	The upper branchy part of a tree above the bole.
CROWN WIDTH	The maximum spread of the crown expressed at its widest diameter.
HEIGHT (TREE)	The straight line distance between the ground level and extreme top of a tree usually measured on slopes on the uphill side of the tree.
INCREMENT BORER	An auger-like instrument with a hollow bit, used to extract cores or cylinders of wood from trees with annual growth ring for increment and age determination.
KNOT	A portion of branch embedded in the wood by the natural growth of the tree. The knot is "loose" or "tight" depending on whether the branch was dead or living at the time it was embedded.
LITTER	The upper most layer of organic debris ( dead vegetable matter) on a forest floor, freshly fallen or only slightly decomposed, an consisting chiefly of leaves but also including bark fragments, twigs, etc.
RINGS ANNUAL	A layer of wood procured by the growth of one year.
RING FALSE	The layer of wood less than a full year's growth and seldom extending round the stem; formed when diameter growth is interrupted and resumed during the same growing season.



LOAM	A soil composed of sand, silt and clay in such proportions that the properties of the soil are not dominated by any one of them.
4 SHELTERBELT	A belt of trees and/or shrubs maintained for the purpose of shelter from wind, sun, snow-drift, etc.
SHRUB	A woodyperennial plant differing from a perennial herb in its persistent and woody stem and less definitely from a trees in its low stature and its habit of branching from the base.
STOREY	A horizontal stratum or layer of canopy in a plant community. Forests often have two or more canopy layers each a storey.
TREE SAMPLE	A tree chosen as representative of a given population for detailed study of one or more of its characteristics.
TREE WOLF	A vigorous tree, usually of bad form, occupying more space than its future value warrants and threatening potentially better neighbours; usually a broad crowned dominants.
UNDERSTOREY	The lower storey of a forest crop, e.g., a young crop under seed bearers, coppice under standards, or the lower storey in a multistoreyed high forest.
WIND BREAK	A narrow shelterbelt or other obstacle maintained against the wind.

SECTION - IV

SAMPLE COPIES OF FIELD FORMS

# POINT DESCRIPTION FORM

Job Card Design	Report Number	Subar. Number	Crew Leader
1-3 4-5	6-7	8	9-10

## PREINVESTMENT SURVEY OF FOREST RESOURCES-3 NORTHERN ZONE

Cluster Number	Grid Zone	Cluster Centre Grid Reference	Inventory Design
67-69	70	71-78	79-80

Date:-

Name of C.I.:-

Plot classification	State	Revenue District	Forest Division	Catchment	Land class	Legal status	Vegetation	Forest type	Species stocking in forest:						Average height	Size class	Spacing	Regeneration	Crown density	Forest potential	Slope	Steepness	Humus	Soil depth	Altitude	Terrain	Aspect	Number of farms	Photo Class	Forest type	Density	Sample point No.		
									Spp. %	Spp. %	Spp. %	Spp. %	Spp. %	Origin																				
11	12	14	15	17	18	19	20	21	22-24	25	26-28	29	30-32	33	34	35	36-37	38	39	40	41	42	43	44	45	46	47-48	49	50	62	63	64	65	66

Remarks:-

Checked by:-

1.  
2.

Cluster centre	Inventory
1	1
2	2
3	3
4	4
5	5
6	6
7	7
8	8
9	9
10	10
11	11
12	12
13	13
14	14
15	15
16	16
17	17
18	18
19	19
20	20
21	21
22	22
23	23
24	24
25	25
26	26
27	27
28	28
29	29
30	30
31	31
32	32
33	33
34	34
35	35
36	36
37	37
38	38
39	39
40	40
41	41
42	42
43	43
44	44
45	45
46	46
47	47
48	48
49	49
50	50
51	51
52	52
53	53
54	54
55	55
56	56
57	57
58	58
59	59
60	60
61	61
62	62
63	63
64	64
65	65
66	66
67	67
68	68
69	69
70	70
71	71
72	72
73	73
74	74
75	75
76	76
77	77
78	78
79	79
80	80
81	81
82	82
83	83
84	84
85	85
86	86
87	87
88	88
89	89
90	90
91	91
92	92
93	93
94	94
95	95
96	96
97	97
98	98
99	99
100	100

Total No of trees	Forest type	Point No.	Cluster No.	Grid Zone	Cluster centre Grid Reference	Inventory Design
63-64	65	66	67-69	70	71-73	79-80

[illegible]

PRE-INVESTMENT SURVEY OF FOREST RESOURCES, NORTHERN ZONE

### SAMPLE TREE FORM

Job	Card Design	Report Number	Sub.R. Number	Total No. of Trees	Forest type	Point No.	Cluster No.	Grid Zone	Cluster Centre Grid Ref.	Inventory Design
1-3	4-5	6-7	8	83-84	65	66	67-68	70	71-78	79-80

Date: -

Name of C.I.

[illegible]

FORM FACTOR AND CULL FACTOR STUDY

1. Introduction

1. The field work for this study will be carried out in accordance with the procedure laid down in the following paragraphs.

2. Sampling design

2. Selection of point for sampling has been done by a stratified two stage sampling, with restriction as to the maximum number of trees to be sampled at each point. In the first stage, the same point were selected as for the inventory work. On the basis of the inventory results all the sample plots were classified into different forest types. At the second stage of sampling, random selection of sample plots, from the stratified list of plots, was done. In each plot the maximum number of trees to be sampled would be six for each species. In case there are more than trees of a species, the selection of six trees will be done by random sampling.

3. The list of points selected by the above procedure along with maps sheet nos. grid reference, cluster number, point number and number of trees of each species to be felled, are given in Appendix I.

Selection of  
Sample Trees

4. To collect the data for Form & Cull Factor data the trees will have to be felled to enable measurements at different places along its stem. For this purpose it is necessary that tree should be selected unbiased and should represent the whole population. In each sample plot, selected for felling of trees, a tally will be taken with a Relaskop as for inventory, using B.A.F.-2. All trees 5 cm and over in d.b.h.o.b., will be serially numbered in the sequence of the tally. The tally will start from the north direction and proceed in a sweep in clock-wise direction till the complete circle of 360° is made. Wherever there are more than six 'IN' trees of a species in a sample plot, the six trees to be felled will be selected by random selection. For example if there are 11 trees in a sample plot then after giving a serial number to each tree take out a three digit number from the table of random number and divide this number by 11, the remainder will give the tree number which is to be felled. Repeat this process till the required number of trees have been selected. While selecting the trees if the same remainder is obtained in two or more different cases only one will be considered and the process will be repeated till a different tree number is obtained.

5. The total number of trees to be felled of different species are given below :

Fir/Spruce	-	40
Deodar	-	30
Bluepine	-	30
Chir pine	-	30
Oaks	-	40
Upland hard woods	-	30

4. Detailed Field Procedure

6.1 The Crew Leader should copy out the approaches of all the sample points in each cluster where the felling is to be done. This work should be completed at the Headquarters itself where the approach description for all the visited sample points is available.

6.2 Collect all the tools required for the work before proceeding to the field. The Crew Leader should have a list of tools required in the forest and before leaving the camp he should personally check that all the tools are being taken to the field.

6.3 Locate the sample point with the help of approach description photographs and the map sheet of the area. In case the peg is not available this can be located with the help of reference tree.

6.4 In case the old sample point can not be located inspite of thorough search all around the area upto a radius of 200 meters then locate the sample point afresh, as it is done by the inventory crew, and fix the point. Record this fact that the sample point done by inventory crew could not be located.

6.5 Fill up the volume study form (for standing trees) in col 1-29 and 64-80 as done in case of inventory.

6.6 From the peg i.e. the sample point, take a Relaskop tally using Basal Area Factor 2 and mark all the 'IN' trees 5 cms and over in d.b.h.o.b. giving each a serial number starting from the north.

6.7 Carry out measurement on all 'IN' standing trees and record in the Tree Volume Study Form in Col.30-63 as done while filling sample tree form in inventory work.

6.8 Mark the B.H. point with J.K. writer in a ring on all the 'IN' trees and also the side facing the P.C. This direction mark will be required while measuring the diameter, towards the point centre and perpendicular to P.C.

6.9 Fell the tree as near to ground level as possible. The tree should be felled in the uphill direction using all precautions for felling. As far as possible use power chain saws for felling. Only where it is not possible to use power chain saw due to bigger diameter of the tree in such cases hand saw may be used for felling.

5. Numbering of tree portion

7. The following sequence will be used for denoting the main stem and the branches of a tree which is named as tree portion. The main stem from the base upto the leading shoot which be called tree portion 01. In case of coniferous trees we shall not be taking into consideration the side branches and hence the tree portion will always be 01. In case of broad leaved species the branches having diameter of 5 cms. d.o.b. and above at the origin are also to be considered separately. The main stem will be tree portion 01. as in case of coniferous trees, and the branches will be called as tree portion 02,03,04 and so on depending upon the number of branches of 5 cms. d.o.b. and above. Branches less than 5 cms. d.o.b. will be ignored. The figures below depicts how the various tree portions are numbered.



6. Stem wood  
measurements

Measurement of stem length

8.1 Measure the length of the stem from the breast height point up to the tip of the leading shoot placing the tape reading 1.37 meters at B.H. point. The tape reading would directly give the total length of the tree. Let this length be 'L' meters.

Marking the sections

8.2 Mark sections at  $L/10$ ,  $2L/10$ ,  $3L/10$ ..... upto  $9L/10$  along the main stem of tree portion 01. If there is some abnormality on the stem at any of these points like knots, swelling etc. mark may be made slightly above or below the correct point. So that the abnormal portion is avoided. Mark also section on the stem where d.o.b. is 5 cms, 10 cm, 20 cms and 40 cms. B.H. point at 1.37 meters is already marked. In case any of the  $L/10$  sections fall on these diameters then separate marking is not required. Cut the tree into logs at the various sections marked. The logs should be so cut that the end faces are perpendicular to the axis of the log.

Numbering of sections :

8.3 Number the section (where measurements are to be made) serially from the base of the tree. Therefore; the first section number will be 01 at the stump level at various points where the  $L/10$  sections, the breast height section and 40 cms, 20 cm 10 cms, 5 cms, d.o.b. sections are marked. The figure below illustrates how the marking will look on a felled tree.

8.4 It means if none of the marks are overlapping there will be in all 15 sections.

Measurement on the sections :

8.5 The following measurements are to be made and recorded for each section on the Tree Volume Study Form (for felled trees).

Height of the sections from the ground level :

8.5.1 In case of 10 L/10 section which theoretically will be at the ground level, the section at stump level will be studied as it is not possible to cut the tree exactly at the ground level. To find the height of any section from the ground level measurement is taken from breast height point, which forms the reference point even for the sections below the B.H. point. For the purpose of the measurement of height of any section, place 1.37 meter point of the tape at B.H. and take the reading. The Height will be measured correct to a centimeter.

Diameter measurement :

8.5.2 On each section the diameter over bark and diameter under bark in radial direction to the sample point and another diameter perpendicular to first will be measured. The diameters will be measured with the help of meter scale correct to a millimetre. If the face of the section, where measurement is to be done, is not perpendicular to the axis of the log the Scale will be held perpendicular to the axes of the log and correct diameter will be recorded.

Counting of annual rings :

8.5.3 In coniferous trees distinct annual rings can be seen on the face of each section. Count the total number of rings and record in the appropriate column. Remember, some time false rings also appear on the section and to avoid this you will check up that the rings which you are counting are making complete circle on the section. Wherever the rings are closer to each other you must make use of the magnifying glass. Also apply some water on the section before counting the rings. This will make the rings more distinct.

Measurement of defects :

8.5.4 The section is to be examined to see if there are any defects on it. There may be rot, knot, hollowness, insect damage etc., on the face of the section. If there is any defects then enclose the defect in a rectangle by drawing pencil lines and measure the sides of the rectangle and write in the appropriate column. This will give the area of the defective portion. Sometimes the defects may be present in more than one patch. Then it has to be examined whether it is possible to take out a sound piece in between the defective portions. Generally, if the defective portions are within 10 cms then it is not possible to take out any sound piece in between. In such case the different defective portions will be combined and one rectangle covering the entire defective area will be drawn and its measurements will be recorded. When the defective portions are 10 cms or more apart their measurements are to be recorded separately by enclosing each within a rectangle.

7. Branch wood measurement

9. In case of broad leaved species the branches having d.o.b. 5 cms and above are to be considered as separate tree portions. Just as in case of tree portion 01, the 1st section is at the base of the tree, similarly, in case of branches the first section will be at the base of the branch i.e. from the junction of the stem and the branch or the junction of branch and sub-branch, as the case may be. Here, sub-branch means the branch which is not originating from the main stem but which is coming out of another branch. The further sections of the branch will be done at an interval 2 meters till the point where d.o.b. 5 cms is reached. The portion of branch less than 5 cms d.o.b. will be ignored. If the length of the last section where 5 cms d.o.b. has been reached, is 1 meter or less than 1 meter in length, it should be included with the previous section, but if the length of the last section is more than 1 meter it will be treated as separate section. It means the length of the last section can vary from more than 1 meter to 3 meters. In place of the height of the section above the G.L. here it will be the length of the section from the junction. Therefore, the length of the first sections will be 0000 and the length of the subsequent sections will be the distance from the junction to the point where the sections have been cut.

SECTION - VI

INSTRUCTION FOR FILLING UP  
VARIOUS FIELD FORMS

# 1. Tree Volume Study (For standing trees)

All the column in Tree Volume Study form (for standing trees) excepting Col. 1 to 5 and 79-80 are to be filled. The information in Col. 8-29 pertains to the plot description form and Col. 30-65 pertains to sample tree form data as given in the Inventory Manual for U.P. Fill up each column as explained below :-

## Col. No.

1-3	Job No.	Leave it blank.
4-5	Card Design	Leave it blank.
6-7	Grew Leader	Give your code number.
8-9	State	For U.P. Code is 27
10	Forest Division	Give the code of the division in which you are working. The code number for different divisions is given in the Inventory Manual for U.P.
11	Forest Type	Classify the Forest into forest type as per the instruction given in the Inventory Manual for U.P.
12-14) 16-18)	Species	Write the species code in Col. 12-14 and 16-18 corresponding to the % given in Col. 15 and 19 respectively.
15 19 20		Give the % of species given in col. 12-14 and 16-18 in Col. 15 and 19 respectively. In Col. 20 give the % of the remaining species in the Forest Type.
21 22-23 24 25 26	Origin Average height Size class Crown density Slope	Refer P.D.F. instruction in U.P. Inventory Manual .
27-28	Altitude	Fill up from the list available at the office.
29	Aspect	Fill up from the list available at the office.
30	Tree No.	Write the number of the tree.

31-33	Species	Refer Inventory Manual . for U.P.
34	Dominance	Refer Sample Tree Form instruction in Inventory Manual.
35-37	D.B.H.O.B. towards S.P.	Measure the diameter at breast height with the calliper pointing the longer arm towards the sample point or peg.
38-40	D.B.H.O.B. perpendicular to P.C. S.P.	Measure the diameter at breast height keeping the longer arm of the calliper in a direction perpendicular to the sample point.
41-42	Height of the tree.	Refer sample tree form instruction in Inventory Manual.
43-44	Clear Bole	-do-
45	Natural defect	-do-
46	Defect others	-do-
47-49	Crown width towards P.C.S.P.	Measure the crown width in the direction of the sample point in decimetre and record.
50-52	Crown width perpendicular to S.P.	Measure the crown width in a direction perpendicular to the sample point in decimeter and record.
53-54	Last 10 years increment towards S.P.	Refer sample tree form instruction in the Inventory Manual.
55-56	Last 20 years increment to- wards S.P.	-do-
57-58	Last 10 years increment perpendicular to S.P.	-do-
59-60	Last 20 years increment perpendicular to S.P.	-do-

61	<u>Tree Felled</u> Tree not felled	Use the following code to denote whether the tree has been felled or not.  Tree not felled - 1 Tree felled - 2
62-63	No. of tree portion	Write the total number of tree portion in the tree. This column should be filled only when the tree has been felled. In case of coniferous species it will always be 01.
64-65	Total No. of trees.	This will correspond to the total tallied trees in the Sample Point.
66	Point No.	Give the number of the Sample point i.e. 1, 2, 3
67-69	Cluster number	Give the number of the cluster in three digits.
70	Grid Zone	It is always 2 for U.P. Area.
71-78	C.C.G.R.	Give the grid reference of the cluster.
79-80	Inventory Design.	Leave it blank.

## 2. TREE VOLUME STUDY FORM (Felled trees)

Fill-up the various columns as explained below :-

### Column No.

1-3	Job No.	Leave it blank
4-5	Card design	Leave it blank
6-7	Tree No.	Here give the serial No. of the tree that was given to the tree after taking tally.
8-10	Species	Give the species code for the tree.
11-12	Tree portion	Write the code for the tree portion for which the data is being recorded in the subsequent columns. For conifers it will be always 01 but for broad leaved species the main stem will be 01 and the branches will be separately numbered as 02, 03, 04 depending upon their numbers.

13-14	Section No.	How the section will be numbered has already been explained. Here write the section No. for which the data is being collected.
15-18	Height of section.	The height of the section above the base of the tree in case of 01 portion and above the junction of the branch and stem or junction of two branches in case of tree portion 02 or more to be given in this column. It has been already explained that B.H. will be taken as a reference point for the determination of the height of the section for portion No.01. The height is to be recorded correct to the nearest centimetre.
19-22	D.O.B. towards P.C.	Measure the diameter over bark towards point centre upto the nearest millimetre.
23-26	D.O.B. perpendicular to P.C.	Measure the diameter over bark in a direction perpendicular to the point centre upto the nearest millimetre.
27-30	D.U.B. towards P.C.	Measure the under bark diameter towards point centre upto the nearest millimetre.
31-34	D.U.B. perpendicular to P.C.	Measure the underbark diameter in a direction perpendicular to point centre to the nearest millimetre.
35-37	No. of rings at the Section.	Count the number of rings on the face of the section from the pith to the periphery of the section. Write 999 if the rings cannot be counted and 000 when there is no annual formation.
38	Cull presence	Examine whether there are defects on the section or not and fill the appropriate code as given below :-  Defect absent - 1 Defect present - 2
39-40	Type of defect	This column will be filled only when in Col. 38 the presence of defect has been shown. If the defect is absent in Col. 38 in that case write '0' in Col. 39 as well as in Col.40.



39-40

Type of defect      In case there is a defect it will be classified in the following main classes in Col. 39.

<u>Type of defect</u>	<u>Code</u>
Rot	1
Knots	2
Cracks	3
Insect damage	4
Others	5

In Col. 40 each of the above defect is to be further classified according to the description given below :-

Rot

Fibrous Rot	1
Pocket Rot	2
Spongy Rot	3

Knot

Loose knot	1
Tight knot	2

Cracks

Superficial cracks	1
--------------------	---

(Not deeper than 0.5 cms and not wide than 1 mm)

Radial shake	2
--------------	---

(Crack from surface inwards deeper than 2.5 cms. and wider than 1 mm)

Star shake	3
------------	---

(Crack from pith onwards)

Cup shake	4
-----------	---

(Crack along the rings)

Others

Fire damage	1
Hollowness	2

41-43. 44-46	Size of rectangle	Enclose the defect in a rectangle and write the measurement of the sides in mm.												
47-48 ) 49-51 ) 52-54 )		When the number of defects is more than one these columns are to be used similar to columns 39-46. Whenever there is no defect put '00' as the size of the rectangle.												
55	Straightness	Each section has to be examined in respect to its straightness. It will be classified into the following classes and the appropriate code will be used :												
		<table><tr><td>Straight</td><td>1</td></tr><tr><td>Slightly bent (Less than 10°)</td><td>2</td></tr><tr><td>Pronounced bend (one bend more than 10°)</td><td>3</td></tr><tr><td>Hooked (More than 1 bend)</td><td>4</td></tr></table>	Straight	1	Slightly bent (Less than 10°)	2	Pronounced bend (one bend more than 10°)	3	Hooked (More than 1 bend)	4				
Straight	1													
Slightly bent (Less than 10°)	2													
Pronounced bend (one bend more than 10°)	3													
Hooked (More than 1 bend)	4													
56	Shape of Section.	Classify the end face of the section in the following classes and write the appropriate code.												
		<table><tr><td>Circular</td><td>1</td></tr><tr><td>Elliptical (one diameter longer than the other by more than 20%)</td><td>2</td></tr><tr><td>Fluted (Where the periphery of the section is wavy)</td><td>3</td></tr></table>	Circular	1	Elliptical (one diameter longer than the other by more than 20%)	2	Fluted (Where the periphery of the section is wavy)	3						
Circular	1													
Elliptical (one diameter longer than the other by more than 20%)	2													
Fluted (Where the periphery of the section is wavy)	3													
57	Anticipated out turn (Round wood %)	Assess the anticipated percentage of the wood in round that can be utilised from the tree. While assessing the utilisable wood give due consideration to loss in felling. Defects natural and others etc. The assessment will be done for the entire tree and not section-wise. The following code will be used to denote the various utilisation percentages.												
		<table><tr><td>Up to 10%</td><td>1</td></tr><tr><td>10-20%</td><td>2</td></tr><tr><td>20-30%</td><td>3</td></tr><tr><td>30-40%</td><td>4</td></tr><tr><td>40-50%</td><td>5</td></tr><tr><td>50-60%</td><td>6</td></tr></table>	Up to 10%	1	10-20%	2	20-30%	3	30-40%	4	40-50%	5	50-60%	6
Up to 10%	1													
10-20%	2													
20-30%	3													
30-40%	4													
40-50%	5													
50-60%	6													

		60-70%	7
		70-80%	8
		and above 80%	9
58	Anticipated out turn (Sawn Wood 3)	Assess the anticipated out turn of the sawn wood after accounting for the losses in sawing, defects etc. and classify in the following classes.	
		Up to 10%	1
		10-20%	2
		20-30%	3
		30-40%	4
		40-50%	5
		50-60%	6
		60-70%	7
		70-80%	8
		80% and above	9
59-62	Average D.B.H. O.B.	Calculate the average D.B.H.O.B. by converting the girth over bark at breast height into diameter.	
		Average diameter = $\text{Girth} \times 7/22$ Write the diameter nearest to the millimetre.	
63-66	Total length of the tree (In cms)	Measure the length of the tree from B.H. point to the tip of the tree and add 1.37 M. to get the total length of the tree.	
67-68	Total No. of Section.	Here write the total number of section for each tree portion. If there is only one tree portion as in case of coniferous species i.e. 01, then only one figure will come in this column giving the total number of section in this portion. In case of broad leaved species there will be number of tree portion depend- ing upon the total number of branches above 5 cms. d.o.b. and for each tree portion the total No. of section will come separately.	
69.	Point No.	Write the point No. of the cluster.	
70	Grid Zone	It will always be 2 for U.P. Areas.	
71-78	Cluster centre grid reference	Write the C.C.G.R. from the map sheet.	
79-80	Inventory Design	Leave it blank.	

### 3. Stem Analysis

1. Stem analysis will be carried out for all the coniferous trees felled.

#### 2. Method of data collection

- 2.1 The collection of data for stem analysis is to be done from the same trees which will be felled for the collection of form factor and cull data.
- 2.2 The measurements are to be done on the faces of each L/10 section and also on the breast height section. On each section find out the average d.b.h. by converting the girth into diameter and from the average diameter calculate the average radius. Mark two average radii from the pith on each section. The two radii should be as far apart as possible.
- 2.3 The first measurement is always to be done on the breast height section. Mark two average radii as explained in para 2.2. Count the rings from pith to the periphery on those average radii and fix a pin at every tenth ring. In case the total number of rings is not a multiple of 10 then after the last pin less than 10 rings will be left in between the last pin and the periphery of the section which will give you the number of rings in the incomplete decade.
- 2.4 Now measure the distance from the pith to the outer most pin on one radius. This will give you the width of the first complete decade. Next measure the distance from the pith to the last but one pin and this will give you the width of second decade like this go on measuring from the pith the first pin or the nearest pin. Also measure the distance from the periphery to the last pin which will give the width of the incomplete decade. Similar measurements are to be done on the second radius also.
- 2.5 On the next section, above the B.H. point, mark first the two average radii. On each radii count the same number of rings from periphery, as was found in the incomplete decade of the breast height section and fix a pin. Then continue to count inwards and fix a pin at every 10th ring till you reach near the pith. It is possible that in the inner most decade i.e. nearest to the pith, there may be less than 10 rings, but even then it will be considered as complete decade for measurement purposes on this section. Also measure the width of the outer incomplete decade i.e. width of the number of rings left at the periphery.

2.6 Repeat the measurement on all other sections in the same way as explained in para 2.5.

3. Seedling height:

The seedling data will be collected at each place where stem analysis is done. For this you will select 5 free growing, i.e. growing without any supersession, seedlings or saplings of 1 metre to 4 metres in height and of the same species for which stem analysis is being done. Cut the seedling or sapling at the base and at the breast height point, count the rings at both these places and record in the form.

4. GROWTH STUDY FORM

The detailed column-wise instruction of filling the growth study form is given below :-

Column No.

1-3	Job No.	Leave it blank.
4-5	Card Design	Leave it blank.
6-7	Crew Leader	Write your code.
10-11	Species	Write the code number of the species as given in the inventory manual of U.P.
12-13	Section No.	Write the number of the section on which the measurement is being done.
14-17	Height above the base	Measure the length of the section taking B.H. point as reference and subtract or add the value to 1.37 M depending upon whether the section is below B.H. or above B.H. respectively.
18-20	No. of rings on the section.	Count the total number of rings on the section and write the total count.
21-24	D.O.B. m.m.	Write the average diameter over bark which is calculated from the girth measurement.
25-28	D.U.B. m.m.	Write the average diameter under bark calculated by subtracting double the bark thickness from the average diameter over bark.

29	Radius No.	In each section two average radii will be drawn. Number one of them as 1 and the other as 2. The measurements on each section have to be done, on radius 1 and radius 2 separately.
30	Century code	When the total number of rings are within 100 then put century code 1. When the number of rings are 101 to 200 for this put century code 2. Similarly when the rings are 201-300 put century code 3 and so on, that means if there are 325 rings on a section then for the 1st ten decades write 1 under century code, for 11th to 20th decade write 2 under century code, for 21st to 30th decade write 3 under the century code and for the remaining decades write 4 under the century code.
31-33		Under 31-33 write the width of the 1st decade in Col. 34-36 write the width of the second decade and so on till col. 58-60 where the width of the 10th decade will come. If the total number of rings are more than 100 then for century code 2 write the width of 11th decade under 31-33, 12th decade under 34-36 and so on so that the 20th decade will come under col. 58-60. Similarly for century code 3 the width of the 21st decade will come under col. 31-33 and so on.
34-36		
37-39		
40-42		
43-45		
46-48		
49-51		
52-54		
55-57		
58-60		
61-63	Width of incomplete decade.	Write the width of those rings which are in the incomplete decade i.e. width of these rings which are between the last pin and the periphery of the section.
64-65	Total number of sections.	Write the total number of sections on which the measurements have been done.
66	Sample Point No.	In each cluster there are three sample points. Write the number of the sample point where you are working.
67-68	Cluster No.	Write the cluster number of the sample point.
70.	Grid Zone.	It will always be 2 for U.P. Area.

71-78	C.C.G.R.	Write the cluster centre Grid reference as done in the inventory work from the map sheet.
79-80	Inventory Design	Leave it blank.

5. SEEDLING HEIGHT FORM

The column-wise instruction for filling the seedling height is given below :-

Column No.

1-3	Job No.	Leave it blank
4-5	Card Design	Leave it blank
6-7	Crow Leader	Write your code number
8-9	Seedling No.	Give the number of the seedling. The first seedling taken for felling and measurement will have C1. No., the second seedling taken will be 02 and so on.
10-12	Species	Write the code No. of the species as given in the inventory manual.
13-16	Diameter at collar	Measure the over bark diameter at collar with the help of metric scale, after cutting at the base, in millimetres and record.
17-20	Diameter at B.H.	Measure the over bark diameter at the B.H. point with the help of metric scale, after cutting at the B.H. point, in millimetres and record.
21-23	Height in cms.	Write the total height of the Seedling correct to cms. For this measure the length of the seedling from the base to the tip of the seedling.
24-26	No. of Rings of collar.	Count the total number of rings at the collar section and record. For this the cut should be clear and made with sharp edged instrument.
27-29	No. of Rings at B.H.	Count the total number of rings at the B.H. section and record.
64-65	Total No. of Seedlings.	Write the total number of seedling felled in the vicinity of the sample point.

66	Sample point No.	Write the sample point No. of the cluster.
67-69	Cluster No.	Write the cluster No. of the sample point.
70	Grid Zone	It will always be 2 for U.P. Area.
71-78	Cluster Centre Grid reference.	Write from the map sheet.
79-80	Inventory Design	Leave it blank.

6. Details of No. of trees of various species to be felled in Uttar Pradesh.

Map Sheet	Cluster No./ S.P. No.	Grid Reference	Division	No. of trees to be felled
53 F/13	002/2	36780767	Chakrata	Fir - 6 Kail-3 Deodar-4 Total. = 13
53 F/13	003/1	36780764	Chakrata	Oak - 6 Deodar-6 Hardwood(Misc)-1 = 13
53 F/13	015/3	36860767	Chakrata	Kail - 5 Oak - 6 = 11
53 J/1	075/1	37020773	Yamuna	Oak - 6 Hardwood(Misc)-3 = 9
53 J/1	093/1	37060779	Yamuna	Chir - 6 = 6
53 J/1	095/1 & 2	37060773	Yamuna	Chir - 5 Oak - 2 Kail - 6 (Misc Hardwood) = 13
53 J/1	115/1	37100773	Yamuna	Chir - 6 = 6
53 J/1	158/2	37180782	Yamuna	Deodar - 6 = 6
53 J/3	173/3	37180737	Yamuna	Chir - 6 Oak - 2 = 3
53 J/2	193/3	37220749	Uttarkashi	Chir - 6 Oak - 4 = 10
53 J/5	233/3	37300788	Yamuna	Oak - 6 = 6
53 J/7	310/2	37380731	Tehri	Deodar - 4 Misc(Hardwood)-6 = 10



SECTION - VII.

SAMPLE FIELD FORMS

TREE VOLUME STUDY FORM (FOR STANDING TREES)

JOB NO. 1-3	CARD DESIGN 4-5	CREW LEADER 6-7	PREINVESTMENT SURVEY OF FOREST RESOURCES NORTH ZONE			TOTAL NO. OF TREES	POINT NO.	CLUSTER NO.	GRID ZONE	CLUSTER CENTRE GRID REFERENCE	INVENTORY DESIGN
						64-6566	67-69	70	71-73	73-80	

DATE \_\_\_\_\_

NAME OF THE C.L. \_\_\_\_\_

STATE	FOREST DIVISION FOREST TYPE	STOCKING %			ORIGIN	AVERAGE HEIGHT	SIZE CLASS	DENSITY	SLOPE	ALTITUDE	ASPECT		
		SPP. %	SPP. %	%									
8-9	10-11	12-14	15	16-18	19	20	21	22-23	24	25	26	27-28	29

TREE NO.	SPECIES	DOMINANCE	D.B.H.O.B.		TOTAL HT. STANDING TREES	CLEAR BOLE	NATURAL OTHERS	CROWN WIDTH		INCREMENT				TREE F/N	NO. OF TREES PORTIONS	
			TOWARD DS	TO Sp.				TOWARD DS	TO Sp.	DM	TOWARDS	Sp	To			Sp.
			LAST	LAST				LAST	LAST	LAST	LAST	LAST	LAST			
30	31-33	34	35-37	38-40	41-42	43-44	45-46	47-48	50-52	53-54	55-56	57-58	59-60	61	62-63	

**PREINVESTMENT SURVEY  
OF  
FOREST RESOURCES  
NORTHERN ZONE**

JOB NO.	CARD DESIGN	TREE NO.	SPECIES
1-3	4-5	6-7	8-10

Name of the C.I.:—  
Date:—

AV. DBH	Total LENGTH OF TREE AFTER FELLING	TOTAL NO. OF SEC.	SAMPLE POINT NO.	GRID ZONE	CLUSTER CENTRE GRID REFERENCE	INVENTORY DESIGN
59-	63-66	67-68	69	70	71-78	79-80
62						

[illegible]

**INDIAN INVESTMENT SURVEY OF FOREST RESOURCES  
NORTH ZONE**

CLUSTER CENTRE REFERENCE	71-78
CLUSTER NO.	67-59
SAMPLE NO.	67-59
OF SECT	67-59
TOTAL NO	67-59
CLUS-	67-59
TER NO.	67-59
GRID	67-59
ZONE	67-59

**Don**

SECTION NO.	HEIGHT ABOVE THE BASE	NO. OF RINGS ON THE SEC.	AVERAGE D.O.I. MM	AVERAGE D.U.B. MM	RADIUS NO.	CENTURY CODE
12-13	14-17	18-20	21-24	25-28	29-32	33-36
						37-39
						40-42
						43-45
						46-48
						49-51
						52-54
						55-57
						58-60
						61-63

**SIGNATURE OF THE RECORDER**  
**DATE:**

**SEEDLING HEIGHT FORM NO. IV**

JOB NO.	Card Design	Crew Leader
1-3	4-5	6-7

PREINVESTMENT SURVEY  
OF FOREST RESOURCES  
NORTH ZONE

TOTAL NO. OF SEEDLING.	POINT NO.	CLUSTER NO.	GRID ZONE	CLUSTER CENTRE GRID REFERENCE	INVENTORY DESIGN
64-65	66	67-69	70	71-78	79-80

DATE \_\_\_\_\_

NAME OF C.I.

SEEDLING No.	SPECIES	DIAMETER AT COLLAR MM	DIAMETER AT B.H. CM	HEIGHT IN CM.	NO. OF RINGS AT COLLAR	NO. OF RINGS AT B.H.
8-9	10-12	13-16	17-20	21-23	24-26	27-29

Signature of the Recorders  
with date \_\_\_\_\_

PART - II

COST AND ACCESSIBILITY STUDIES

### METHODOLOGY ADOPTED

For conducting cost studies in U.P. survey areas, the following methodology will be adopted. For Bihar areas, it will be modified suitably keeping in view the conditions in the area.

1. Forest Resources/Stock Map

A reliable resources/ Stock map of the forests occurring in the area will be compiled. Resources map prepared on the basis of interpretation of aerial will be preferred. Since photo-interpretation has not been completed by P.I. unit of our organisation up till now, stock maps prepared by U.P. Forest Department for working plans of the area, will be obtained and made use of other details in respect of forest inventory (viz., area, forest type, volume density, size of crop etc.) for each of the forests shown on the stock maps, will be collected simultaneously from the working plans and compartment history files. Stock maps of the forest areas under survey are available with the State Forest Department.

2. Delivery sites :

For purposes of this cost study, Rishikesh will be the delivery site for the wood extracted from Tehri and Uttarkashi Forest divisions whereas Jalalia (Near Herbertpur) will be the site for raw materials extracted from Yamuna, Ghakrata and Tons forest Divisions.

3. Catchments.

Water sheds formed by the main rivers (viz., Bhilangana, Bhagirathi, Yamuna and Tons) flowing through the area will be recognised as four catchments. Drainage area of other streams, the tributaries of the rivers, will be treated as sub catchment under these catchments.

4. Area Planning :

The routes through which the raw materials extracted from the forests are being and can be transported to the delivery sites will be indicated on the stock maps through arrows with pointed heads indicating the direction of flow of the raw materials. Two sketch maps, one under the existing and the second for the proposed methods of extraction will be prepared, the later, of course after the road planning of the area has been carried out. It will also be clearly indicated whether the wood will be floated or transported over the roads in a particular stretch of the area.

5. Road Planning

In each catchment, the construction of new roads and improvement of existing ones may have to be proposed for facilitating extraction of wood under proposed extraction programmes. Tentative road planning will be done on the map. The length of the proposed roads will, also, be estimated from the topographical maps.

Forest inventory results may not be ready before the cost studies are undertaken in U.P. areas. Estimate of volumes/growing stock made available exploitable as a result of proposal for construction of new or improvements of existing roads, should therefore, be made on the basis of enumeration conducted by the State Forest Department.

A new road should be proposed only if it were found that it was more profitable to extract the raw materials through the road even after accounting the expenditure on its construction and maintenance towards costs of extraction of wood when compared with the profits accruing under existing methods of extraction. The same should be taken in respect of improvement of existing roads.

The information should be collected and analysed as per proforma proposed for road planning exercise. The detailed instructions for filling information in the proforma are also given separately alongwith the proforma.

6. Studies on logging devices.

For recommending use of new logging devices, the studies on their suitability and profitability are required to be precisely designed and planned. Since there is not much of time available for conducting these detailed studies, the information collected/compiled by other agencies working in the area will be used for analysis.

No new devices have to be proposed unless it is established that their use is economical and guarantees efficient utilization of forest raw materials.

These studies may be taken up for use of power saws for felling and cross-cutting, installation of power driven saw mills for sawing, use of mechanical winches for dragging and use of ropeways for carriage on off road distances.

A proforma for collection of information for the purposes of this study has, also been enclosed at the end of this manual alongwith the instructions.

7. Unit for record of information

All the forests indicated on the stock/resources maps will be grouped into a large number of units for recording the information to be collected while conducting the cost studies. Each unit will consist of either a portion of forest compartment or a complete compartment or a block of forests containing a few compartments and sub compartments. The main criteria to be observed while carving out these units will be :-



(1) The costs of extraction for the different compartments sub compartment contained in the same unit do not vary from one another by more than an amount equal to half the cost class interval (o.g. Rs. 10/- per m<sup>3</sup> in the present case) kept for ultimate summarisation of cost study results into cost classes.

(ii) And the forest type and the volume density remains uniform in a unit as far as possible. (

All these details will be decided after having a look at the stock maps, topographic maps and map showing the infrastructure in the area. Each unit will, therefore, vary from the other in area.

The units will be serially numbered on the stock maps in each catchment.

#### 8. Method of collection of information

Information will be collected in respect of each forest unit. A separate set of forms (to be described under next item) will be used for units of each sub-catchment.

First of all the forests where extraction works are in progress, will be visited. The information available will be studied collected and entered against the unit/units in which these forests are situated.

For 20% of the total number of units in each catchment, the data should be collected after due inspection of the forests of the unit as if actual extraction were to take place. If this quota of 20% were completed during the visits to the forests in which the extraction was in progress, no additional unit should be normally visited. Otherwise in case, this quota falls short, calculate the number of units falling of random numbers. Visit the forests contained in the units selected through the method described above, and fill in the information after due study on the spot.

For balance units in each catchment or in whole of the area, the information should be filled in by the study of maps, taking into account the experience gained during visits to the forests of other units and the data available with the State forest department and the forest lessees doing the extraction work in the area.

#### 9. Forms for collection of information

For collection of information about cost details, the following forms have been prescribed :-

~~✓~~ short for inspection in the field and select the units with the help

- a) Cost Studies - Data Descriptive Form - I.
- b) Cost Studies - Rates of Extraction (i) Form - II  
(Under existing logging practices)
- c) Cost Studies - Rate of Extraction (ii) Form - III  
(Under proposed practices, conversion factors etc.)
- d) Cost Studies - Distances Data Form - IV.

Besides this, two proformas have been prescribed for carrying out road planning exercise and study on logging devices.

Detailed instructions for filling in these forms and proformas prescribed above are given in the following part of this manual.

SECTION - IX

INSTRUCTIONS FOR FILLING UP OF  
FORMS & PROFORMS

1. COST STUDIES - DESCRIPTIVE DATA FORM

The Descriptive Data Form has to be filled in for every recording unit. The information in respect of most of the items is of ~~qualitative~~ and descriptive nature and can be of immense use for wood harvesting operations. Efforts have been made to quantify the information, but than can, also, be very broadly approximate and representative for whole of the unit. This does not, in any way, mean that precise information data is not aimed at, but wherever some special study or extra work is required to be done for sake of precision, it has to be avoided and approximations are resorted to. However, wherever, accurate data is available, it has to be accurate data is available, it has to be entered as such without major alternations.

For all the items (except Aspect i.e. column No.17) for which information is either NOT REQUIRED or NOT APPLICABLE fill in the code 9,99,999 for items occupying one, two, three columns etc. respectively.

The detailed instructions for filling up the information in this form are given against each of the items.

S.NO.	Items	Column Nos.	Instructions
1.	Job	1-3	Leave it blank. To be filled in by Data Processing Unit at the time of punching.
2.	CARD DESIGN	4-5	Leave it blank. To be filled in by Data Processing Unit at the time of punching.
3.	STATE	6-7	Write 27 for U.P.
4.	REVENUE DISTRICTS	8	Fill in following codes :- <div style="display: flex; justify-content: space-between;"> <div> <u>District</u>  Dohra Dun  Tahri  Uttarkashi </div> <div> <u>Code No.</u>  1  2  3 </div> </div>
5.	FOREST DIVISION	9-10	Fill in the following codes for :- <div style="display: flex; justify-content: space-between;"> <div> <u>Forest Division</u>  Chakrata  Tons  Yamuna  Uttarkashi  Tahri  Dohra Dun West </div> <div> <u>Code No.</u>  01  02  03  04  05  06 </div> </div>

6. TERRAIN

11-17

The information on terrain will include information on altitude variation, topography slope and aspect of the forest unit. Whatever units are visited by the field parties, the information should be filled in on the basis of their ocular assessment and topographical maps. For the remaining units, it should be filled in from topographical maps only.

While filling this information pertaining to terrain, slope and aspect the overall picture of the unit should be studied and the type representing the maximum area should be indicated.

(a) ALTITUDE

- (i) Lowest
- (ii) Highest

11-12 )

13-14 )

The information should be filled in with the help of topographical maps and to the nearest 100 meters i.e. if the lowest/highest altitude of the recording unit is 2325 meters, only 23 should be written.

(b) TOPOGRAPHY

Fill in the following codes for :-

<u>Topography</u>	<u>Code No.</u>
Hilly	1
Valley	2
Plain	3

Where the Forest Unit has more than one category of topographical areas, the most predominant one has to be filled in.

(c) SLOPE

16

The codes for different categories of slopes are :-

<u>Code</u>	<u>Description</u>
1	Precipitous i.e. when the slope is more than 60%
2.	Very steep i.e. slope is between 45% to 60%

3. Steep i.e. slope is between 30% to 45%
4. Gentle i.e. slope between 5% to 30%
5. Flat i.e. where slope is less than 5%

(d) ASPECT

17

The codes for different aspect are :-

<u>Aspect</u>	<u>Code</u>
North	1
North-East	2
East	3
South-East	4
South	5
South-West	6
West	7
North-West	8
None	9

7(A) FOREST

(18-35)

The information on forests has to be filled in under different sub-heads viz., Forest Type, area under type, volume stocking and size of the crop. For each of the recurring unit, provision has been made in the form for repeating these entries thrice.

If there are more than three forest types in a unit, areas under the forest types having the same volume density should be grouped together so that the information is accommodated under three categories of entries and the forest type for such a group will be the one having maximum area in the group.

The purpose of collection of information under these columns is not the preparation of forest inventory but to use the results of reliable inventory

for cost studies. The information in respect of these columns should, therefore, be filled in from the following source strictly in order of preference :-

- (i) Resource map prepared as a result of interpretation of aerial photographs and information available therefrom.
- (ii) Stock Maps/Working Plans/Compartment history files etc.
- (iii) Management Maps/Working Plans/Compartment history files etc.
- (iv) Ocular estimation/guestimates.
- (v) Any other source.

Since the resource map prepared from aerial photographs is not ready as yet, the information may be filled in from stock maps/working plans/compartment history files.

It will be possible to fill in most of the information at the headquarters and undue time need not be wasted in these columns.

(a) Forest type 18

Fill in following codes for forest types :-

<u>Forest Type</u>	<u>Code No.</u>
Fir/Spruce	1
Blue pine	2
Deodar	3
Chir	4
Conifers(Mixed)	5
Broad leaved	6
Bamboos	7
Others	8

(b) Area 19.21

The area should be filled in by 100 hectare units. The area under the type should either, be obtained from the working Plans/compartment history files or should be calculated by planimentering/dot grid method the

stock maps prepared by the State Forest Department.

(c) Volume Density 22

The information should be filled in on the basis of enumeration data available in the working plans. Allotment of forests to different periodic blocks may also indicate the extent of volume of wood in such forests. The volume density should be classified as under :-

<u>Code No.</u>	<u>Description</u>
1.	High i.e. Volume/hectare exceeds $150 \text{ m}^3$ .
2.	Medium i.e. Volume/hectare lies between 50 to $150 \text{ m}^3$ .
3.	Low i.e. Volume/hectare is less than $50 \text{ m}^3$ .

(d) Size class 23

The size class of the trees occurring in the forest type should be classified under the following categories.

<u>Code No.</u>	<u>Description</u>
1.	Regeneration crop, when the average girth of the crop is less than 20 cms.
2.	Pole crop; average girth of the crop lies between 20-60 cms.
3.	Middle sized; average girth lies between 60-130 cms.
4.	Big sized average girth exceeds 150 cms.

(B)

(a) Forest type 24  
 (b) Area 25-27  
 (c) Volume density 28  
 (d) Size class 29

As for A



- (9) (a) Forest Type. 30  
 (b) Area 31-33 As for A  
 (c) Volume density 34  
 (d) Size class 35

8. WORKABLE PERIODS (36-38) The information under its sub-heads should be filled in after due enquiries from the local forest staff or the persons involved in the extraction of forests.

(a) Seasons 36 The information is to be filled up in respect of seasons during which wood harvesting operations are possible. The different codes are -

Code No.      Description

- . Extraction of Forest Raw materials
1. (a) is possible throughout the year
  2. (b) is not possible during winters only
  - 3 (c) is not possible during winters only.
  - 4 (d) is not possible during rains and winters only.
  - 5 (e) is possible during summer only.
  - 6 (f) is possible during winter only.
  - 7 (g) is possible during winters and rains.

(b) No. of months 37-38 No. of months during which extraction is possible is to be indicated in these columns. The information can be filled up on the basis of information under seasons and if the duration of the seasons are properly known.

9. AVAILABILITY OF  
LOGGING LABOUR

(39-42)

An approximate position on the availability of logging labour under the existing logging practices being adopted in the area, will be known through these columns. The information under the sub heads should be filled in on the basis of concrete studies if any conducted in the area or on the basis of the majority feelings of Logging agencies working in the area.

(a) Availability , 39

Fill in the following codes for

<u>Code No.</u>	<u>Description</u>
1.	Logging labour is available in sufficient numbers.
2.	Logging labour supply is deficient.
3.	Labour is not at all available.

(b) Origin of labour 40

Origin of labour will indicate whether the logging labour, the availability of which was discussed in column 39, is locally available or is imported. The codes will be as under :-

<u>Code No.</u>	<u>Description</u>
1	Labour is locally available
2.	Labour is imported.
3.	Labour is locally available as well as it is imported.
4.	Not applicable.

(c) Deficient labour 41-42

When the labour supply is deficient, the category of deficient labour will be specified under these columns. The codes for some of important categories of logging labour are as under :-

		<u>Code No.</u>	<u>Description</u>
		01	All categories of logging labour is deficient.
		02	Only fellers are in short supply.
		03	Only sawyers are in short supply.
		04	Only ropeway labour is in short supply.
		05	Only carriage labour is in short supply.
		06	Only floating labour is in short supply.
		07	More than one category of labour are in short supply
INFRASTRUCTURE	(43-49)		The information under these columns will throw light on the present state of infrastructure (i.e. roads mainly) and new proposals and how far they could be useful for extraction of forest raw materials.
(a) Road density	43		<p>Road density for an area is normally defined as an average length of roads in Kms. per 100 Sq. Kms. of area. Higher the road density is usually taken to mean higher the state of development in the area.</p> <p>In each major catchment total up the lengths of all categories of existing roads in Kilometers. Divide this total by the geographical area (in Sq.Kms.) of the catchment and multiply the resultant by 100. This will be the road density for the major catchment.</p> <p>The road density for all the units lying in the same catchment will be same.</p> <p>Only one column has been allotted for recording road density. It should be rounded off to one digit only (may be one point of decimal only) and in case</p>

the road density works out to be more than one and there is a difficulty in recording, a suitable note may be given in the form.

(b) Nearness from the existing roads. 44

Nearness of the forest unit from the existing roads has to be indicated under this item.

Fill in the information as per codes listed below -

<u>Code No.</u>	<u>Description</u>
	Distance of the forest unit from the existing roads as :-
1.	a) within 2 Kms.
2.	b) within 2 to 5 Kms.
3.	c) within 5 to 10 Kms.
4.	d) more than 10 kms.

(c) Nature of distance 45

Whether the distance as per discussion under the previous column is uphill, down-hill, mixed or plain will be described here. The codes are :-

<u>Code No.</u>	<u>Description</u>
1.	Uphill - More than 50% of distance is uphill.
2.	Downhill - More than 50% of the distance is down hill.
3.	Mixed - distance is both uphill and down hill.
4.	Plain - Neither uphill nor down hill.

(d) Type of Road 46

For the road, from which Nearness/Nature of distance is assessed as above, fill in the following codes for.

(e) Proposal for new Roads. 47

- | <u>Code No.</u> | <u>Description</u>                 |
|-----------------|------------------------------------|
| 1.              | Road is Jeepable/Tractorable.      |
| 2.              | Road is Truckable and metalled.    |
| 3.              | Road is truckable and un-metalled. |

Fill in the following codes for :-

(f) Proposed road 48-49

- | <u>Code No.</u> | <u>Description</u>       |
|-----------------|--------------------------|
| 1.              | A new road is proposed   |
| 2.              | No new road is proposed. |
- From the cross reference of Road Planning exercise fill in the serial number of the proposed road in two digits.

11. ACCESSIBILITY (50)

The idea is to know whether the extraction wood from the forests of the unit has been or has not been or can be or cannot be carried out. Fill in the following codes for.

- | <u>Code No.</u> | <u>Description</u>  |
|-----------------|---|
| 1.              | The forests contained in the Unit.  |
|                 | (a) have been worked in the past.   |
| 2.              | (b) are being worked.   |
| 3.              | (c) will be worked out and extraction has been prescribed in the working plan.                          |
| 4.              | (d) have never been worked out in past and their extraction has not been provided in the working plans. |

12. EXISTING LOGGING PRACTICES. (51-56)

The information under this head or its sub heads will be filled in on the basis of as to how the extraction of wood is being done presently in the unit itself, if not, in the forest situated nearby or in sub catchment or major catchment of Forest Division

in which this unit lies. The information will be listed only in order of preference stated above.

When the forests of the unit are considered accessible i.e. they have not been classified under category 4, under the heading 'Accessibility' the items under columns here on wards and up to column No.58 should be filled in.

(a) Felling 51

Under this, fill in the following codes for :-

<u>Code No.</u>	<u>Mode of Felling</u>
1.	By Axe
2.	By saw
3.	By both Axe and Saw
4.	By Power Chain Saw
5.	By combination of all.

(b) Conversion pattern 52

The information should be able to throw light upon as to how the extraction is being carried out from the forests. Whether the wood is taken out in the form of logs or it is sawn, roughly split and taken out has to be clearly known from it.

Fill in the following codes for :-

<u>Code No.</u>	<u>Description</u>
	Timber is converted and is taken out in the form of.
1.	(a) logs
2.	(b) Sawn, roughly shaped and split at site.
3.	(c) Logs, sawnwood & splitwood etc. or combination of (a) & (b).

(c) Gross cutting 53

After the trees are felled, they are converted into logs for transport as such or for further conversion into sawn wood splitwood etc. Tools used for cross-cutting will be described here.

<u>Code No.</u>	<u>Mode of cross-cutting</u>
1.	By <del>Axe</del>
2.	By Saw.
3.	By power Saw.
4.	By all.

Only most likely tool used has to be mentioned.

(d) Conversion at site. 54

Sometimes or most-ly in difficult terrains, it is not possible to take out wood in the form of logs or in heavier sizes on account of the transportation difficulties and economic reasons. The timber, is, therefore, sawn, roughly fashioned or split at site and is then taken out. Whether the conversion at site is done or not and when it is carried out, the tools with which it is done, should be described here.

Fill in the following codes for :-

<u>Code No.</u>	<u>Description</u>
	Conversion of timber at site is done by -
1.	Axe
2.	Hand Saw
3.	Axe and Hand Saw
4.	Power driven saw mills.
5.	Axe, hand saws, saw mills installed in or near the forests.
6.	Conversion of timber at site is not done at all.

(e) Off-road transport 55

Methods and devices used for transport of wood from stump to the nearest road head or the launching depot should be indicated under this column.

Fill in the following codes for :-

<u>Code No.</u>	<u>Description</u>
1.	Skyline cranes and ropeways are used.
2.	Winches and yarders are used.
3.	Donald gravity ropeways.
4.	Manual labour
5.	Not done.

Coding should be done on the basis of the hierarchy of the device used and under only one of the codes mentioned above. When ropeways are used, winches and manual labour may have been used for off road transport but code for ropeway above has to be given. Similarly for codes 1 and 2.

(f) Road transport

56

After the off-road transport the wood may have to be transported to the delivery site either directly by road or through water transport and then through road transport. It is also possible that road transport may not be required at all. The information on these aspects will be recorded in this column.

Code are -

<u>Code No.</u>	<u>Description</u>
	Road transport of wood is done by
1.	(a) Trucks.
2.	(b) Tractors and Gattoos
3.	(c) Both
4.	(d) Road transport of wood is not done at all.



-- (g) Floatability 57-58

Under this - information on two aspect is required to be given. Firstly it has to be known whether all the streams are floatable or not Secondly; will it be possible to float all kinds of conifers wood in all the streams flowing by the side of unit or not ? This information is summarised as per codes given below :-

(1) Floatability of 57 streams.

Code No.      Description

Floating of wood is possible in

1.      a)    main rivers only.
2.      b)    main rivers and side nallahas.
3.      c)    Floating of wood is not possible.

(Main rivers will include, Bhilangana, Bhagirathi, Yamuna and Tons.)

(ii) Floatability of 58 wood

Code No.      Description

All kinds of coniferous wood are floated in.

1.      i) main rivers only.
2.      ii) Main river and side nallahas also.
3.      Coniferous logs are floated in main rivers only.
4.      Wood has never been floated.

13. PROPOSALS FOR CHANGES IN EXISTING LOGGING PRACTICES. (59)

Code No.      Description

1.      Changes in existing logging practices are proposed.
2.      No change is proposed.

Changes should be proposed only on the basis of some concrete studies and not on whimsical grounds

14. OPERATIONS IN WHICH  
CHANGES ARE SUGGESTED

(60-61)

Operations in which changes have been suggested should be spotted in these columns. Codes for some of the important operations are given below.

<u>Code No.</u>	<u>Description</u>
01	Felling
02	Cross-cutting
03	Sawing
04	Off-road transport.
05	Felling and cross cutting
06	Felling and sawing.
07.	Felling and off-road transport.
08.	Cross-cutting and sawing.
09	Cross cutting and off-road transport.
10	Sawing and off road transport.
11	Felling, cross cutting and sawing.
12	Cross cutting, sawing and off road transport.
13	Sawing, off road transport and cross cutting.
14	Off road transport, felling and cross cutting.
15	All operations.

15. AVAILABILITY OF  
LABOUR ON CHANGES  
IN EXISTING LOGGING  
PRACTICES.

(62)

Only a rough estimate needs to be given codes are -

<u>Code No.</u>	<u>Description</u>
1.	Sufficient labour will be available.
2.	Sufficient labour will not be available.
3.	Labour will not be available at all.

16. PROPOSED LOGGING  
PRACTICES.

(63-69)

Columns under this head/sub-heads should be filled in very carefully and on the basis of some specific studies conducted by our organisation or by any other agency. Guesses and stray ideas should be avoided.

(a) Conversion pattern 63

Fill in the following codes for :-

Code No.      Description

1. Timber should be extracted in the shape of logs only.
2. Timber should be sawn, roughly fashioned and split and then extracted.
3. Timber should be extracted in shape of logs, sawn and pulpwood.
4. Extraction is not possible and should not be done.

When extraction is indicated under this column i.e. code filled in is 4, columns from here onwards should not be filled in.

(b) Felling 64

Code No.      Description

Felling should be done with the help of -

1. Axe
2. Saw
3. Power Chain Saw
4. All the tools mentioned above.

(c) Cross-cutting 65

Fill in the following codes for -

Code No.      Description

Gross cutting should be done by

1. Axe
2. Saw
3. Power Chain Saw.
4. All

(d) Conversion at site. 66

Fill in the following codes for :-

Code No.      Description

Conversion at site should be done by -

1. (i) Axe
2. (ii) Saw
3. (iii) Both Axe and Saw
4. (iv) Power driven saw mills.
5. (v) By all the above tools.
6. Conversion of timber should not be done at site.

(e) Off-road transport

67

Fill in the following codes for :-

- | <u>Code No.</u> | <u>Description</u>                  |
|-----------------|-------------------------------------|
|                 | For off-road transport.             |
| 1.              | Sky line cranes should be used.     |
| 2.              | Winches and yarders should be used. |
| 3.              | Donald ropeways.                    |
| 4.              | Manual labour shall be used.        |

(Please see other instruction under existing logging practices).

(f) Road transport 68

Fill in the following codes for :-

- | <u>Code No.</u> | <u>Description</u>                                |
|-----------------|---|
|                 | Road transport of wood should be done by -        |
| 1.              | Trucks  |
| 2.              | Tractors/Gattoos                                  |
| 3.              | Both  |
| 4.              | Road transport of wood should not be done at all. |

(g) Floating

69

Fill in the following codes for :-

- | <u>Code No.</u> | <u>Description</u>          |
|-----------------|-----------------------------|
|                 | Timber should be floated in |
| 1.              | 1) Main rivers only.        |

2. ii) Main rivers and side nallahs also.
3. iii) Timber should not be floated at all but should be carried through road transport.

17. STATUS OF INFORMATION

(70)

Whether the unit was visited or not visited for filling up information under most of the columns will be indicated in this column.

Code No.      Description

1. The unit was visited and the extraction work was in progress.
2. The unit was visited but the extraction work was not in progress.
3. The unit was not visited and information was filled in from stock maps/working plans and other sources.

18. SOURCE OF INFORMATION

(71)

For most of items, the source of information in respect of items should also be quoted. Fill in the following codes for -

Code No.      Description

1. Source of information is -
1. Stock Maps/Working Plans etc.
2. State Forest Department.
3. Other Government agencies.
4. Private agencies.
5. Any other agencies.
6. All Agencies.

(72-73)

Blank.

19. S. NO. OF FOREST UNIT. (74-76) Three digits. The forest units should be serially numbered and written as under :-  
001, 002, 003.....and so on.
20. CREW LEADER (77) Give codes as per plot descriptive form of inventory.
21. SUB CATCHMENT NO. (78-79) Two digits. The sub catchments should be serially numbered and written as under :-  
01, 02, 03.....and so on.
22. CATCHMENTS (80) One digit. There are four major catchments in the survey area and the codes are as under :-

<u>Code</u>	<u>Catchment</u>
1.	Bhilangana
2.	Bhagirthi
3.	Yamuna
4.	Tons.

2. COST STUDIES - RATES OF EXTRACTION (I)

(Under Existing Logging Practices)

.....

Rates(per M<sup>3</sup>) being paid presently for different logging operations carried out for the extraction of logs, sawn wood and pulp wood/fuelwood under the existing logging practices will be filled up in this form.

The information should be collected separately for all the units. This will be done to ensure for taking into the account, the effects of all variations, due to type, age/size, volume, density etc. of the crop in the unit as described in Form -I, on the rates of extraction. The units in which the extraction is in progress, the information should be filled in on the basis of rates being actually paid for various logging operations. For the remaining units the data should be based on the following criteria :-

- (i) Rates paid or preferably being paid in the nearby forests with similar working conditions, both by private lessees and the Forest Department.
- (ii) Schedule of rates fixed by the forest department for extraction of wood from those areas in which the unit is situated .
- (iii) Prevailing rates as being charged by other agencies engaged with the work of extraction and transportation.

Before making the entries the information obtained from different sources should be thoroughly compared and checked.

Rates shown against an operation will include any or all of the following :-

- a) the wages paid to the labour.
- b) Costs incurred on the facilities being provided to the labour.
- c) commission paid to the labour contractors.
- d) cost of materials used.
- e) costs on account of repairing, maintenance, rent, installation/dismantling as well as depreciation of machinery when used.

Contribution towards cost on account of Establishment/sundry charges and adjustments due to conversion and floating/transport losses have not to be taken into account. Separate provision has been made in Form-III

for the record.

In a unit, some or all the logging operations mentioned in the form will be used depending upon the conversion pattern and methods of extraction being followed for the unit. The rates for the operations not being used for the extraction of wood, need not be filled in and instead a code value consisting of all 9's should be filled to indicate both "NOT REQUIRED" and "NOT APPLICABLE". For items having two, three or four columns, the entries will be 99,999 and 99999 respectively.

For individual items, please read the instructions given against each of items.

S. NO.	ITEMS	COLUMNS NOS.	INSTRUCTIONS.
1 to 5	As per Form I	1 to 10	Codes should be filled in as per Data Descriptive Form No.1.
6	EXTRACTION OF LOGS	(11-28)	<p>Rates will be given only for major logging operations viz.,</p> <p>(i) Felling and cross-cutting.  (ii) Off-road transport  (iii) Road transport and floating.</p> <p>Costs for other operations will be apportioned/appropriated to any of the above mentioned major operations.</p>
(a)	Felling of Trees and cross cutting them into logs.	11-13	<p>In ten paise units (i.e. Decimals). This cost will be per cubic meter of converted logs and will also include expenditure on the following additional operations i.e.</p> <p>i) marking, lopping, roping etc. of trees  ii) debarking of logs.  iii) 'Khundan' marking on logs.  iv) Any other expenditure incurred in the forests.</p>
(b)	Off-road Transport.	14-19	<p>For off-road transport, only two operations have been recognised i.e. (i) Rolling of logs including manual carriage and  (ii) Transport through ropeways.</p>



(i) Rolling of logs 14-16

In ten paisa units (in Deci. Rs.)  
per Km. of distance.

The cost on account of rolling/  
carriage of logs will include the  
costs on the following operations  
also :-

- i) Construction of Rolling/carriage  
paths (if any).
- ii) Stacking of logs at the end of  
job.

(ii) Transport through  
Ropeways. 17-19

In ten paisa units (In deci. Rs.) per  
Km. span of ropeways.

Rates will cover expenses towards  
labour cost of materials, depreciation  
of machinery and stacking at the last  
station of ropeways etc.

Note :- Other methods of off-road  
transport are not anticipated  
in U.P. area. If per chance  
they happen to be different  
than the two operations  
mentioned above, they should  
be included under any of the  
two.

(c) Road Transport 20-25

Under this, only three categories  
of roads i.e. Hill Kaccha, Hill  
pacca and Plain roads have been  
considered for road transport of  
wood. Any variation from this may  
be properly recorded in remarks  
columns.

(i) Hill kaccha 20-21

Rate will be in piasas per cubic  
meter of wood and per Km. of  
distance.

(ii) Hill pacca 22-23

-do-

(iii) Plain roads 24-25

-do-

(d)	Floating till destination	26-28	<p>Rate will be in Deci. Rupees (i.e. ten paise) per M<sup>3</sup> till the delivery site. The distance of delivery sites for different units is given in the distances data form (IV). For the forests of Tehri and Uttarkashi Forest Divisions, the delivery site is fixed at Rishikesh, whereas Jaulia near Dakpathar will be the destination for the forests of Chakrata, Yamuna and Tons Forest Divisions.</p> <p>Rate under this operation will include the costs on account of one or more of the following:-</p> <ol style="list-style-type: none"> <li>i) Launching</li> <li>ii) Transport through west slides.</li> <li>iii) Floating in side nullahs and creation of channels etc.</li> <li>iv) Floating in main rivers.</li> <li>v) Rafting.</li> <li>vi) Stacking and re-stacking etc. at depots.</li> <li>vii) Installation/Dismantling of booms, launching/floating fee etc.</li> <li>viii) Cost of materials.</li> <li>ix) Other costs in improvement of the river beds etc.</li> </ol>
7.	EXTRACTION OF SAWN TIMBER	(29-51)	<p>Wherever the wood is being extracted in the form of sawn timber whether it is being sawn through conventional saws or power driven saw mills, the columns under this major head or its sub heads should be filled in.</p> <p>Other detailed instructions will be the same as given against various columns under extraction of logs.</p>
(a)	Felling of Trees	29-30	<p>Rate will be in Deci. Rs. per M<sup>3</sup> of sawn wood.</p> <p>Fill in the code 88 if the cost on this operation has been included in sawing.</p>
(b)	Sawing of Timber	31-36)	
(i)	Sawing by Handsaws	31-33	In deci. Rupees per M <sup>3</sup> of sawn wood.

ii)	Sawing by power Driven Saw Mills.	34-36	In Deci. Rupees per M <sup>3</sup> of sawn wood.
(c)	Off-road Transport	37-42	In Deci. Rupees per m <sup>3</sup> of sawn wood.
i)	Manual carriage	37-39	-do-
ii)	Transport by ropeways	40-42	-do-
(d)	Road Transport	(43-48)	
i)	Hill Kaccha Road	43-44	in paisas per m <sup>3</sup> per km.
ii)	Hill pacca Roads	45-46	In paisas per m <sup>3</sup> per km.
iii)	Plain Roads	47-48	-do-
(e)	Floating till Destination.	(49-51)	In Deci. Rupees and as per destinations described under extraction of logs.
8.	EXTRACTION OF PULP FUEL WOOD	(52-71)	Detailed instructions will be the same as for logs and sawn timber.
(a)	Felling of trees	(52-53)	In Deci. Rupees per M <sup>3</sup> of converted pulp/fuel wood.

Wherever pulp/Fuel wood is available as by product one of the trees felled for extraction of either logs or timber, code 99 should be filled in. But when this cost is included in the cost of conversion, the next operation, code 88 should be filled in.

(b)	Conversion	54-56	In Deci. Rupees.
-----	------------	-------	------------------

Rate should include costs on account of the following also :-

- (i) Gross-cutting/billoting/splitting.
- (ii) debarking, if any
- (iii) carriage and stocking.
- (iv) Other costs on materials etc.

(a)	Off Road Transport	(57-62)	
-----	--------------------	---------	--

(i)	Manual carriage	(57-59)	
-----	-----------------	---------	--

In Deci. Rupees per m<sup>3</sup> and per Km. of distance.

(ii)	Transport by bypeways.	(60-62)	In Deci. Rupees per m <sup>3</sup> and per Km. of distance.
(d)	Road Transport	(63-68)	
(i)	Hill kaccha Roads	63-64)	In paise per m <sup>3</sup> and per Km. of distance.
(ii)	Hill pacca Roads	65-66)	
(iii)	Plain Roads	67-68)	
(e)	Floatin, till Destination.	(69-71)	In Deci. Rupees till the delivery site's as discussed under extraction of logs.
		72-73	Blank.
9.	S.NO. OF THE UNIT	74-76)	
10.	CREW LEADER	77)	as in Data Descriptive Form - I.
11.	SUB CATCHMENT NO.	78-79)	
12.	CATCHMENT	80)	

3. COST STUDIES - RATES OF EXTRACTION (II)

Under proposed Practices (Additional operations only) out-turn %, Floating losses, Other factors of conversion etc.

.....

The information to be filled in this form will include -

- (a) the rates of extraction for operations suggested under proposed Logging Practices.
- (b) contribution by the proposed roads towards the extraction costs.
- (c) establishment/contingency charges for the extraction of different categories of wood under existing as well as proposed practices.
- (d) Out-turn percentages available under existing and proposed practices.
- (e) floating/transport losses and
- (f) other factors.

Rates for suggested operations under proposed logging practices will be filled on the basis of the results of experiments/studies conducted on the use of logging devices and keeping in view the detailed instructions laid down for filling up the Form - III.

Data on the costs on account of the construction of new roads and improvement of existing ones towards the costs of extraction will be based on the road planning exercise for the area.

Establishment/contingency charges for the extraction of different categories of wood under existing and proposed methods of extraction, will be worked out on the basis of total quantities/values of wood extracted vis-a-vis the total expenditure under these charges.

Information on out-turns will be based either on the extraction figures available from the nearby and similar forests where extraction has been completed or on the result of some specific studies conducted for the purpose.

Floating/Transport losses, if any, will be given on the results of floating/transportation carried out in the past from these forests or some nearby forests.

Instructions for filling up the form are briefly as under :-

S.NO.	ITEMS	COL.NOS.	INSTRUCTIONS
1-5	As in DDF I	1-10	See instructions under Data descriptive Form - I
6.	RATES UNDER PROPOSED PRACTICES	(11-24)	Detailed instructions as per Form- II
(a)	Felling	(11-12)	In Dec. Rs. m <sup>3</sup> of converted wood.
(b)	Felling & Cross-cutting.	13-15	In Dec. Rs. per m <sup>3</sup> of logs. When rate for felling is given under (a), it will be taken to mean that the rate under (b) is for cross cutting only.
(c)	Sawing through Power Driven Saw Mills.	16-18	In Deci. Rupees per m <sup>3</sup> of sawn wood.
(d)	Off-road Transport	(19-24)	
	i) Use of winches/yarders.	19-21)	In Deci. rupees per m <sup>3</sup> per Km. of distance.
	ii) Use of skyline cranes	22-24)	Note :- For "NOT APPLICABLE" and NOT REQUIRED" entries please fill in code consisting digits of 9's.
7.	CONTRIBUTION OF PROPOSED ROAD TOWARDS EXTRACTION COSTS.	25-27)	Rate will be in deci.rupees per m <sup>3</sup> of all categories of wood extracted and will be based on Road Planning Exercise.
8.	ESTABLISHMENT/CONTINGENCY CHARGES.	28-45)	The establishment/contingency charges incurred on the extraction of logs. Sawn Timber and Pulp/fuel wood(per m <sup>3</sup> ) under the existing as well as proposed logging practices will be filled in these columns.

The general instruction given earlier for working out these costs is clarified through the following specific instruction.

Suppose 100 m<sup>3</sup> of wood of which logs were 40 m<sup>3</sup> sawn timber 30 m<sup>3</sup> and pulp/fuel wood 30 m<sup>3</sup> were extracted from a forest at the following costs :-

- i) Logs @ Rs. 40 per m<sup>3</sup> - Rs. 1600.00
- ii) Sawn wood @ Rs. 70 p.m<sup>3</sup> - Rs. 2100.00
- iii) Pulp/fuelwood @ Rs. 30/- Rs. 900.00

Total Expenditure Rs. 4600.00

Net total expenditure -

on Establishment/Contingency be Rs. 800/-

Then Establishment charges per m<sup>3</sup> of logs, sawn wood and pulp /fuelwood should be calculated as

$$\frac{1}{40} \times \frac{1600}{4600} \times 800, \frac{2100}{4600} \times 800 \times \frac{1}{30}$$

and  $\frac{1}{30} \times \frac{900}{4600} \times 800$  respectively i.e.

Rs. 7/-, Rs. 12.17 and Rs. 5.22 approximately

The sub heads are -

(a) Under Existing Practices. (28-36)

(i) Logs	28-30	In Deci. Rupees per m <sup>3</sup>
(ii) Sawn wood	31-33	-do-
(iii) Pulp/Fuelwood	34-36	-do-

(b) Under Proposed Practices. (37-45)

(i) Logs	37-39	-do-
(ii) Sawn Wood	40-42	-do-
(iii) Pulp/Fuelwood	43-45	-do-

OUT-TURN PERCENTAGES (46-57)

In whatever shape, the wood has been or is proposed to be extracted, out turn need to be given only for those categories of wood. For the remaining items code for being Not Applicable (in all 9's) be filled in.

Out turn percentages are to be given both for existing and proposed logging practices.

Suppose 100 m<sup>3</sup> of standing volume is felled and as a result of extraction 20 m<sup>3</sup> of logs, 10 m<sup>3</sup> of sawn timber and 30 m<sup>3</sup> of pulp wood have been or are proposed to be extracted, out turn percentages for logs, sawn timber and pulp wood will be taken as 20 10 and 30 respectively under existing or the proposed practices as the case may be.

Fill in these percentages on the basis of information collected from the Local Forest Department and Agencies engaged in the extraction work.

The condition of the forests i.e. quality, cull etc. occurring therein should be kept in view.

(a)	Under Existing Practices.	(46-57)	Fill in 99 for 'NOT APPLICABLE' entries.
	(i) Logs	46-47)	
	(ii) Sawn timber	48-49)	
	(iii) Pulp/Fuelwood	50-57)	
(b)	Under Proposed Practices	(52-57)	The losses during floating/transportation of wood are to be reported under those columns.
	(i) Logs	52-53	
	(ii) Sawn timber	54-55	
	(iii) Pulp/Fuelwood	56-57	
10.	FLOATING/TRANSPORT LOSSES.	(58-65)	

Since there is always a big difference in the amount of losses in different categories of wood when they are floated down the rivers/nallahs, a provision has been made to record them separately. As far as transport of wood by road is concerned, chances of losses being smaller, separate, categories have not been made and the losses are put under one record only.



The losses will be indicated in percentages.

The information will be filled in on the basis of records/information supplied by the Forest Department/Lesses etc.

(a) Floating losses

- (i) Logs 58-59
- (ii) Sawm timber 60-61
- (iii) Pulp/Fuelwood 62-63

Code 99 for "NOTE APPLICABLE" entries should be used.

(b) Transport Losses 64-65

11. OTHER FACTORIES OF CONVERSION. (66-72)

A few other factors of conversion useful from the extraction point of view are mentioned here. They can also be termed as out turn factors.

The information should be as accurate as possible and should be on averaged based on local experience.

(a) Conversion factors

The information should be as follows :-

<u>CODE</u>	<u>PERCENTAGES OUT TURN</u>
1.	$\angle$ 15 and $>$ 5
2.	$\angle$ 25 and $>$ 15
3.	$\angle$ 35 and $>$ 25
4.	$\angle$ 45 and $>$ 35
5.	$\angle$ 55 and $>$ 45
6.	$\angle$ 65 and $>$ 55
7.	$\angle$ 75 and $>$ 65
8.	$\angle$ 85 and $>$ 75
9.	85

For non-applicable entries leave blank.

(i)	Logs from standing trees.	66	
(ii)	Sawn timber from logs.		
i)	By Hand Saw	67	
ii)	By Saw Mills	68	
iii)	Pulp/Fuelwood from		
i)	Logs as by product.	69	
ii)	Trees	70	
(b)	Pulp/Fuelwood Volume/Weight factors	71-72	This should be filled up only upto one place of decimal for air dry pulp/Fuel wood (in m <sup>3</sup> per ton).
		73	) Blank.
12.	S.NO. of Unit	74-76	)
13.	CREW LEADER	77	)
14.	SUB CATCHMENT NO.	78-79	)
15.	CATCHMENT NO.	80	)

4. COST STUDIES - DISTANCES DATA FORM

Different categories of distance under off Road/Road Transport and Floating, over which the forest raw materials extracted from the forests of unit will be transported, will be filled up in this form.

Rishikesh and Jalalia (near Dakpathar) will be the delivery sites for the forest raw materials extracted from Tehri/Ugtarkashi and Yamuna/Chakrata/Tons Forest Divisions respectively.

Off road distances for the forests which are visited and in which the extraction is in progress, will be filled in on the basis of actual carriage being done both manually as well as through ropeways. The units which are inspected but the extraction is not in progress, the information on off-road distances will be worked out, as though the carriage had to be done in actual practice. For the remaining units, it will be calculated from topographical and stock maps. For manual carriage, the distances will be worked out by aligning paths on topographic maps in 1 in 6 gradients whereas for ropeways on average gradient of 1 in 10 should be adopted. For up-hill transport, the distance should be doubled.

For Road Transport, the distance should be filled in on the basis of actual road lengths of existing roads. The distances of the proposed roads will be taken from road planning exercise. Suling gradient of 1:25 to 1:30 has been assumed for construction of proposed roads in this exercise.

The distances for floating will be obtained after measurements on the maps. In case, the same are available in Forest Department records, they should be compared with the distances measured on the map and then entered in this form.

Two or more entries (one below the other) should be made for the distances when the wood extracted from the forest is transported to some intermediate conversion/processing centres from where the processed products are later on transported to the delivery sites. The specific example of logs can be cited in this regard. Logs extracted from the forests may be taken to saw mills where they are sawn and later on the sawn timber is transported to the delivery sites. In the first part, cost, of transport will relate to logs and in the second part it will be for sawn timber.

In this form, distances for both the practices i.e. Existing as well as Proposed will be given.

Other instruction for filling this form are briefly as under :

S.NO.	ITEMS	COL NOS.	INSTRUCTIONS						
1-5	As per Form I	1-10	Codes as per Data Descriptive Form-I						
6.	DESTINATION	11	Codes will be as under :-  <table><tr><th>Code No.</th><th>Destination</th></tr><tr><td>1.</td><td>Rishikesh</td></tr><tr><td>2.</td><td>Jalalia (Near Dakpathar)</td></tr></table>	Code No.	Destination	1.	Rishikesh	2.	Jalalia (Near Dakpathar)
Code No.	Destination								
1.	Rishikesh								
2.	Jalalia (Near Dakpathar)								
7.	DISTANCES UNDER EXISTING LOGGING PRACTICES	12-30							
(a)	Off Road Transport	12-17	Distances will be in 100 meters:						
	i) Manual carriage	12-14							
	ii) Ropeways.	15-17							
(b)	Road Transport	18-25	Distances will be in Kms.						
	i) Hill Kaccha roads	18-19							
	ii) Hill pacca roads	20-22							
	iii) Plain roads	23-25							
(c)	Floating	26-30	Distances will be in Kms.						
	i) Side nallahas	26-27							
	ii) Main rivers	28-30	Tons, Yamuna, Bhagirathi and Ghilangana will be taken as main rivers and the remaining as side nallahas.						
8.	DISTANCES UNDER PROPOSED LOGGING PRACTICES.	31-55							
(a)	Off road Transport	31-42	Distances will be in 100 meters.						
	i) Manual Rolling/ carriage	31-33							
	ii) By winches/yarders	34-36							
	iii) Skyline cranes/ Ropeways.	37-39							
	iv) By carts, Pack Animals etc.	40-42	Do not fill it for U.P. areas.						

(b)	Road Transport	43-50	Distances will be in Kms.
	i) Hill kaccha roads	43-44	
	ii) Hill pacca roads	45-47	
	iii) Plain roads	48-50	
(c)	Floating	51-55	Distances will be in Kms.
	i) Side nallahas	51-52	
	ii) Main rivers	53-55	See instructions against column 28-30.
	Blank	56-73	
9.	S.No. of Unit	74-76	
10.	CREW LEADER	77	As per Data Descriptive Form.I
11.	SUB CATCHMENT NO.	78-79	
12.	CATCHMENT NO.	80	

5. INSTRUCTIONS FOR FILLING INFORMATION IN THE PROFORMA ON  
ROAD PLANNING EXERCISE.

.....

1. Name of the Road.

Give a specific name to the road, may be on the basis of the names of the places at both the ends of the road or on the basis of area through it passes.

2. Sl.No. of the Road

Give a serial number to each road.

3. Catchment

Write down the name of the catchment the name of the catchment through which the major portion/length of the road passes, catchments having the same meaning and the codes as given in different forms.

4. Sub-Catchment

If the road wholly lies in a sub catchment write the serial number of the sub catchment also.

5. Average cost of the construction per Km. of Distance

In the areas where the road is being proposed for construction, find out from the local P.W.D. or the local Forest Department as to what will be the average cost of construction per kilometer of road distance in that area.

6. Proposed Length and Standing Volumes which will be made exploitable.

Under this, places for five entries have been provided. The idea is that when a road is being constructed starting from a point on the road already constructed, it will connect a no. of forests. The length from the main road till the first forest should be entered under (A) alongwith the total growing stock (Vol.) of the forests made exploitable on account of this road link. On further extension, this road may connect another forest. Total length of the road upto the second forest and total growing stock of the first and second forests may be entered under (B). Proceed similarly in respect of entries under C, D and E.

The underlying idea for recording the road lengths and total volumes, under this heading is to find out the optimum length of the proposed road. The road-length on account of whose construction, net return from the extraction of wood from the forests is the highest after taking into account the expenditure of road construction, will be termed as optimum length of the road.

7. Out Turn

(A) Average Out Turn Percentage when Road is not Proposed.

If the extraction were to take place as if the proposed road were not

there, the percentage of all categories of wood i.e. logs, sawn timber, fuel wood available as a result of extraction from the total standing volume marked for felling will be filled in, under this item, State Forest Department will be the best source to give out this information.

(B) Average Out Turn Percentage when proposed Road is Constructed.

When the road is constructed the conversion pattern may change and higher out-turn may be possible. Fill in this out-turn percentage figure. It will be an estimate on the basis of information supplied by the Forest Department.

In both A & B it is not necessary to aim at collection of very precise information.

8. Cost of Extraction Till Delivery Site or Market.

The information under this head will be compared and filled up for as many sets as the no. of proposed road lengths.

(A) Average Cost per Cu. M. when the proposed Road is Not There.

Find out approximate quantity of different categories of wood, their costs of extraction at the delivery site under the existing conditions of working. The information will be available from the Forest Department/ Timber contractors.

(B) Average Cost Per Cu.M. when Road is there.

Find out the costs of extraction per cu.m. and approximate quantities of all categories of wood extracted from the forest when the proposed road is there. Give these costs under two sub heads namely (i) excluding cost of the road constructed & (ii) including cost of the road constructed.

When the cost of construction of the road is included it will be taken to mean that the road has been solely constructed for the purposes of extraction of wood only.

9. Prices

(A) Average Price Per cu. M. Delivery Site when the Road is not there.

From the sales rates of the past three years, find out what is that average price per cu.m. of all categories of wood extracted through conventional methods. The source will be Forest Department and the timber market.

(B) Average Price Per Cu. M. when the Road is there

The conversion pattern may change with the construction of this new road.

Find out the price per cu.m. from the sales of last 3 years as done under

(A). In this case also, the source will be the Forest Department and the timber market.

10. Net Profits Per Cu. M. on Road Lengths.

Price multiplied with out-turn will give out the gross-return. Net profit per cubic meter will be obtained when the cost of extraction is subtracted from the gross return and divided by the total standing volume. For different lengths of the roads, different figures for net profit will be worked out and will be entered against the different columns provided for the purpose.

11. Optimum Road Length

The length of the road which gives the maximum net profit will be called optimum length. This road should be recommended for construction.

12. Contribution Per Cu. M. of Volume (Standing).

Work out the total expenditure on the construction of recommended roads, divided by the total standing volume and obtain figures per cu.m. of standing volume. This contribution can also be worked out for one cu.m. of converted volume for the forests of each unit on the basis of the conversion pattern followed/to be followed in that unit.



6. INSTRUCTIONS FOR FILLING IN THE PROFORMA FOR EXPERIMENTS ON  
LOGGING DEVICES

.....

1. Name of the Devices used :

Power Chain Saw, Saw Mills, Skyline Cranes, Tractors etc.

2. State briefly where-experiments were conducted

Discribe briefly the condition of the area where the device has been used for experimentation, so that the results available on the use of logging devices are not made applicable to the areas having different conditions.

3. Source of Data

When the experiment has not been done by the staff of this organisation and data is collected or is supplied by other agencies, this column should be filled in and the name of the agency who has supplied the data, should also be stated.

4. Bio-data of Machine

The information under the sub-headings of this item should be filled in on the basis of the information supplied by the manufacturing agencies for the logging devices. For installation charges and calibrated life the experience of the agencies who have used the device should be weighed against the information supplied by the manufacturers. The information should be entered after thorough satisfaction.

5. Cost for doing the Job.

(A) Through Machine

All costs for doing a particular job with the help of the machine should be entered under this sub-head.

(B) When Machine is Not used.

The costs for doing the same job as mentioned under (A) when the machine/ logging device is not used should be noted here.

6. Recommendations

Recommendations should be made on the basis of entries under 5A and 5B. If there are some other reasons on account of which the device has to be recommended for use, mention those reasons also very clearly. Attach profitability calculations, if any, in support of your recommendations.

7. PROFORMA FOR ROAD PLANNING EXERCISE

1. Name of the Road
2. Code/Serial Number of the Road
3. Catchment
4. Sub Catchment
5. Av. Cost of Construction per Km. of Distance(P.W.D./Forest Department).
6. Proposed Lengths and Standing Volumes which will be made exploitable.

A		B	C
i)	Length	i) Length	i) Length
ii)	Total Volume	ii) Total Volume	ii) Total Volume.

D		E
i)	Length	i) Length
ii)	Total Volume	ii) Total Volume.

7. Out-turn.

- (a) Av. Out-turn percentage when Road is not proposed.  
(All Categories of Wood) - Source F.D.
- (b) Av. Out-turn Percentage when Proposed Road is Constructed.  
(All Categories of Wood) - (Source F.D./Estimate).

8. Cost of Extraction Till Delivery Site/Market.

- (a) Av. Cost/Cu.m. when Road is not there.  
(All Categories) - Source F.D.
- (b) Av. Cost/Cu.m. when Road is there  
(All categories) - i) Excluding cost of road construction  
(Estimates)  
ii) Including cost of road construction  
(Source road costs).

9. Prices.

(a) Av. Price/Cu.m. when Road is not there.

(All categories) - Source F.D. MARKET

(b) Av. Price/Cu.m. when Road is there.

(All Categories) - Source F.D./Market

10. Net Profit on Road Lengths.

A	B	C	D
i) Length	i) Length	i) Length	i) Length
ii) Profit	ii) Profit	ii) Profit	ii) Profit

11. Optimum Road Length.

12. Contribution/Cu.m. of Volume (Standing).

8. PROFORMA FOR EXPERIMENTS ON LOGGING DEVICES

.....

1. Name of the Device used.
2. State briefly where Experiments were conducted(tract, terrain, type, asscessibility and other conditions).
3. Source of Data (Attached Data).
4. Bio-Data of Machine.
  - i) Name of the Machine
  - ii) Name of the Manufacturing Agency.
  - iii) Capital Cost.
  - iv) Installation charges.
  - v) Caliberated Life.
5. Costs for doing a Job.
  - (a) Through Machine.
    - i) Running
    - ii) Maintenance
    - iii) Further installation, if any.
    - iv) Depreciation
    - v) Establishment and Other Charges.
    - vi) Total
  - (b) When Machine is Not used.
6. Recommendations.

State reasons briefly,if there are other reasons on account of which the device has to be used. Attached profitability calculation if any, in support of your recommendations.

SECTION - X

SAMPLE COPIES OF FIELD FORMS

## FORM I.

REINVESTMENT SURVEY OF FOREST RESOURCES  
NORTHERN ZONE

## COST STUDIES- DESCRIPTIVE DATA FORM.

(U.P.)

JOB	CALD REGION	STATE	REVENUE DISTRICTS	FOREST DIVISIONS
1-3	4-5	6-7	8	9-10

Crew leader	Sub Catchment No.	Catchment No.
77	70-79	80

Date:..

TERRAIN		FORESTS				WORK-ABLE PERIODS		AVAILABILITY OF LOGGING LABOUR.		INFRASTRUCTURE		EXISTING LOGGING PRACTICES		PROPOSED LOGGING METHODS SUGGESTED																																																																						
LATITUDE	HIGHEST	TYPE-I			TYPE-II			TYPE-III			No. of months	Origin	Different category	Road density	Nearness existing roads	Nature of distance	Type of existing roads	Proposals new roads	S.No. proposed roads	Accessibility	Felling	Conversion pattern	Crosscutting	Conversion at site	Off road transport	Road transport	Streams	Wood	Proposed changes in ELP	Operation changes	Availability of labour on charges	Conversion pattern	Felling	Cross cutting	Conversion at site	Off road transport	Road transport	State of forest unit																																														
		Area	Volume Density	Forest Type	Area	Volume Density	Forest type	Area	Volume Density	Forest type																													Area	Volume Density	Forest type	Area	Volume Density	Forest type																																								
11-	13-	18	19	20	21	22	23	24	25	26	27	28	29	30	31	32	33	34	35	36	37	38	39	40	41	42	43	44	45	46	47	48	49	50	51	52	53	54	55	56	57	58	59	60	61	62	63	64	65	66	67	68	69	70	71	72	73	74	75	76	77	78	79	80	81	82	83	84	85	86	87	88	89	90	91	92	93	94	95	96	97	98	99	100

**AN INVESTMENT SURVEY OF FOREST RESOURCES  
NORTHERN ZONE**

**COST STUDIES RATES OF EXTRACTION/CUM.**  
**UNDER EXISTING LOGGING PRACTICES**  
**( U. P ).**

JOB	CARD DESIGN	STATE	REVENUE DISTRICTS	FOREST DIVISION
1-3	4-5	6-7	8	9-10

Crew Leader	Sub-Catch- ment No.	Catch- ment No.
77	70-79	80

[illegible]





FORM-IV

PLAIN STATE SURVEY OF FOREST RESOURCES  
IN PUNJAB

JOB	CARD	STATE	REVENUE	FOREST
DESIGN		DISTRICTS	DIVISIONS	
1-3	4-5	6-7	8	9-10

COST STUDIES - DISTANCES DATA PART  
(U.P.)

CREW	SUB CATCH- MENT NO.	CATCHMENT NO.
77	78-79	80

EXISTING LOGGING PRACTICES		UNDER PROPOSED LOGGING PRACTICES									
Off Road Transport in 00 meters.	Road transport in Kms.	Floating in Kms.	Off Road Transport in 00 meters.	Road Transport in Kms.	Floating in Kms.	BLANK					
Manual cartage in 00 meters.	Hill Kacha Road Hill Pacca Road	Side Nallaha Plain Road	Rolling by Manual	By winches	Skyline crops By carts, animals	Hill Kacha Road	Hill Pacca Road	Plain Road	Side Nallaha	Main Rivers.	S.No. of Forest Unit.
11 12-14 15-17	18-19 20-22	23-25 26-27 28-30	31-33	34-36	37-39	40-42	43-44	45-47	48-50	51-52 53-55	56 to 73 74-76

SECTION - XI

PART - III

DATA PROCESSING

### CHAPTER - III

#### 3.1 Data Processing

Data Processing involves punching and verification of the data for computer input, checking for consistency between and within various characters, preparation of suitable computer programmes for consistency checking, calculation of volume of felled trees and sample trees, graphs between various variable, general volume equations, local volume equations and preparation of growing stock tables.

##### 3.1.1 DATA

The data collected in the following forms was analysed :

- (1) Point description form (CD 01)
- (2) Tally sheet (CD 03)
- (3) Sample tree form (CD 04)
- (4) Tree volume study form (Standing tree) (CD 05)
- (5) Tree volume study form (felled tree) (CD 06)

The full details of items on which information was collected are given in the manual "Instruction for field inventory work (U.P.) areas".

##### 3.1.2 Input for the computer

The information of the field forms was key-punched, and verified in the Data Processing Unit. The following number of cards were punched for each card design.

- (1) Point description form (CD 01) 2697 cards.
- (2) Tally sheet (CD 03) 1779 cards.
- (3) Sample tree form (CD 04) 4605 Cards.
- (4) Tree volume study form (Standing trees) (CD 05) 394 cards.
- (5) Tree Volume study form (felled trees ) (CD 06) 4203 Cards.

##### 3.1.3 Consistency checking :

The punched data was checked for consistency between various parameters by a computer programme CLEANS on IBM 1620 computer. The

discrepancies were resolved with the help of Northern Zone field officers and the data cards corrected accordingly. After correction the data were loaded on to Magnetic Disk Packs.

#### 3.1.4 Volume of Felled Trees :

The under bark and over bark volumes of each log of tree are calculated by using Smalian Formula. Volume of the whole tree was calculated by totalling the volumes of individual logs. Tree volumes limits of were calculated up to top over bark diameter limits of 40 Cms. 20 Cms. 10 Cms. and 5 Cm. using computer programme NALVAL. These volumes were loaded on Disk for different tree portions of a tree along with other parameters and identification data.

For the variable Volume (V), Diameter (D), height (H), and  $D^2H$  mean and standard deviation were also computed for each important species by diameter classes using computer programme VOLDIS.

#### 3.1.5 Graphs :

Scatter diagrams were prepared between the variables total under bark volume up to 5 cm. top over bark dia. limit and  $D^2H$  mean and standard deviation were also computed for each important species by diameter classes using computer programme GRPHS. After a careful study of the scatter of points for the species some abnormal observations were deleted.

#### 3.1.6 Regressions :

Table No. IV, IV-1 gives the distribution of trees by diameter classes for important species as they occurred in the felled tree data.

##### (a) General Volume Equations :

It can be seen from the above table that the felled tree data is not representative of whole range of diameter distribution as they appear to occur in the enumeration data. This is a very serious limitation for the preparation of volume tables. However, in the absence of other alternatives this data was used for the preparation of volume equations.

The following equations were tried to arrive at a general volume equation suitable for a particular species using computer programme REGFOR.

$$1. \quad V = a + b D^2H$$

$$2. \quad V = a + b D^2H + c (D^2H)^2$$

$$3. \quad V/D^2H = a + b/D^2H$$

4.  $V/D^2H = a + b/D^2H + c D^2H$
5.  $\text{Log } V = a + b \text{ Log } D + c \text{ Log } H$
6.  $V = a + b D + c D^2 + d D^2 H$
7.  $V = a + b D + c H + d H$

Where: V under bark volume (Cm) of a tree upto 5 Cm. top over bark diameter limit.

D - Diameter (meter)

H - Height (meter)

The final equations selected species-wise are presented in Appendix I.

(b) Local Volume Equations :

Using these equations and the computer Programme SAMVOL volume of sample trees were calculated and loaded on the disk along with the other parameters. Means and standard deviation for the variables volume, diameter, height and  $D^2H$  by important species and diameter classes, were computed as for the felled tree data using the same computer programs.

The following equations were tried for the selection of local volume equations.

1.  $V = a + bD + cD^2$
2.  $V = a + bD^2$
3.  $\text{Log } V = a + b \text{ Log } D$
4.  $\sqrt{V} = a + bD$
5.  $V/D^2 = a + b/D + c/D^2$
6.  $V/D^2 = a + b/D^2$

Where V and D stand for the same variables as described earlier.

Final equations selected for different species are presented in Appendix II.

### 3.1.7 Area break-up

The total geographical area of the project in Uttar Pradesh was 10,336.02 Sq. Kms. The break-up of this area into various land-use classes is given in Table- III-1. It was proposed to get area estimates from aerial photo interpretation but this could not be done. In the absence of photo interpretation results, the areas in different land use classes were calculated on the basis of the proportions of sample points falling in each land-use class.

The area estimated under land-use class 'Tree Forest' was further divided into various forest types. These are given in Table III-2,

As desired by the State Forest Department, the estimated area of each forest type was further distributed by Forest Division, Altitude, Terrain, Slope and crown density. This is given in Tables III-3 and IX-1 to IX-4 (Volume I). It may be noted that the estimates of area are based on very few sample points as the sampling design was not prepared to estimate the area.

Estimates of area were obtained for the following forest types.

- (1) Fir including Spruce.
- (2) Blue pine and Deodar.
- (3) Chir.
- (4) Upland hardwoods and mixed conifers.
- (5) Oaks
- (6) Low-land hardwoods.

Since the sample points in the forest types, Blue pine, Deodar, upland hardwoods & mixed conifers were very few, it was decided in consultation with U.P. Forest Department that combined estimates of Blue and Deodar as well as upland hardwoods and mixed conifers be given, as separate estimates for these forest types would not be reliable.

### 3.1.8 Stand and Stock.

A variable length record file merging the data of plot description (CD 01) and Tally sheet (CD 03) was created on the magnetic disk using computer program VARFIL.

At each sample point number of stems per hectare were calculated by the multiplication of B.A.F. and total of the reciprocals of the basal area of each tallied tree.

NO. of Stems per hectare.

$$= B.A.F. \sum_{i=1}^m \frac{1}{B_i}$$

Where  $B_i$  - Basal area of  $i$  th tallied tree at a sample point.

$m$  - No. of trees tallied

Estimates of the number of stems per hectare were also calculated for each diameter class of important species.

In case of volume, the volume of each tallied tree was calculated from the respective local volume equation of species.

Volume per hectare at a sample point was calculated as follows :-

$$\text{Volume per hectare} = B.A.F. \sum_{i=1}^m \frac{V_i}{B_i}$$

Where  $V_i$  = Volume of the  $i$  th tallied tree at a sample point.

Volume per hectare was calculated for each diameter class of important species.

From these values, stems and volume per hectare by diameter classes were estimated for each important species of a forest type by using computer program PREND 1. These figures are presented in Appendix - 2 Tables 2.1.1 to 2.6.2 (Volume I). In addition, stems and volume per hectare were also calculated for the entire area which are also given in Appendix - 2 Tables 2.1 and 2.2. (Volume-I).

Standard errors for Volume per hectare were also calculated for each forest type using computer program ERRORS. To estimate these standard error, ratio method of estimation was used. The standard errors expressed as percentage are also given in Table IV-3 (Volume I).

It may be noted that the local volume equations given in Appendix II are valid for breast height diameters 20 cms. and above. Therefore, most of the estimates for volume and the standard errors are derived for diameters 20 cms. and over. However, the estimates of volume for 10-20 cm. diameter class are also given for forest types using average sample trees volume in that class.

### 3.1.9 Diameter-height relation-ship.

Equation of the following form was fitted between diameter (breast height) and height from the sample tree data for some important conifers.

$$H - 1.37 = \frac{d^2}{a + bd + cd^2}$$

Where H - Height in metre

d - diameter at breast height (Cm)

a, b, c are the constants to be determined and 1.37 is the breast height in meters.

The estimated heights for various diameter classes are given in Table V-1 (Volume I).



UTTAR KASHI

4. SELECTED GENERAL VOLUME EQUATIONS

GHIR

$$\frac{V}{D^2H} = .27408 + .00249/D^2H$$

KAIL

$$\frac{V}{D^2H} = .30649 + .03085/D^2H$$

DEODAR

$$V = .06168 + .27696 D^2H$$

SPRUCE

$$\frac{V}{D^2H} = .028318 + .03370/D^2H$$

FIR

$$V = .17507 + .22606 D^2H$$

BAN OAK

$$V = .01480 + .31906 D^2H$$

MOHRI OAK

$$V = .03560 + .31504 D^2H$$

REST OF SPECIES

$$\frac{V}{D^2H} = .29886 + .00817 /D^2H$$

APPENDIX - II

UTTAR KASHI

5. SELECTED LOCAL VOLUME EQUATIONS  
(20 Cm AND ABOVE D.B.H.)

CHIR

$$V = .276739 - 3.068630 D + 12.409920 D^2$$

KATE

$$V = .223189 - 2.35096 D + 11.906690 D^2$$

DEODAR

$$V = -.001650 + 8.209795 D^2$$

SPRUCE

$$V = 0.298532 - 4.541390 D + 16.325240 D^2$$

FIR

$$V = 0.419832 - 2.725510 D + 10.893378 D^2$$

BAN OAK

$$V/D^2 = 7.702984 - 1.258189/D + 0.085356/D^2$$

MOHRU OAK

$$V/D^2 = 10.163169 - 1.554715/D + .098800/D^2$$

REST OF SPECIES

$$V = .384595 - 3.455960 D + 10.987590 D^2$$