(FOR OFFICIAL USE ONLY)

GOVERNMENT OF INDIA

Preinvestment Survey of Forest Resources

25, Subhash Road

DEHRA DUN

Report

CHENAB VALLEY

(Jammu & Kashmir)

VOLUME—II

METHODOLOGY ADOPTED

1975–76

Contents

R/NZ-7

Government of India

Ministry of Agriculture and Irrigation

(Department of Agriculture)

CHENAB VALLEY

(JAMMU & KASHMIR)

VOLUME II

THE METHODOLOGY

Preinvestment Survey of Forest Resources
North Zone

Contents

C O N T E N T S

PART I - INVENTORY PROCEDURES

Contents

Page

PART II - DATA PROCESSING

CONTD.....

@*@*@*@*@

Contents

Data Processing unit

P A R T- I

INVENTORY RESOURCES

Contents

INSTRUCTIONS

A Crew Leader is over all incharge of the party and is responsible for correct location, layout of the plots, and collection of data.

2.1 SAMPLING DESIGN

(a) You should understand the sampling design, before proceeding ahead.

(b) Sampling shall be done in systematically spaced blocks. Each block has 8 plots of 0.1 hec. area arranged in four clusters of two plots each. Each plot is a 0.1 hec. i.e. 31.62 x 31.62 m. Four corners of the plot are pointing towards N.S.E.W. i.e. the two diagonals are NS, EW, each being 44,72 m. in length.

(c) The plots in a cluster are spaced so that the plot centres are 200 meters horizontal from the cluster Centers (c.c.) in radially opposite directions i.e. distance between two plots centres, in a cluster is 400 m. horizontal. The plots in the northern cluster and southern cluster are to the E & W of the C.C. And the plots in the eastern and western clusters are to the north & south of the c.c. The cluster centres are 1 grid Km. towards grid N,S,E,W of the block centre. The block centres are spaced 8 x 8 km, in a grid NS and grid EW direction (refer diagram on the opposite page).

(d) The block is to be referred to by the grid reference of the block centre, Grid reference is an eight digit number e.g. 33570981 (It is always an eight digit number). The first four digits refer to the X-Coordinate of the grid in grid kilometers and the last four digits refer to the Y-Coordinate of the grid Km. In the example, the X-Coordinate (easting of the block centre is 3357 grid kilometers (3357000 metres) and Y-Coordinate (Northing) of the block centre is 0981 grid kilometers 981,000 metres). On 1/50,000 sheets the grids are shown in red lines, one grid kilometer apart and the grid value on the border of the sheets is shown in grid metres.

(e) ' Plot Number' within a block is referred to by one digit number from 1 to 8, The plots have been numbered in a clock-wise direction, starting from the western plot of the northern cluster.

(f) Centres of the blocks to be surveyed are indicated on the maps.

Contents

(g) If aerial photographs of the area are available, the B.Cs. and the C.Cs shall be transferred on to the aerial photographs. Grid reference of the BCs shall be indicated on the photographs. And the CCs shall be indicated by writing the numbers of the plots in that cluster as 12, 34,56,78, for the N,E,S,W cluster centres respectively.

2.2 PLOT LOCATION

(a) Before starting from the camp you should locate the cluster centre to be surveyed on the map. This should be easy. First locate the block centre. Now the clusters are one grid kilometer from the B.C. towards grid N,S,E,W. It should be the crossing of the grid lines.

(b) Now study the approach to the C.C. from the camp and decide the easiest and shortest route of approach.

(c) Locate the cluster centre on the ground with the help of aerial photographs, (if available) and or 1/50,000 scale map.

(d) At the cluster centre put a peg 50 cm. in length and 10 cm. in diameter. Blaze it at the top facing the direction from which you have approached this point. Write the block centre grid reference and the numbers of plots in that cluster in copying pencil in 10 digits. The last two digits indicating the number of the plots in that cluster, For example a reference like 3357098112 indicates that the point marked is the cluster centre having plots 1 and 2 in the block 33570981. Each cluster has one odd numbered plot (e.g. 1,3,5,7) and one even numbered plot (e.g.-2,4,6,8) Give the COGR on two nearly prominent trees and record the same in the field note book and on the back of the PDF.

(e) From the cluster centre measure 200 meter horizontal distance using a steel tape in the desired direction to locate the plot centre. Measure the slope and find out the sloping distance and measure it on the ground. The distance may be measured in sections, if the slope varies. The direction is to be controlled by Silva Compass. It is easy to know the direction of the p.c. from the c.c. from the diagram showing the sampling design. However, the following table has been prepared to indicate the direction from the relevant cluster centres for ready reference.

Plot No.	C.C.	Magnetic direction from the C.C.	F.B. from C.C. Silva compass)
1	N	W	300
2	N	E	100
3	E	N	000
4	E	S	200

Plot No.	C.C.	Magnetic direction from the C.C.	F.B. from C.C. Silva compass)
5	S	E	100
6	S	W	300
7	W	S	200
8	W	N	000

(f) On reaching the plot centre fix a stout peg about 50 cm. in length and 10 cm. in diameter. Blaze it on the top facing the C.C. Write the B.C. grid reference and the plot number on the peg in nine digits. The first eight digits give the BCGR and the last digit refers to the plot number.

(g) Record in the field note book and at the back of the PLF, the direction and the distance of the P.C. from the two nearest prominent trees. This reference should also be given on the said trees in copying pencil after blazing at about 25 cm. below B.H. facing the plot centre.

(h) IN EACH CLUSTER PROCEED TO THE ODD NUMBERED PLOT FIRST (This is necessary since the sample tree data is to be collected from only one plot in the cluster i.e. odd numbered plot. If the odd number plot in the cluster does not have tree growth, then and only then, the "Sample tree data " is to be collected from the other plot in the same cluster, which is even numbered. If even this ' even number plot' has no tree growth, no sample tree data need be collected from this cluster)

2.3 PLOT LAY-OUT

(a) The plot centre represents the point of inter-section of the diagonals of the plot. The diagonals are NS,EW,length of each diagonal is 44.72 m. From the plot centre measure a horizontal distance of 22.36 m. using a steel tape, in the four directions, viz. N,S,E, W (using Silva Compass). These are the four corners of the plot and should be marked by a peg 25 cm. in length and about 5 cm. in diameter.

(b) Check the length and direction of diagonals, relay if incorrect and mesure each side of the plot. Record in the field note book and on the back of the PLF. Also record the length of NS diagonal.

(c) Plot need not be laid where the vegetation class is "Tree in Line".

Contents

2.4 DATA COLLECTION

(a) Now, you should prepare to collect the data and record in the following forms read the instructions to fill up each form carefully. You should be very precise and accurate in recording the information. The information should be recorded legibly. If you find any freak item or category (which would be very rare) leave the columns in the form blank, record all the information in your field book in detail and contact the officer-in-charge for guidance.

i) -PLOT DESCRIPTION FORM- One form should be used for each cluster.

ii) -SAMPLE TREE FORM

iii) -PLOT ENUMERATION FORM

iv) -TALLY SHEET B.A.M-2

(b) Normally in case of last 3 forms one form should be enough for each plot. However, if the data in each plot cannot be accommodated in one form, a second form as a continuation sheet may be used. Whenever, a continuation sheet is used all the columns from 1-8 and 69-70 should be filled in both the forms which should be stapled together. To facilitate the data collection and avoid waste of energy the following sequence for data collection is advised:-

Write in the field note book the route adopted to reach the C.C. from the camp.

(c) Standing at the centre of the plot, take a tally byreilla scope with B.F.2 put a sample tree card on each 'In' tree, (note down in the field note book the total number of 'in' trees).

(d) You can now start filling the plot description form. (Ref. instructions for P.D.F.) In the meantime you can direct the Assistant Crew Leader to take measurements of diameters for all the 'in' trees, and write it on the sample tree card. (This information would be required for the Tally sheet.)

(e) Now the Assistant Crew Leader can number all the 'in' trees greater than or equial to 20 cm. D.B.H.O.B., serially from the north side of the plot in a sweep. All these trees are the 'sample trees' (This need be done only on the plot form where sample tree data is to be collected). Also blaze trees at about 25 cm. below B.H. facing the P.C. and write the sample tree number on it in copying pencil.

Contents

(f) By now, you would have completed the plot description form. If not, go ahead, In the meantime the Assistant Crew Leader can continue to collect ('Sample tree data' and record it in the sample tree cards, tagged on each tree).

(h) After completing the Plot Description Form you can fill up the Tally Sheet. This should be very easy as all the 'in' trees have been tagged and their dismeters measured and already written on the sample tree cards. (Don't forget to check whether you have recorded the information for all the 'in' trees).

(i) Now fill up the plot Enumeration Form as explained in the instructions,

(j) Now you can also start collecting data for the sample trees and recording on the sample tree cards. Between the two of you, you can collect the information faster, write it down on the sample tree cards. 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 the S.T.C. on 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.

(k) While you are filling up the sample tree form, the Asstt. Crew Leader can have all the instruments collected at the centre. He should check that the instruments are properly packed and according to the list.

(l) Having finished this plot you can proceed to the next plot (or camp, if the days work is over). Before you leave check up that you have filled all the forms and collected all instruments.

2.5 GENERAL INSTRUCTIONS:

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

(2) Before proceeding on tour ensure that your party is fully equipped with the camp and survey equipment.

(3) Ensure that your party members a e equipped with field dress and appropriate clothing and bedding. It is desirable that the personal luggage should be light in weight and volume. Heavy and superfluous baggage will add to your transport problems.

(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 SHOWN TO ANY ONE NOT CONNECTED WITH THE ORGANISATION, OR TO ANY FOREIGNER, WHOSO-EVER HE MAY BE. THE MAPS AND PHOTOGRAPHS SHOULD ALWAYS BE KEPT IN YOUR PERSONAL CUSTODY. LOSS OF MAPS OR PHOTO-GRAPHS IS A CRIMINAL OFFENCE. Damage or loss of those should immediately be reported to the Zonal Coordinator, Northern Zone and the Officer-in-charge.

(5) You shall collect the data with the help of the crew and record on the prescribed forms PROPERLY CODED.

(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

(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.

(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.

Contents

3.1 PLOT DESCRIPTION FORM

Now you have to fill up the plot description form. Fill it up column wise. You should be precise and accurate. Follow instructions as under :-

Col. No.		
1-3	Job No.	Leave it blank.
4-5	Card Design	
6-7	Reporting Unit.	Two digit. Write the code number of the main reporting unit. (Appendix II-D)
8	S.Reporting Unit.	Leave it blank.
9-10	Crew Leader	Two digits. Write your code number. You ought to remember this by now. (Appendix III)
69	Plot No.	One digit. Write the number of the plot sampled, within the block.
70	Grid Zone	One digit. The grid Zone for the present area is IA (Appendix II-E)
71-78	Block Centre Grid Ref.	Eight digits. Write the grid reference of the centre of the block.
79-80	Inventory Design.	Two digits. Leave it blank.
11-12	State	Two digits. Write 07 for Jammu & Kashmir.
13-14	Revenue District.	Two digits. Write the code number of the Revenue Distt. in which the plot lies (Appendix II-B)
15-16	Forest Division.	Two digits. Write the code number of the Forest (Appendix II-C) Division in which the plot lies.

Contents

17	Land Class	One digit. Consider the present land use of the area covered by the plot under reference, and classes. While considering the land use identify the class in which the plot lies. Write the code number of the land use class in this column. 1. Forest Land 2. Farm Wood Land (Agri. Tree Land). 3. Non-Forestry Plantations. 4. Agricultural Crop Land. 5. Pasture Land. 6. Urban, Village, and Industrial Lands. 7. Barren Lands. 8. Others.

Note :- The following definitions of the above referred eight classes will help you in deciding the class to which the plot belongs :-

(1) FOREST LAND

It includes all lands with forest cover (including bamboo & palm) of any density, i.e. areas with trees and/or scrub growth and grasses and where land surface is not used primarily for purposes other than forestry provided it is more than 2 hect. in area expecting areas defined as "Farm Wood Land (agri. tree land). "

It also includes;

i) Nurseries, forest roads and streams surrendered by forests.

ii) Temporarily unstocked and under stocked areas.

iii) Shelter belts, wind breaks, trees in rows or narrow strips along road and canal banks.

(2) FARM WOOD LAND (AGRI. TREE LAND)

This includes all lands at present under cultivation of agricultural crops with tree cover of any density and more than or equal to 2 hect.

i.e. It includes

a) Shifting cultivation areas, where trees are also growing.

b) Farm Forests, where trees are grown together with agricultural crops. The trees may be growing in patches or rows or lines. It also includes Walnut plantations.

(3) NON FORESTRY PLANTATIONS:

This includes areas with tree growth primarily planted for purposes other than forestry. (if more than or equal to 2 hectare). e.g. fruit orchards (excluding walnut plantations)

(4) AGRICULTURAL CROP LAND:

This includes areas under cultivation without any tree growth (if not less than 2 hectares).

(5) PASTURE LAND:

This includes all areas managed primarily for production of grasses, and for grazing (if not less than 2 hect.) Such lands are incapable of conversion into productive wood lands due to adverse natural factors or legislation. e.g. high level grass lands or village pastures.

(6) URBAN VILLAGE AND INDUSTRIAL LANDS :

This includes areas of habitation and industrial sites (if not less than 2 hect.)

(7) Barren LANDS:

Includes areas, devoid of any soil, like rocky out-crops, not less than 2 hect.
It also includes sand dunes and Swamps, without tree growth (not less than 2 hect.)

(8) OTHERS:

Includes :

a) Water
b) Roads other than forest roads.
c) River beds.

It also includes lands which can not be classified in any of the above classes.

EXAMPLES:

(i) SHIFTING CULTIVATION: Classify, as ' Farm Wood land' or Agricultural Crop Land' depnding on the presence or absence of tree cover.

(ii) ABANDONED SHIFTING CULTIVATION:

It may be covered with trees or scrub growth of any density or grasses. Classify it as 'Forest Land '.

(iii) Grassy blanks less than 2 hect. the wooded areas should be classified as "Forest Land."

(iv) Plantations raised primarily for "Soil Conservation" and "Aesthetic" purposes should be classified as "Forest Land".

18 LEGAL STATUS

One digit. Considering the legal status the following categories have been made. Classify the plot in one of these categories and write code in this column. Each category is to be identified separately only if it is not less than 2 hect. in area.

Code:

1. RESERVED FOREST: Includes areas declared as such under the IFA/SFA

NOTE: Forest area of Jammu & Kashmir under the control of Forest Department may be classified as Reserved Forest.

2. PROTECTED FOREST: Includes areas declared as such under the IFA/SFA (It also includes areas notified under Sec. A. Where settlement proceedings are in progress).

3. NATIONAL PARKS AND WOOD PRESERVES:

Includes forest areas where folling-s are restricted by legislation.

It also includes Forest tree growth, planted or natural maintained primarily for purposes other than marketable wood production; e.g. Tree preserves Parks Municipal Wood Lands for esthetic purposes etc.

Contents

4. GOVT. BANJONI (CLASSIFIED)

It includes forest areas (or waste lands) 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: It includes areas owned by private individual or firms.

7. UNDETERMINED: Includes all lands which can not be classified in any of the above categories.

19-24 TERRAIN

The information regarding terrain has to be filled in from topo sheets. You should study the area around the plot in the 1/50,000 topo sheets and record the information regarding

Altitude

Topography

Slope

Position on Hill

and Aspect.

19-20	Altitude	From the topo sheets of 1"= 1 mile or 1/50,000 find the altitude of the plot centre, in meters. Write the altitude in four digits Drop the last two digits and write the remaining two in the appropriate column.
21.	Topography	Examine the general Topography over an area of about 6-8 Sq. Km. in the type of terrain in which the plot lies, on topo map and classify the terrain in one of the following classes.

Code	Description
(i) Precipitous	Steep areas where logging is not possible.

Contents

(2) Very Hilly — Areas with steep slopes where logging is possible but difficult.

(3) Hilly — Areas with moderate slopes where logging is no problem as per existing practices.

(4) Gently Rolling — Area with series of rounded hill topo and gentle slopes with wide valleys in between, where logging is easy.

(5) Flat

EXAMPLE :- A billock 100-200 m. in height covering an area of about 1 Sq. K. surrounded by 4-5 Sq. Km. of gently undulating area is to be classified as gently rolling.

It should be abvious from this that both the adjoining plots will have the same topography class.

22 SLOPE — Measure the slope on topo map (1/50,000) around the plot centres over an area of about 1 Sq.Km. Take average of 2-3 measurements and classify in one of the following classes. Write the code number of the class in the appropriate column.

Code	Degrees.
1.	70 and above
2.	60 to less than 70
3.	45 to less than 60
4.	20 to less than 45
5.	0 to less than 20

23 POSITION OF HILL — Examine the position of the P.C, on the topo map (1:50,000)with reference to hill slope on which it is located and classify as under :
Write the code number of the class so arrived at in the form.

Code	
1.	Ridge top
2.	Upper 1/3rd
3.	Middle 1/3rd
4.	Lower 1/3rd
5.	Valley

Contents

24. ASPECT

General aspect of the area wherein the plot is to be studied on the map and classified as under :-

N	1	S	5
NE	2	SW	6
E	3	W	7
SE	4	NW	8
		None	9

25. STONINESS

Observe an area of about 2 hectare around the plot and consider the extent of rocks/boulders, greater than 25 cms. in diameter. Any thing less than 25 cms. in diameter and weight by less than about 40 kg. and can easily be moved. 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 column.

Code

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/boulders.

3. Less than 30% of the land surface is covered with stones/boulders.

4. Stones/boulders are absent.

SOIL DATA

Information regarding soil data is to be filled in for plots classified as Forest Land and Farm Wood Land. This information may also be collected for areas not falling in any of the above referred categories but are visited, for soil data regarding HUMUS, consistency, texture and depth. Consider the predominant soil type around the plot.

26-30 HUMUS

Humus is the dcomposed organic matter (leaf, needles, twigs etc.) which has become a part of the upper most soil horizon. This should be clearly distinguished from undecomposed leaf litter. Remove the liter from the soil surface before making measurements.

Dig a small pit about 5 cm. in the predominent soil type. Now measure the depth of humus and write the code of the class in which it falls, in the appropriate column.

Code

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

27. SOIL CONSISTANCY

Classify the soil in and around the plot in one of the following classes and write the class code in this column.

Code

Friable	1
Slightly Compact	2
Compact	3
No soil	4

FRIABLE: is one which is loose and which crumbles very easily while pressing with fingers. Such soil can be scraped easily with toe of the shoe. Sand content in this type of soil is more. Digging is very easy.

SLIGHTLY COMPACT: is one which sticks together as a lump when taken in hand digging a pit in this type of soil is very easy with a pick axe.

COMPACT SOIL: is one which makes digging rather difficult due to soil particles cementing together.

29. SOIL TEXTURE

Examine the texture of the soil in the region where the humus and the mineral soil are mixed by feeling with the hand and classify in one of the following categories and record the code number. Apply this test to the soil type predominent in the area.

Code :

1.	Clayey
2.	Clayey loan
3.	Loam
4.	Sandy loam
5.	Sandy
6.	Pebbles
7	No soil

30 SOIL DEPTH

Dig a pit with 'Khukhri' in the predominent soil type upto a depth of more than 30 cm and measure the depth of the soil below the undecomposed leaf litter (i.e. dry leaves or needles) upto the parent rock or slightly more than 30 cm. whichever is less. Classify the soil depth in one of the following categories and write the code number in this col.

Code

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

31. VEGETATION

This column is to be filled up only for plots which have been classifed as Forest Land (1) and Farm Wood Land (2) under land class column 17.

Observe the growth in the region and classify it is one of the following classes.

Code

1.	Forest
2.	Open Forest
3.	Tree in line
4.	Scrub
5.	Open scrub
6.	Grasses
7.	Others.

Contents

(1) FOREST: Includes all areas having tree cover with crown density more than 20 % (Not less than 2 hect.)

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

(b) Young natural stands and plantations, for forestry purposes, which may or may not have reached a crown density or more than 20%

(c) Abondened cultivation having forest cover.

(d) Forest roads streams, small open areas in the forest, and nurseries which form an integral part of the forest.

(e) Farm Forests more than 2 hect.

The definition includes, that, where such forest areas defined above have density less than 20% these are necessarily in the process of restocking and shall achieve crown density of more than 20%

(2) OPEN FOREST: Areas with understocked tree growth of density less than 20% and more than 5% with or without scrub of any density. (Not less than 2 hect.)

(3) TREE IN LINE: Includes areas where trees are growing in lines, row and narrow strips along canal banks, roads etc., shelter belts and wind breaks etc. It also includes scattered trees (to which the system of collecting growing stock data as in Col. 32-40 can not be applied).

(4) SCRUB: To this category belong areas with scrub growth and stunted tree growth less than 3 m. in height, and density more than 20% (not less than 2 hect.). Trees (i.e. more than 3 m. in height) if present, area less than 5% in density.

(5) OPEN SCRUB: To this category belong areas with scruby growth and stunted tree growth less than 3 m. in heigh t and density less than 20% to more than 5% (Not less than 2 hect.). Trees if present are less than 5 % density.

(6) GRASSES: This class covers areas covered predominantly with grasses, provided that these, are not less than 2 hect. in extent. Trees or scrubs if present or less than 5 % in density.

(7) OTHERS Includes areas which can not be classified in any of the above categories.

GROWING STOCK DATA Columns from 32 to 40 are to be filled up only for plots classified as "Forests" and " OPEN FOREST" under vegetation above. Look around at the crop in which the plot lies and fill up the following columns from 32-40.

32 ORIGIN OF STAND: 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.

CODE

1. Natural
2. Man made
3. Partially Natural and partially Man Made e.g. Natural Forest, supplemented with artificial regeneration.

33-34 FORESTRY TYPE: Observe the areas around the plot and classify the crop in which the plot lies in one of the following Forest Types, provided that it is not less than 2 hect. in extent. Write the code of the Forest Type in this column.

Code	Forest Type
01	Chir
02	Blue pine
03	Deodar
04	Spruce
05	Fir
06	Spruce-Fir
07	Spruce, Fir, Blue pine
08	Deodar - Blue pine
09	Chir - Ban Oak
10	Blue pine - Moru Oak
11	Blue pine -Kharsu Oak
12	Deodar - Moru Oak.

Contents

13	Deodar - Ban Oak
14	Fir - Spruce - Kharsu Oak
15	Fir - Spruce - Moru Oak
16	Other Hardwoods
17	Willows
18	Poplars
19	Walnut

If a species constitutes more than 80% of the crop, it is to be considered as pure. Any species forming less than 20% of the mixture will be ignored. In the case of the mixed forests a species shall be recognised only if it forms a part more than 20% of the mixture.

35 NO OF STOREYS: Consider the Forest Type to which the plot belongs and describe the vertical distribution of height of the trees in the stand, in one of the following classes. Do not consider scrubs as a storey.

CODE

1. Single storeyed forest
2. Two storeyed Forest
3. The variation in height is such that the trees can be grouped into one upper and one lower canopy.

4 Multi storeyed forest.

The variation in height is such that it is not possible to group the trees in canopies.

36-37 TOP HEIGHT : Occularly estimate the average height of the top canopy. (i.e. the average of the heights of Predominant Codominant Trees), in about two hectare of the woodland type to which the 'plot' belongs, and round it off to the nearest 5 meters. Recorded this height in the appropriate column.

The occular estimate must be checked with 2-3 measurements of Predominant and Codominant trees in the stand, with Blume-Leise Hypsometer.

EXAMPLE: i) If the average height is 27 m. round it off to 25 m. and record.

ii) If the average height is 28 m. round it off to 30 m. and record.

NOTE :- In a young crop with scattered mother trees the top height of the young trees should be recorded. Ignore the mother trees when estimating the height.

38 SIZE/AGE

On the basis of the predominant diameter (over bark at breast height) class in the woodland type to which the plot belongs classify the age in one of the following classes and write the code in the appropriate column.

Code	Age	D.B.H.O.B. in cm. for conifers.	D.B.H.O.B. Class in cm. for broad leaved species.
1.	Regeneration	Less than 5	Less than 5
2.	Young	5 to less than 40	5 to less than 10.
3.	Middle aged	40 to less than 60	10 to less than 20
4.	Mature	60 to less than 90	20 to less than 30
5.	Over mature	90 or more	30 or more.

39 STOCKING:

Observe average specing of tees in and around the plot in the Forest Type. Take a few measurements in the beginning, After a few days you should have enough experience to assess the average spacing. Classify the stocking and write the code in this column.

Code	Spacing m.
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

Contents

49 REGENERATION: All saplings less than 5 cm. in diameter at breast height (over bark) are to be considered as regeneration. Count the regeneration in the south west quadrant or the plot. On the basis of the count, decide the condition of the regeneration as per the following consideration and record the code in the appropriate column.

Code	Abundance of regneration	Criteria No. of seedlings in .025 hect.
1.....	Profuse	60 or more
2.....	Adequate	30 to less than 60
3.....	Scanty	10 to less than 30
4.....	Regeneration present but burnt or damaged	- less than 10
5.....	Nil	

SPECIES STOCKING IN FOREST:

Observe the forest type in which the plot 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:

Code	
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%

55-57) SPECIES CODE
59-61)
63-65)

Write the code number of the main species than constitue the crop. If there are more than three species in the crop, write the code numbers of the ones that are in greater abundance and group the rest as 'others', for which species code column is not provided.(Appendix IV)

58)
62)
66)
67)

Write the code for stocking percentage, by number of stems, in these columns for the species, indicated in column (55-57), (59-61) and 63-65) respectively in columns 58, 62 and 66. In column 67 write the stocking % code for species grouped as ' others'.

NOTE:- If the number of species is less than three write 000 in the rest of the columns.

EXAMPLE :-1 A crop of fir-spruce-Blue-pine has these species in the proportion of 15%, 35% and 50% respectively.

Write code number of Fir in column (55-57) and code 1 in the column. 58.

Write code number of spruce in column (59-61) and code 3 in column 62.

Write code number of blue pine in column (63-65) and code 5 in column 66. Write '0' in column 67.

EXAMPLE :-2 If it is a pure crop blue pine write code number of blue pine in column (59-61) and (63-65) write 000. In column 62, 66 and 67 write 0.

69 FOREST POTENTIAL

If in the vegetation class (in column No. 31) you have classified the plot as, open forest (2) scrub (4) open scrub) (5) grasses (6) others (7) observe and decide whether it is possible to convert the area into a productive Forest or not, and write the appropriate code in this column.

While deciding whether an open forest or scrub or grassland is capable of conversion into a productive forest or not, give due the consideration to, aspect, soil and its depth drainage, crop in the surrounding areas and other biotic and climatic factors.

CODE

1.	Potential Forest
2.	Not Potential Forest
3	Not applicable.

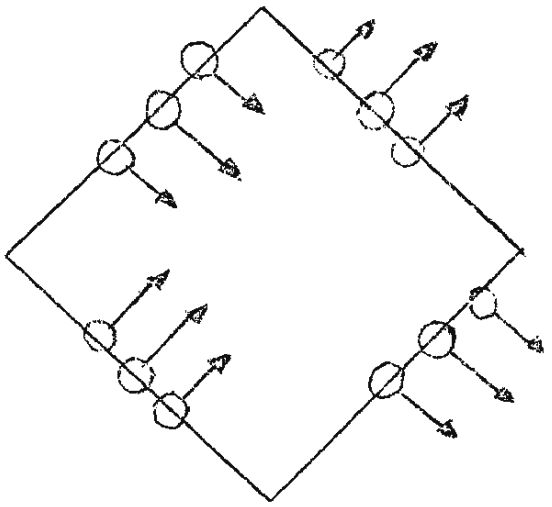
.-.-.-.-.-.

3.2 PLOT ENUMERATION FORM

(a) All trees in the plot are to be enumerated and the data recorded by species in the appropriate columns in the prescribed form. Trees for the purpose of enumeration are to be over 5 cm, in diameter over bark at breat height. Dead trees are not to be enumerated.

(b) To decide whether a border line tree is "in" or "outside" the plot, the following method will be adopted.

All trees touching or lying on the NW or SW side of the plot shall be considered as "In the plot". And all trees touching or lying on the NE and SE sides of the plot shall be considered as "Out of Plot". The following diagram would illustrate the point.



(c) Every tree enumerated shall be marked with a tree marker or chalk facing the plot centre where you should stand. By this you shall be able to check whether a tree has been enumerated or not.

(d) Record the following information in the appropriate columns as in the plot description form :-

Job Number	(Col, 1-3)
Card Design	(Col, 4-5)
Report Number	(Col, 6-7)
Sub Report Number	(Col, 8)
Plot Number	(Col, 69)
Grid Zone	(Col, 70)
Block Centre)	(Col, 71-78)
Grid Reference)	
Inventory Design	(Col, 79-80)

Contents

On the top write the date on which the data is collected and the name of the Crew Leader, in BLOCK CAPITALS.

(e) Use one form for each plot. If number of trees in the plot is more than can be accommodated in one form, use another continuation sheet and fill up all the columns (1-8) (66-80) in that also.

(f) The enumeration form consists of rectangular blocks. Data for each tree is recorded in each such block. Data is to be recorded in 1st row, then 2nd row and so on till all the trees in the plot have been accounted for.

(g) In each block on the top write the local or botanical name of the tree emmerated. In the lower left column write the code number of the species, in three digits and in the lower right column write the diameter at B.H. of the tree in centimeters.

(h) Total number of trees in the plot is to be recorded in three digits in Col. 66-68).

(i) MEASUREMENT OF DIAMETER.

Measure the D.B.H. over bark (at a point 1.37 m. above the base of the tree from the uphill side) with callipers to the nearest centimeter. (.5 cm. is to be rounded off to the nearest even number). Take only one measurement along the diameter pointing towards the plot centre.

(j) If there is considerable abnormality at the base of the stem, upto or at the breast height then take the measurement above or below such abnormality.

(k) In case of trees forking below the B.H. measure and record diameter at breast height considering each stem as a separate tree.

3.3 TALLY SHEET:- (B.A.F.-2) (Tally need not be taken where plot is not laid out).

(a) Stand at the plot centre. Fill up columns (1-8) (69-70). Now take a tally with the Relaskope for Basal Area Factor of 2. Measure the diameter at Breast height of all the "in" trees (above 5 cm. D.B.H.O.B.) in centimeters and record in the form. The tally sheet consists of rectangular blocks. In each block on the top, write the local or botanical name of the 'in' tree. In the lower left column write the code number of the species. In three digits and in the lower right column write the diameter at B.H. & O.B. in centimeters.

IGNORE DEAD TREES AND TEREE LESS THAN 5CM. D.B.H.OB.

Write the total number of trees tallied in Col, (67-68)

(b) 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 calliper to the nearest centimeter. (Round off 0.5 cm. to the nearest even number). Take only one measurement along the diameter pointing towards the plot centre.

(c) If there is considerable abnormality at the base of the stem, upto or at the breast height than take the measurement above of below such abnormality.

(d) In case of trees forking below the B.H. measure and record diameter at B.H. considering each stem as a separate tree.

(e) "IN TREES"

Look at the B.H. point of the tree through the 'Relaskop' If the tree is definitely begger 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 of the tree from the 'Relaskop'.

(f) Suppose distance of the tree from the Relaskop is Z(in meters) and the diameter, in centimeters is Y. Then the tree is 'In', if Yx. 3535 is equal to or greater than Z.

3.4 SAMPLE TREE FORM:- (Fill this form for "Tree in line" also)

(a) All the "in" trees for BAF.2 from the plot centre, greater than or equal to 20 cm. D.B.H.O.B. are to be treated as "Sample Tree". Dead trees are to be ignored.

Fill this form for the sample trees at the plot numbered as 1,3,5,7. If any of these plots is not a forest than the data for sample trees may be recorded at the next plot, i.e. if plot No. 1 is not a forests, 'Sample tree data' may be collected at Plot No. 2. But if plot No. 2 is also not a forest then no data regarding sample tree is to be collected at the cluster (1,2). In case of "Tree in Line," fill this form, in which plot it occurs.

(b) Number all the 'Sample trees' serially. Make a small blaze of the tree stem about 20 cms. below the B.H. facing the plot center and write the number of the tree in two digits on the tree.

(c) Use one form for each plot. If necessary continuation sheet (second form) may be used and all the columns, therein filled up.

(d) Now write the following information in the sample tree form, as for the plot description form.

Job number	(Col, 1-3)
Card Design	(Col. 4-5)
Report number	(Col. 6-7)
Sub Report Number	(Col. 8)
Plot Number	(Col. 69)
Grid Zone	(Col. 70)
Block Centre Grid Reference	(Col. 71-78)
Inventory Design	(Col. 79-80)

(e) Observe each sample tree and take measurements and record the following information regarding each tree, column-wise.

(i) Name of the species.

(ii) Serial number in two digits (Col. 8-10. 38-39).

(iii) Species code in three digits (Col. 11-13,40-42). (App. IV).

(iv) Dominance (Col. 14, 43).

Classify the tree in one of the following classes and write the code of the class in the column headed Dominance.

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 without its leader free in a chance gap should not be classed as dominant.

TREE OF UNDERSTOREY :- is a tree which is part of the understorey

SOLITARY :- a tree, standing alone in a blank.

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

(v) D.B.H.O.B. (Col. 15-17, 44-46)

Measure the diameter, over bark with callipers, at a point 1.37 M., from the base on the up-hill side, to the nearest cm. 0.5 is to be rounded off to the nearest even number.

Measure only one diameter pointing towards the plot centre and record the diameter in centimeters (three digits). If the tree is forking below B.H. (i.e. 1.37 M. high point) then each stem is to be considered as a separate tree.

(iv) TOTAL HEIGHT (Col. 18-19, 47-48)

Measure the height of the tree from the base on the up-hill 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 off to the nearest even number. Write the height of the tree in meters in two digits in the column headed " Total Height".

(vii) CLEAR BOLE (Col. 20-21, 49-50)

Measure the height along the stem of the tree from the base, on the uphill/side to the beginning of the regular crown with BlumeLeise Hypsometer, to the nearest meter, (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 recogised as the place from where the 1st major branch takes off or the main stem forks.

(viii) DEFECT NATURAL (Col. 22, 51)

Examine the stem of the tree and classify as under the basis of the extent of ' Natural Defects' and write the code in the column headed "Defects - Natural".

Code	Description
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 these abnormalities are included which are very natural and normal for the tree.

e.g. Knots, callous fromation, twisted and spiral grain (of chir) etc.

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

Contents

(ix) DEFECT OTHERS (Col. 23, 52)

Examine the stem and classify as under on the basis of the extent of defects causod by "External Agencies" and write the code in the column headed "Defect - Others".

Code	Description
1	Complete stem free from any defects.
2	One theird 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 agen-cies 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.

(x) LAST TEN YEARS HEIGHT GROWTH (Col.. 24-25, 53-54)

Measure the height along the stem of the tree from the base, on the uphill side, to the 10th of whorl from the top, with Blume-Leiss Hypsometer, to the nearest meter. Substract this from the total height measured. Write the difference (in two digits) in the column headed "Increment - Neight " last decade ".

(It will be easy for young conifers).

If it is not possible to locate the position of the 10th whorl from the top write in the column 00. It will be difficult to record this measurement in broad leaved species.

(xi) TOWARDS P.C.

(a,b) Collect a core with the increment borer at B.H. at the point where the arm of the callipers touched the stem while taking the diameter measurement (towards the plot centre). Count the number of rings from periphery towards the pith with the help of a hand lens provided for the purpose and measure the growth in millimeters for :-

- the last 10 years
- the last 20 years.

Record the increment in two digits in the appropriate columns.

(e) Blaze the tree and remove the bark making a neat out at the same point as at (a). Measure the bark thickness with a scale to the nearest m.m. and write in this column.

NOTE :- For counting the rings use Fluoroglusine (if available) or water on the core before counting. This will make the growth rings distinct.

(ii) Use a transparent scale for measuring the growth (distance between the growth rings).

(iii) For species where, growth rings are not distinct, write 00 in the columns.

(xii) OPPOSITE TO P.C.

on the point at B.H. opposite to the plot centre (where the arm of callipers touched while measuring the D.B.H.O.B. measure the bark thickness and the last 10 years and 20 years growth and record as in (xi) above.

(f) Data for the next tree is to be written in the next row and so on.

(g) Write the total number of sample trees in two digits in the space under column (67-68)

Contents

APPENDIX :- I

Sl.No.	B.C.G.R.	Mapsheet No.
1.	3304 1109	43 J/4
2.	3312 1109	-do-
3.	3312 1101	-do-
4.	3320 1117	43 J/8
5.	3320 1109	43 J/8,4
6,	3320 1101	43 J/8,4
7.	3326 1117	43 J/8,6
8.	3328 1109	-do-
9.	3328 1101	-do-
10.	3336 1125	-do-
11	3336 1117	- do-
12.	3336 1109	-do-
13.	3336 1101	-do-
14.	3344 1165	43 J/10
15.	3344 1157	-do-
16.	3352 1165	-do-
17.	3352 1157	-do-
18.	3360 1173	-do-
19.	3360 1165	-do-
20.	3360 1157	-do-
21.	3344 1149	43 J/11
22.	3344 1141	-do-
23.	3344 1133	-do-
24.	3352 1149	-do-
25.	3352 1141	-do-
26.	3352 1133	-do-
27.	3360 1149	-do-
28.	3360 1141	-do-
29.	3360 1133	-do-
30.	3344 1125	43 J/12
31.	3344 1117	-do-
32.	3344 1109	-do-
33.	3344 1101	-do-
34.	3352 1125	-do-
35.	3352 1117	-do-
36.	3352 1109	-do-
37.	3352 1101	-do-
38.	3360 1125	-do-
39.	3360 1117	-do-
40.	3360 1109	-do-
41.	3360 1101	-do-
42.	3368 1165	43 J/14
43.	3369 1157	-do-
44.	3376 1165	-do-
45.	3376 1157	43 J/14,15
46.	3384 1165	43 J/14, N/2

Contents

Sl. No.	B.C.G.K.	Mapsheet No.
47	3384 1157	43 J/14,15
48	3368 1149	43 J/15
49	3368 1141	-do-
50	3368 1133	-do-
51	3376 1149	-do-
52	3376 1141	-do-
53	3376 1133	-do-
54	3384 1149	43 J/15
55	3384 1141	-do-
56	3384 1133	-do-
57	3368 1125	43 J/16
58	3368 1117	-do-
59	3368 1109	-do-
60	3368 1101	43 J/16, K/13
61	3376 1125	43 J/16
62	3376 1117	-do-
63	3376 1109	-do-
64	3384 1125	-do-
65	3384 1117	-do-
66	3384 1109	-do-
67	3328 1093	43 K/5
68	3336 1093	-do-
69	3336 1085	-do-
70	3344 1077	43 K/5,9
71	3344 1069	43 K/6,10
72	3344 1095	43 K/9,5
73	3344 1085	-do-
74	3352 1093	43 K/9
75	3352 1085	-do-
76	3360 1093	-do-
77	3360 1085	43 K/9
78	3360 1077	-do-
79	3352 1069	43 K/10
80	3352 1081	-do-
81	3352 1053	-do-
82	3352 1045	-do-
83	3360-1069	-do-
84	3360 1061	-do-
85	3360 1053	-do-
86	3360-1045	43 K/10,11
87	3368 1081	43 K/10,14
88	3368 1053	43 K/10,14
89	3368 1045	43 K/10,11
90	3368 1093	43 K/13
91	3368 1085	-do-
92	3368 1077	-do-

Contents

Sl. No.	B.C.G.R.	Mapsheet No.
93.	3376 1101	43 K/13,J/16
94.	3376 1093	43 K/13
95.	3376 1085	-do-
96.	3376 1077	-do-
97.	3384 1101	43 K/13,J/16
98.	3384 1093	43 K/13
99.	3384 1085	-do-
100.	3384 1077	-do-
101.	3368 1069	43 K/14,10
102.	3376 1069	43 K/14
103.	3376 1061	-do-
104.	3376 1053	-do-
105.	3384 1069	-do-
106.	3384 1061	-do-
107.	3384 1053	-do-
108.	3376 1045	43 K/15,14
109.	3384 1045	43 K/1,5
110	3392 1045	43 K/15,O/3
111.	3392 1157	43 N/3,2
112.	3392 1149	43 N/3
113.	3392 1141	-do-
114.	3392 1133	-do-
115.	3400 1149	43 N/3
116.	3400 1149	-do-
117.	3400 1141	-do-
118.	3400 1133	-do-
119.	3408 1157	43 N/3,7
120.	3408 1149	-do-
121.	3408 1141	43 N/3
122.	3408 1133	-do-
123.	3392 1125	43 N/4
124.	3392 1117	-do-
125.	3392 1109	-do-
126.	3400 1125	-do-
127.	3400 1117	-do-
128.	3400 1109	-do-
129.	3408 1125	-do-
130.	3408 1117	-do-
131.	3408 1109	-do-
132.	3416 1165	43 N/6
133.	3416 1157	43 N/7
134.	3416 1149	-do-
135.	3416 1141	-do-
136.	3416 1133	-do-
137.	3424 1138	-do-
138.	3416 1125	43 N/8
139.	3416 1117	-do-

Contents

Sl. No.	B.C.G.R.	Mapsheet No.
140.	3416 1109	43 N/8
141.	3424 1125	-do-
142.	3424 1117	-do-
143.	3424 1109	-do-
144.	3432 1117	-do-
145.	3392 1101	43 O/1
146.	3392 1093	-do-
147.	3392 1085	-do-
148.	3392 1177	-do-
149.	3400 1101	-do-
150.	3400 1093	-do-
151.	3400 1085	-do-
152.	3400 1077	-do-
153.	3408 1101	-do-
154.	3408 1093	-do-
155.	3408 1085	-do-
156.	3408 1077	43 O/1
157.	3392 1069	43 O/2
158.	3392 1061	43 O/2, K/14
159.	3392 1053	-do-
160.	3400 1069	43 O/2
161.	3400 1061	-do-
162.	3400 1053	-do-
163.	3408 1069	-do-
164.	3408 1061	-do-
165.	3408 1053	-do-
166.	3416 1101	43 O/5
167.	3416 1093	-do-
168.	3416 1085	-do-
169.	3416 1077	43 O/5
170.	3424 1101	-do-
171.	3424 1093	-do-
172.	3425 1085	-do-
173.	3424 1077	43 O/5, 6
174.	3432 1077	-do-
175.	3416 1069	43 O/6
176.	3416 1061	-do-
177.	3416 1053	43 O/6,2
178.	3424 1069	43 O/6
179.	3424 1061	-do-
180.	3424 1053	-do-
181.	3432 1069	-do-
182.	3432 1061	-do-
183.	3432 1053	-do-
184.	3424 1045	43 O/7
185.	3432 1045	-do-
186.	3432 1037	-do-
187.	3440 1061	43 O/10
188.	3432 1109	43 N/8

Contents

Sl. No.	R.C.G.R.	Mapsheet No.
189.	3440 1117	43 N/12
190.	3440 1109	-do-
191.	3400 1045	43 O/3
192.	3400 1037	-do-
193.	3400 1029	-do-
194.	3408 1045	-do-
195.	3408 1037	-do-
196.	3408 1029	-do-
197.	3408 1021	-do-
198.	3416 1037	43 O/3, 7
199.	3416 1029	-do-
200.	3416 1021	43 O/3,4
201.	3408 1015	43 O/4
202.	3408 1005	-do-
203.	3408 0997	-do-
204.	3416 1013	-do-
205.	3416 1005	-do-
206.	3432 1101	43 O/5
207.	3432 1093	-do-
208.	3432 1085	-do-
209.	3416 1045	43 O/7,3
210.	3424 1037	43 O/7
211.	3424 1029	-do-
212.	3424 1021	43 O/7,8
213.	3432 1029	43 O/7
214.	3440 1029	43 O/7,11
215.	3424 1013	43 O/8
216.	3424 1005	-do-
217.	3432 1021	43 O/8,7
218.	3432 1013	43 O/8
219.	3432 1005	-do-
220.	3440 1021	43 O/8,7,12
221.	3440 1013	43 O/8
222.	3440 1005	43 O/8
223.	3440 0997	-do-
224.	3440 1101	43 O/9
225.	3440 1093	-do-
226.	3440 1085	43 O/8,9
227.	3448 1101	-do-
228.	3448 1093	-do-
229.	3448 1085	-do-
230.	3456 1101	43 O/9
231.	3456 1093	-do-
232.	3456 1085	-do-
233.	3440 1077	43 O/10,9
234.	3440 1069	43 O/10
235.	3440 1053	-do-
236.	3448 1077	-do-
237.	3448 1069	-do-

Sl. No.	B.C.G.R.	Map sheet No.
238.	3448 1069	-do-
239.	3448 1053	-do-
240.	3456 1077	-do-
241.	3456 1069	-do-
242.	3456 1061	-do-
243.	3456 1053	-do-
244.	3440 1045	43 0/11
245.	3440 1037	43 0/11,7
246.	3448 1045	43.0/11
247.	3448 1037	-do-
248.	3448 1029	-do-
249.	3456 1045	-do-
250.	3456 1037	-do-
251.	3456 1029	-do-
252.	3448 1021	-do-, 0/12
253.	3448 1013	43 0/12
254.	3448 1005	-do-
255.	3448 0997	-do-
256.	3456 1021	-do-
257.	3456 1013	-do-
258.	3456 1005	-do-
259.	3456 0997	-do-
260.	3464 1021	43 0/12,16
261.	3464 1013	-do-
262.	3464 1005	43 0/12
263.	3464 0997	-do-
264.	3464 1101	43 0/13
265.	3464 1093	-do-
266.	3464 1085	-do-
267.	3472 1001	-do-
268.	3472 1093	-do-
269.	3472 1005	-do-
270.	3480 1101	-do-
271.	3480 1093	-do-
272.	3480 1085	-do-
273.	3464 1077	43 0/14
274.	3464 1069	-do-
275.	3464 1061	-do-
276.	3464 1053	-do-
277.	3472 1077	-do-
278.	3472 1069	-do-
279.	3472 1061	-do-
280.	3472 1053	-do-
281.	3480 1077	-do-
282.	3480 1069	-do-
283.	3480 1061	-do-
284.	3480 1053	43 0/14,15
285.	3464 1045	43 0/15
286.	3464 1037	-do-
287.	3464 1029	43 0/15,11
288.	3472 1045	43 0/15

Contents

Sl. No.	B.C.G.P.	Mapsheet. No.
289.	3472 1037	-43 O/15
290.	3472 1029	-do-
291.	3480 1045	-do-
292.	3480 1029	-do-
293.	3480 1029	-do-
294.	3472 1021	43 O/16
295.	3472 1013	-do-
296.	3472 1005	-do-
297.	3472 0997	43 O/16,P/13
298.	3480 1021	43 O/16
299.	3480 1013	-do-
300.	3480 1005	-do-
301.	3488 1005	43 O/16,52 O/4
302.	3440 0989	43 P/5
303.	3456 0989	43 P/9
304.	3464 0989	-do-
305.	3472 0989	43 P/13
306.	3480 0997	43 P/13,O/16
307.	3480 0989	43 P/13
308.	3488 0997	43 P/13,O/16
309.	3488 0989	43 P/13
310.	3488 1093	52 O/1
311.	3488 1085	-do-
312.	3496 1093	-do-
313.	3496 1085	-do-
314.	3488 1077	52 O/2
315.	3488 1069	-do-
316.	3496 1077	-do-
317.	3496 1069	-do-
318.	3504 1077	-do-
319.	3504 1069	-do-
320.	3488 1043	52 O/5
321.	3488 1037	-do-
322.	3488 1029	-do-
323.	3496 1045	-do-
324.	3496 1037	-do-
325.	3496 1029	-do-
326.	3504 1045	-do-
327.	3504 1037	-do-
328.	3504 1029	-do-
329.	3488 1021	52 O/4, 43 O/16
330.	3488 1013	-do-
331.	3496 1021	52 O/4
332.	3496 1013	-do-
333.	3496 1005	-do-
334.	3504 1021	-do-

Contents

Sl. No.	B.C.G.R.	Mapsheet No.
335.	3504 1013	52 C/4
336.	3504 1005	-do-
337.	3512 1045	52 C/7
338.	3512 1037	-do-
339.	3512 1029	-do-
340.	3520 1045	-do-
341.	3520 1029	-do-
342.	3512 1021	52 C/8
343.	3512 1013	-do- 4(52 C/8,4)
344.	3512 1005	-do-
345.	3520 1021	52 C/8
346.	3496 0997	52 C/1

Contents

APPENDIX :- IIA

STATE	CODE
JAMMU - KASHMIR	07

APPENDIX :- II B

REVENUE DISTRICTS (J&K)

NAME	CODE
SRINAGAR	01
ANANTNAG	02
BARAMULA	03
DODA	04
UDHAMPUR	05
KATHUA	06
POONCH	07
JAMMU	08
LADAKA	09

APPENDIX :- IIC

FOREST DIVISION (J. & K.)

KAMRAJ	01
IANGET	02
SINOH	03
JHELUM VALLEY	04
AIR PANJAL	05
KASHMIR	06
KISHTWAR	07

Contents

NAME	CODE
BHADARWAH	08
DODA	09
RAMBAN	10
BIABI	11
UDHAMPUR	12
POONCH (S.C.)	13
RAJOURI	14
BILAWAR	15
JAMMU (S.C.)	16
LEH	17

APPENDIX :- II-D

REPORTING UNIT

KASHMIR	05
JAMMU	06

APPENDIX :- II-E

GRID ZONES

	CODE
O	1
IA	2
IB	3
IIA	4
IIB	5
IIIA	6
IIIB	7
IVA	8
IVB	9

Contents

APPENDIX:-III

Crew Leaders Code

Kashmiri Lal	01
Virinder Lal	02
Juneja R.L.	03
Purshotam Dayal	04
Pathania S.S.	05
Bashir Ahmed.	06
Sharma M.L.	07
Kanwarjit Singh	08
Mughal M.B.	09
Kuldip Raj.	10
Kanwar KuldipSingh	11
Pathania M.S.	12
Sharma O.P.	13
Sharma K.S.	14

INSPECTING OFFICERS

Das B.S.	16
Bahadur M.P.	17
Kapoor J.P.	18
Sangal P.M.	19
Sadashivaiah A.S.	20
Verma B.K.	21
Mukherji S.D.	22

Contents

APPENDIX - IV

Code Nos. for Northern Zone Species.

Shorea robusta	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 leucotrichophera	009
Quercus himalayana	010
Quercus semecarpifolia	011
Betula utilis	012
Alnus nitida	013
Poplus ciliata	014
Juglans regia	015
Acer spp.	016
Aesculus indica	017
Prunus padus	018
Rhododendron arboreum	019
Pieris lyonia	020
Celtis australis	021
Ulmus wallichiana	022
Rhus spp.	023

Contents

Morus spp.	024
Corylas colurna	025
Salix spp.	026
Pistacia integrrima	027
Terminalin alata.	028
Lannea coramendelica	029
Anogeissus latifolia	030
Mallotus philippensia	031
Grewia spp.	032
Rauhinia spp.	033
Buchanania lanzan	034
Syzygium cumini	035
Acacia catechu	036
Ficus spp.	037
Boswellia serrata	038
Brythrina suberosa	039
Pyrus pshia	040
Diospyros spp.	041
Ougeinia cojinensis	042
Bombax ceiba	043
Terminalia bellirica	044
Cassia fistula	045
Flacourtia ramontchi	046
Kydia calycina	047
Mitragyna parviiolia	048
Ehretia laevis	049

Contents

Zizyphus spp.	050
Nyctanthus arbortristis	051
Emblica officinalis	052
Aegle marmelos	053
Bochmeria spp.	054
Casearia tomentosa	055
Limonia spp.	056
Toona ciliata	057
Holoptelea integrifolia	058
Madhuca longifolia van lotifolia	059
Terminalia chebula	060
Lagerstroemia parvifolora	061
Adina cordifolia	062
Butea monosperma	063
Cordia myxa	064
Schlichera oleoza	065
Moringa pterygosperma	066
Albizzia lebback	067
Artocarpus lakoocha	068
Bridelia retusa	069
Dalbergia sisoo	070
Garuga pinnata	071
Phoebe lanceolata	072
Phoenix sylvestris	073
Prosopis spp.	074
Quercus glauca	075

Contents

Machilus odoratissima	076
Carpinus species.	077
Thuja compacta	078
Toona serrata	079
Melia azadirach	080
Kigelia africana	081
Mangifera indica	082
Gardinia species	083
Other miscellaneous	096
Fraxinus spp.	099
Robinia psuedoacacia	100

Contents

(Section IV)

FORM FACTOR AND CULL FACTOR WORK

4.1. Design and General Instructions :

The following instructions should be followed while carrying out field work for collection of data for Form and Cull studies :

The work for this will be carried out in two types of areas.

(i) Sample plots of statistically selected blocks over which inventory data has already been collected.

(ii) Felling coupes, where departmental or contractor's fellings are in progress.

The forms to be filled in for both are the same, though there will be some difference in the procedure for selection of plots and trees.

(I) For inventory sample plots :

(a) Sampling Design :-

For form and cull factor data, trees will have to be felled to enable measurements at different places along its stem. For this purpose it is necessary that trees should be selected unbiased and should be spread over the whole sampled population. Hence certain blocks have been systematically selected and data will be collected. on all sample plots in that block. For the purpose of form and cull studies every third block will be systematically taken up. The first block will be selected at Random. The blocks to be done are 1,4,7,10,13,16,19,22,25,28,31,34,37,40,43,46,49,52,55,58,61,64, 67,70,73,76,79,82,85,88,91,94,97,100,103,106,109,112,115,118,121, 124,127,130,133,136,139,142,145,149,151,154,157,160,163,166,169,172, 175,178,181,184,187 etc. You will recall that that every odd numbered plot in block is a sample plot and there will be not more than 4 sample plots in a block. The selection of trees in a sample plot will again be done statistically. For this purpose, from the plot centre, a tally will be taken with a Relaskop as in the past using B/F 2, and all trees 5 cm. and over in d.b.h. will be serially numbered in the sequence of tally. The tally will start from the northern direction and proceed through E.S.W. and back. If two trees are overlapping then the outer trees will be numbered ones viz. 1.3.5.7....etc. will be felled and measurements recorded in the forms provided. As before, the data will be added. The design obviates the necessity of fresh laying of sample plots.

Contents

Some of the information in the same as in the Plot Description Form of the Inventory work for e.g. forest type, origin etc. and the same precautions should be observed and same procedure followed to determine them.

The detailed instructions at each stage are as follows :-

(1) The crew leader should copy out the reference and approach to all the chuster centres of the blocks where data is to be collected. He should note the plot number and number of sample plots in each of the block. Sometimes if the code number plot happens to be non-forest, the sample plot data might have been collected at the even numbered plot. Sometimes there may be less than 4 sample plots in a block.

(2) After getting this information he should collect all the tools required for the work and proceed.

(3) Trace out the cluster centre with the help of the map and the route description available. Sometimes the cluster centre peg may not be available, having been removed by local people. In that case the Reference will help.

(4) From the cluster centre proceed in the direction of the plot centre of the sample plot, stepping out the distance to reach the approximate position of plot centre and fix a peg.

(5) Locate the old plot centre with the help of referances.

(6) If for any reason, and after careful search, you are not able to locate the old plot centre, take the peg fixed after stepping at 200 metres as the plot centre and carry out the work and record this fact.

(7) Fill up the plot description (as in the normal inventory work) in Cols. 51-69 of the tree volume study form.

(8) From the plot centre, take a Relaskop tally using the BAF.2 and mark all the 'IN' trees 5 cms. and over in d.b.h.

(9) Carry out measurements in all 'IN' trees and record in the form in Cols. 8-27.

(10) Mark the B.H. point with chalk on all the odd number trees viz. 1,3,5,7,9 ..... etc. these trees will be felled. In the form also mention the appropriate code for the trees in col. 28 according to whether they are to be felled or not. Mark also the direction of plot centre on the tree.

(11) Measure the DBH, height etc. i.e. upto col. 28 for the standing tree as done for sample trees in inventory work.

(12) Fell the tree as near to ground level as possible. The tree should be felled in the uphill direction using all precautions for felling. Power saws may be used wherever possible. In case of broad leaved tree species having many big branches the main stem along with the branch having the leading shoot which is more or less in line with the main stem shall be called as 01 and the other branches as 02,03,04 .....etc. as illustrated. For conifers the measurements will be made only on the main stem which will be called 01.

In the illustration above, the number of parts are 1 and this number should be written in col. 33.34. Only branches having 5 cm. and over dia. at 1 meter distance from the origin of the branch shall be considered for this purpose. Thinner branches should be ignored. In case of conifers the number will always be 01 and branches will not be taken into consideration.

(b) Stem wood measurements:

Measure the length of the stem from tip of crown to the breast height point and add 1.37 metres to give the total length of the stem and record in cols. 29.32. Let this length be called "L".

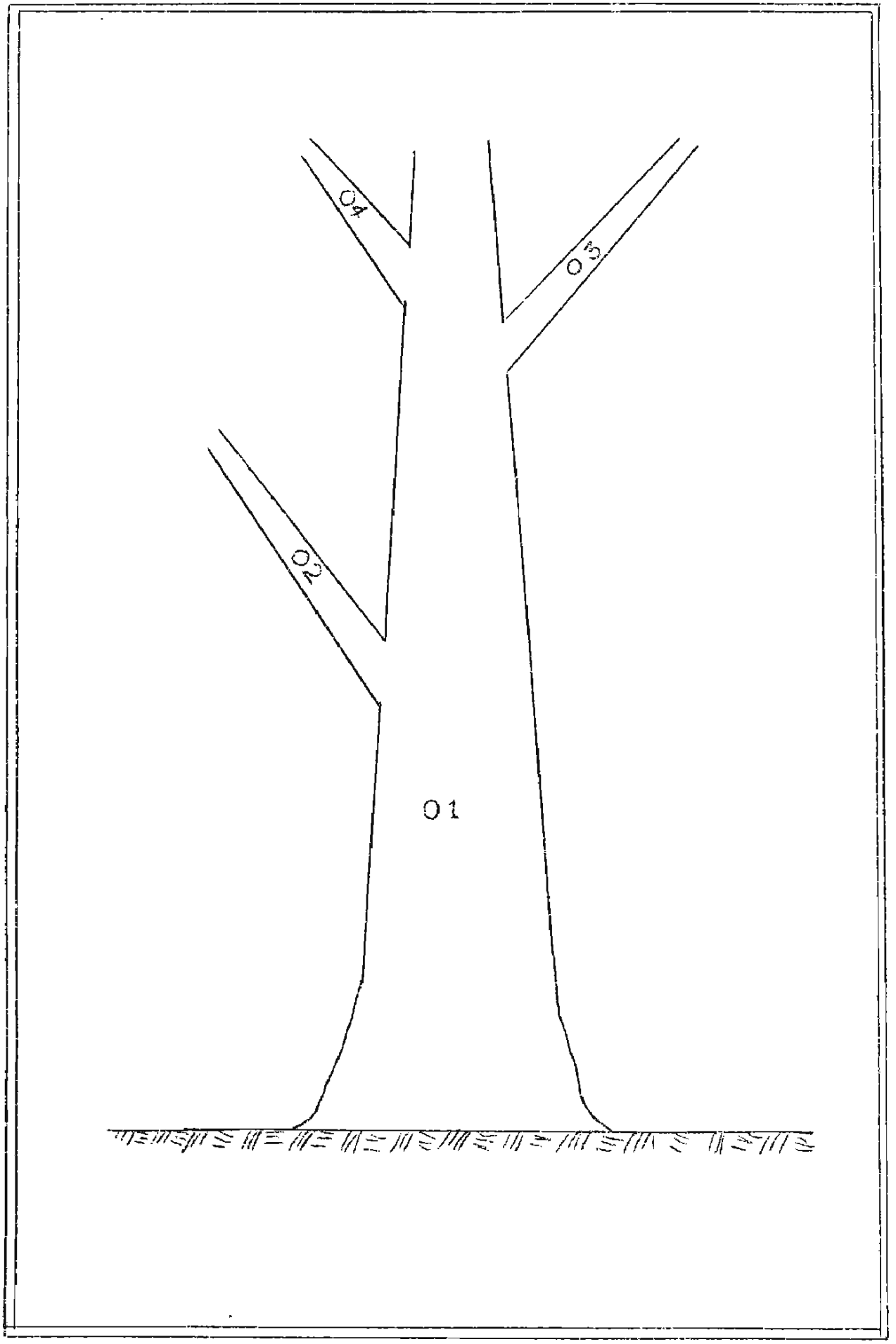
Mark points L/10, 2L/10, 3L/10 etc. till 9L/10 along the stem starting from top of the tree. If there is some abnormalty at any point like knots swelling etc. the mark any be made slightly higher or lower than the correct point. In case of any of the measurement point go below the stamp level take the stump level as the concerned measurement point. 10L/10 section is to be at ground level and generally the tree is felled slightly above the ground level.. In this case the measurement at the stump and record the length.

Mark also points where dia. o.b. is 5 cm. and 20 cms.

Number the sections (where measurements are made) serially from the bottom, numbering the stump as 01. (on the section note defects if any and write in the appropriate columns duly coded).

It should be remembered that two diameters (o.b.) should be measured. One in the radial direction and the other in a direction perpendicular to the radial. For this the radial direction should be marked before felling the tree. After taking the over bark measurement, a narrow remove strip of bark and measure the diameter u.b. in the two directions as earlier. If for any reason the diameter cannot be measured with a calliper, then the diameter in the correct directions may be measured,

Contents



Contents

with a meter scale on the section after cutting the log. If the end face of the log is not perpendicular to the axis of the log, the scale should be held perpendicular to the axis and correct measurements recorded. This precaution should be observed for all measurements on the end face of log.

Cut the tree into logs at the various measurement points. Start measurements of sectional diameter correct to mm. and distance of the measurement point from the ground level in cm. (taking b.h. point as reference viz. distances on the right and the left of the b.h. point) serially from the /01 onwards. Examine the face of the section. Count the total number of rings on the section and note in col. 33-37. See if there are any of the defects listed. They may be Rot, knots, hollow, insect damage etc. Enclose the damage in a rectangle and by drawing pencil lines and measure the side length of the sides of the rectangels and write in the form. This will give the area affected by the damage. Sometimes the defect may be present in two or more patches. In such a case examine whether a sound piece can be sawn between the two patches. Generally the distance should not be less than 10 cm. If the patches are closer than that, treat it as one patch and enclose both in one rectangle and take measurements. However, if they are spaced so aprt as to allow a sizeable scantling to be taken out in between the two i.e. if the distance between the patches is greater than 10 cms. treat them as two defects and take separate measurements of each and record.

(c) Branch-wood Measurements:

For the purpose of measurement a branch has already been defined earlier. The first section will be near the junction of the branch with the stem or the other branch just above the swelling at the junction. The branch should then be cut into billets of 2 meter length. The branch measurements shall be made only till the point where D.O.B. is 5 cm. The thinner portion of the branch beyond this will be ignored.

(b) Stem Analysis Measurements:

A thin disc (about 5 cms. thick) may be cut at the B.H. point and at L/10,2L/10 etc. points. The end face should be plane and perpendicular to the exis of the log. M[illegible]. On the section mark a diameter in pencil along the plot radius. This will be in the same direction in which one diameter measurement is taken.

Count the number of rings from the pith outward on the B.H. section and fix a pin at every decade or 10th ring. The first decade shall be the outermost complete decade. Record the radial distance of the outermost pin from the pith in the cols. 32-34 for the 1st decade. Make similar measurement for the next decade till you

reach the last decade or pin nearest to pith. Count the number of rings in the last incomplete decade and measure the width of the incomplete decade. If for example, a section has 66 rings, there will be 6 complete decades and 6 rings in the last incomplete decade. For the 6 complete decades measure the radial length from the pith and for incomplete decade write only the radial distance from the last complete decade to the circumference of the section.

On the next section, first mark the diameter in the radial direction in pencil. Then counting from the circumference inwards, mark out the same number of rings as in the last incomplete decade on the BH section and fix a pin. Then continue to count inwards and fix pins at every 10th ring till you reach the pith. It is possible that the inner decade i.e. nearest to pith may have less than 10 rings. But consider it as a decade for measurement purposes on this section. Measure also the width of the outer imcomplete decade i.e. width of the number of rings left at the periphery. Repeat the measurement on all other sections.

(e) Seedling Height:

At each place where stem analysis work is done about 5 free growing seedlings and samplings 1-4 metres in height and of the same species as the tree should be selected and cut at the ground level and B.H. point with a sharp Khukri. The diameter should be massured at the base & B.H. point. The rings should be counted at base and B.H. point and recorded in the form (seedling height data).

4.2 INSTRUCTIONS FOR FILLING UP VARIOUS FORMS:

(1) Tree Volume Study Form (for all tallied trees 5 cms. and over in d.b.h.)

All the column in Tree Volume Study Form (For standing trees) excepting Col. 1 to 5 and 79-80 are to be filled. Fill up each column as explained below :-

Col No.		
1-3	Job No.	Leave it blank
4-5	Card Design	-do-
6-7	Crew Leader	Give your code number (Appendix III)
8-9	Tree No.	Write the number of the tree.
10-12	Species	Refer Inventory Manual for J & K (Appendix IV)

Col. No.		
13	Dominance	Refer Inventory Manual for J & K (Appendix IV)
14-17	D.B.H.O.B. towards P.C.	Measure the diameter and breast height with the calliper pointing the longer arm towards the sample point or peg.
18-21	D.B.H.O.B. perpendicular to P.C.	Measure the diameter at breast height keeping the longer arm of the calliper in a direction perpendicular to the sample point.
22-23	Height of the tree.	Refer sample tree form instruction in Inventory Manual.
24-25	Clear Bole	-do-
26	Natural defect	-do-
27	Defect others	-do-
28	Tree F/N	Use the following code to denote whether the tree has been felled or not. Tree not felled -1 Tree felled -2
29-32	Stem length	Measure the length of the stem in cm.
33-34	No. of tree parts.	Write the total number of tree parts in the tree. This column should be filled only when the tree has been felled.
51-52	Total number of Trees.	This will correspond to the total tallied trees in the Sample Point.
53-54	State	For J & K code is 07
55-56	Forest Division.	Give the code of the division in which you are working. The code number for different divisions are given in the Inventory Manual for J & K (Appendix IIC)
57-58	Altitude	Fill up from the list available at the office.

Contents

Col. No.		
59	Slope)	
60	Aspect)	Refer P.D.F. instructions in Inventory Manual.
61	Origin)	
62-63	Forest type	Classify the forest into forest type as per the instruction given in the Inventory Manual.
64	No. of Storeys.	Classify the number of storeys as per instruction given in Inventory Manual.
65-66	Top Height	Refer P.D.F. instruction in Inventory Manual.
67	Size/Age	-do-
68	Stocking	-do-
69	Plot number	-do-
70	Grid Zone	It is always 2 for J & K area.
71-78	Block Centre Grid Reference	Give the grid reference of the block
79-80	Inventory Design.	Leave it blank.

.-.-.-.-.-

Contents

(2) TREE VOLUME STUDY FORM (Felled trees)

Fill up the various columns as explained below :-

Col. No.		
1-3	Job No.	Leave it blank
4-5	Card design	-do-
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 (Appendix IV)
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. /or junction of two branches.	The height of the section above the base of the tree in case of 01 portion stem/ and above the junction of the branche 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 dia-meter 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 millimeter.
27-30	D.U.B. towards P.C.	Measure the under bark diameter towards point c ntre upto the nearest millim ter.

Contents

Col.No.		
31-34	D.U.B. Perpendicular to P.C.	Measure the under bark 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 t the perphery of the section. Write 999 if the rings cannot be counted and 000 when there is no annual formation.
38	Gull presence	Examine whether there are defects on the section or not all 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. In case there is a defect will be classified in the following main classes in col. 39.

Type of defect	Code
Rot	1
Knots	2
Cracks	3
Insect demage	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
Spong Rot	3

Knot

Loose knot	1
Tight knot	2

		<u>Cracks</u> Superficial cracks 1 (Not deeper than 0.5 cms. and not wide than 1 mm). Radial shake 2 (Cracks from surface inwards deeper than 2.5 cms. and wider than 1 mm.) Star shake 3 (Crack from pith onwards). <u>Others</u> Fire damage 1 Hollowness 2
41-43	Size of rectangle	Enclose the defect in a rectangle and write the measurement of the sides in mm.
47-48 49-51 52-54 55-56 57-59 60-62		When the number of defects is more than one these columns are to be used similar to columns 39-40, Whenever there is no defect put '00' as the size of the rectangle.
63	Straightness	Each section has to be examined in respect to its straightness. It will classified into the following classes and the appropriate code will be used. Straight 1 Slightly bent 2 (Less than 10°) Promounced bent 3 (one bend more than 10°) Crooked 4 (More than 1 bend)
64	Shape of Section.	Classify the end face of the section in the following classes and write the appropriate code.

Contents

		Circular 1 Elliptical 2 (One diameter longer than the other by more than 20%) Fluted (Where the perphery of the section is way)
65	Anticipated out turn(%)	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 or others etc.The assessment will be done for the entire tree and not sectionwise.The following code will be used to denote the various utilisation percentages. Upto 10% 1 10-20% 2 20-30% 3 30-40% 4 40-50% 5 50-60% 6 60-70% 7 70-80% 8 above 80% 9
66	Anticipated out turn(Sl.No.%)	Assess the anticipated out turn of the sawn wood after accounting for the losses in sawing., defects etc. & classify in the following classes. Upto 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
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,than 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 depending 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	Plot No.	Write the plot No. of the cluster
70	Grid Zone	It will always be 2 for J & K area.
71-78	Block Centre	Write the B.C.G.R. from the map sheet.
79-80	Inventory Design	Leave it blank.

(3) SEEDLING HEIGHT FORM

The columnwise instruction for filling the seedling height form is given below :-

Column No.		
1-3	Job No.	Leave it blank
4-5	Card Design	-do-
6-7	Crew Leader	Write your code number (Appendix III)
8-9	Seedling No.	Give the number of the seedling. The first seedling taken for felling and measurement will have 01 No., the second seedling taken will be 02 and so on.
10-12	Species	Write the code No. of the species (Appendix IV)
13-16	Diameter at collar	Measure the over bark diameter at collar with the help of metric scale, after cutting at the base point, 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 correst to cms. For this measure the length of the seedling from the base to the tip of the seedling.
24-26	No. of Rings at 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.
69	Plot No.	Write the plot No. of the block.
70	Grid Zone	It will always be two (2) for J&K area.

Contents

Col. No.		
71-78	Block centre Grid Reference	Write from the map sheet
79-80	Inventory Design.	Leave it blank.

(4) GROWTH STUDY FORM

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

Col. No.		
1-3	Job No.	Leave it blank
4-5	Card Design	-do-
6-7	Crew Leader	Write your code (Appendix III)
10-12	Species	Write the code number of the species as given in the inv ntory manual of J & K area (Appendix IV)
13-14	Section No.	Write the number of the section on which the measurement is being done.
15-18	Height above the base.	Measure the length of the section taking B.H. point as reference and substract or add the value to 1.37 M. depending upon whether the section is below B.H. or above B.H. respectively.
19-21	No. of rings on the Section.	Count the total number of rings on the section and write the total count.
22-25	D.O.B. m.m.	Write the average diameter over bark which is calculated from the girth measurement.
26-29	D.U.B. m.m.	Write the average diameter under bark calculated by substracting double the bark thickness from the average diameter over bark.

Contents

Col. No.		
30	Radius No.	In each section two average radii will be drawn. Number them as 1 and as 2. The measurements on each section have to be done on radius 1 and radius 2 separately.
31	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 30 decade write 3 under century code and for the ramaining decades write 4 under century code.
32-34 35-37 38-40 41-43 44-46 47-49 50-52 53-55 56-58 59-61		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 the 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.
62-64	Width of incomplete decade	Write the width of those rings which are in the incomplete decade i.e. width of those rings which are between the last pin and the periphery of the section.
67-68	Total No. of sections.	Write the total number of sections on which the measurements have been done.
69	Plot No.	Write the plot No. of the block
70	Grid zone	It will always be two (2) for J-K area.
71-78	Block centre Grid Reference	Write from the map sheet.
79-80	Inventory Design.	Leave it blank

Contents

PLOT DESCRIPTION FORM

PREINVESTMENT SURVEY OF FOREST RESOURCES

NORTHERN ZONE

Section-V-Field Forms

Jpb	Card Design	Report Number	Sub. R. Number	Crew Leader
1-3	4-5	6-7	8	9-10

Grid Zone	Block centre Grid reference	Inventory Design
70	71-78	79-80

Date :

Name of C.L.

State	Revenue District	Forest Division	Land Class	Legal Status	TERRAIN Altitude	Topo	Slope	P.O.H.	Aspect	SOIL Stoniness	Humus	Consist	Textr.	Depth	Vegetation	Forest and Open For. Origin	Forest type	Storeys	Top height	Size/Age	Stocking	Regn.
11 12	13-14	15 16	17	18	19 20	21	22	23	24	25	26	27	29	30	31	32	33	34	35	36	37	38	39	40

COST

Plot classification	Species stocking in Forest Spp.		Spp.		Spp.			F.Plot	F. Plot.No.
54	55-57	58	59-61	62	63-65	66	67	68	69

17. LAND CLASS - Forest Land(1) Farm Wood Land (2) Non Forestry Plantation (3) Agricultural Grop Land(4) Pasture Land(5) Urban, Village & Industrial Lands(6) Barren Land(7) Others(8).
18. LEGAL STATUS- Reserved(1) Protected(2) National Park & Wood Preserves(3) Govt. Bairuni(4) Community Forests(5) Private (6) Undetermined(7).
21. TOPOGRAPHY - Precipitous(1) Very Hilly(2) Hilly (3) Gently Rolling(4) Flat(5)
22. SLOPE - 70°(1) 60° to 70°(2) 45° to 60°(3) to 45°(4) 0 to 20°(5).
23. P.O.H. - Ridge Top (1) Upper 1/3(2) Middle 1/3(3) Lower 1/3(4) Valley(5).
24. ASPECT - N(1) NE (2) E (3) SE (4) S(5) SW(6) W(7) NW(8) None (9)
25. STONINESS - 60%(1) 30 to 60%(2) 30%(3) Stones Absent(4)
26. HUMUS - 5 cm or more (1) 2 cm. to 5 cm(2) 2 cm (3) Humus Absent(4)
28. SOIL CONSISTANCY- Friable (1) Slightly compact (2) Compact (3) No soil (4).
29. TEXTURE - Clayey(1) Clayey Loam(2) Sandy Loam(3) Sandy(5) Pebbles(6) No soil (7).
30. SOIL DEPTH - 30 cm (1) 20 to 30 cm (2) 10 to 20 cm (3) 5 to 10cm (4) 5 cm(5) No. soil (6)
31. VEGETATION -Forest(1) Open Forest(2) Tree in line (3) Scrub (4) Open scrub(5) Grasses(6) Others(7)
33-34. FOREST TYPE - Chir(01) Blue pine(02) Deodar (03) Spruce(04) Fir(05) Spruce-Fir(06) Spruce-Fir-Blue pine(0&0 Deodar-Blue pine(08) Chir-Ban Oak(09) Blue pine-Moru Oak(10) Blue pine-Kharsu Oak(11) Deodar-Moru Oak(12) Deodar Ban Oak (13) Fir-Spruce-Kharsu Oak(14) Fir-Spruce-Moru Oak(15) Other hard woods(16) Willows(17) Poplars(18) walnut(19) Oaks(20) Deodar-Fir-Spruce (21).
38. SIZE/AGE-Regeneration(1) Young(2) Middle Aged (3) Mature (4) Over Mature(5).
39. STOCKING- 1.3M (1) 1.5 to 3M(2) 3 to 4.5M (3) 4.5 to 6M(4) 6 to 7.5(5) 7.5 to 9M(6) 9 to 10.5M(7) 10.5 to 12M(8) 12M(9).
40. REGENERATION - Profuse 60(1) Adequate 30 60(2) Scanty 10- 30(3)(3) Nil 10(4) Damaged (5) Not required(6)

Contents

PLOT ENUMERATION FORM/TALLY SHEET (BAF-2)

Job	Card Design	Report Number	Sub R. Number
1-3	4-5	6-7	8

PREINVESTMENT SURVEY OF
FOREST RESOURCES
NORTHERN ZONE

Total No. of trees	Plot No.	Grid Zone	Block Centre Grid Ref.	Inventory Design
66-68	69	70	71-78	79-80

Date

Name of C.L.

Species		Species		Species		Species		Species		Species		Species		Species		Species	
Code	Diam	Code	Diam	Code	Diam	Code	Diam	Code	Diam	Code	Diam	Code	Diam	Code	Diam	Code	Diam
9-11	12-14	15-17	18-20	21-23	24-26	27-29	30-32	33-35	36-38	39-41	42-44	45-47	48-50	51-53	54-56	57-59	60-62

Contents

PREINVESTMENT SURVEY OF FOREST RESOURCES

SAMPLE TREE FORM

Job	Card Design	Report Number	Sub.R. Number
1-3	4-5	6-7	8

Total No. of trees	Plot No.	Grid zone	Block Centre Grid Reference	Inv. Design
67-68	69	70	71-78	79-80

Date :

Name of C.L.

Species Local name or Botanical name.	S. No.	Species Code	Dominance	B.B.H.O.B.	Total Height	Clear Bole	Defect Natural	Defect	Last 10 years height growth	Towards P.C. Bark Thickness	Towards P.C. Last 10 yrs. Radial Incre.	Towards P.C. Last 10 yrs. Radial Incre.	Opp to P.C. At B.H. Bark Thickness	Opp to P.C. At B.H. Last 10 yrs Radial Incre.	Opp to P.C. Last 20 yrs. Radial Incre.
										At B.H.			At B.H.		
				VM	M	M			DM	DM	MM	MM	MM	MM	MM
	9-10	11-13	14	15-17	18-19	20-21	22	23	24-25	26-27	28-29	30-31	32-33	34-35	36-37
	38-39	40-42	43	44-46	47-48	49-50	51	52	53-54	55-56	57-58	59-60	61-62	63-64	65-66

PRE INVESTMENT SURVEY OF FOREST RESOURCES
NORTHERN ZONE
THREE VOLUME STUDY FORM (For all tallied trees 5 Cms. and over in d.b.h.)

JOB NO.	CARD DESIGN	CREW LEADER
1-3	4-5	6-7

Date

TOTAL NO. OF TREES	STATE	FOREST DIVISION	ALTITUDE	SLOPE	ASPECT	ORIGIN	FOREST TYPE	NO. OF STOREYS	TOP HEIGHT	SIZE/AGE	STOCKING	PLOT NO.	GRID ZONE	BLOCK CENTRE GRID REFERENCE	INVENTORY DESIGN
51-52	53-54	55-56	57-58	59	60	61	62-63	64	65-66	67	68	69	70	71-78	79-80

TREE NO.	SPECIES	DOMINANCE	D.B.H. O.B. TOWARDS P.C. mm	D.B.H. O.B. IN DIRECTION M	TOTAL HT M.	CLEAR BOLE M.	DEFECT	DEFEC OTHER	TREE F/N	STEM LENGTH Cm.	NO. OF PARTS
8-9	10-12	13	14-17	18-21	22-23	24-25	26	27	28	29-32	33-34

THREE VOLUME STUDY FORM (FELLED TREES)

PREINVESTMENT SURVEY OF FOREST RESOURCES
NORTHERN ZONE

DATE:

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

PLOT NO.	GRID ZONE	BLOCK CENTRE GRID REFERENCE	INVENTORY
69	70	71-78	79-80

TREE PORTION	SL.NO. OF SECTION	HEIGHT ABOVE THE BASE/BRANCH SECTION (Cm.)	D.O.B. TOWARDS P.C.	D.O.B. IR TO P.C.	D.U.B TOWARDS P.C.	D.U.B IR P.C	NO. OF RINGS AT THE STATION	CULL PRESENTED	MEASUREMENT OF DEFECT: TYPE OF DEFECT	SIZE OF RECTANGLE L MM	SIZE OF RECTANGLE B MM	TYPE OF DEFECT	SIZE OF RECTANGLE L MM	SIZE OF RECTANGLE B MM	TYPE OF DEFECT	SIZE OF RECTANGLE L MM	SIZE OF RECTANGLE B MM	STRAIGHTNESS	SHAPE OF SC.	A. OUT TURN U%	A. OUT TURN SL.NO. %	TOTAL NO. OF SECTIONS.
11-12	13-14	15-16	19-22	23-26	27-30	31-34	35-37	38	39-40	41-43	44-46	47-48	49-51	52-54	55-56	57-59	60-62	63	64	65	66	67-68

PREINVESTMENT SURVEY OF FOREST RESOURCES
NORTHERN ZONE

SEEDLING HEIGHT FORM

Job No.	Card Design	Crew Leader
1-3	4-5	6-7

DATE

Plot No	Grid Zone	Block Centre Grid Reference	Inv. Design
69	70	71-78	79-80

Seedling No.	Species	Diameter at Collar mm	Diameter at B.H. mm	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

GROWTH STUDY FORM

PREINVESTMENT SURVEY OF
FOREST RESOURCES
NORTHERN ZONE

DATE:

Job.No.	Card Design	Crew Leader	Tree No.	Species
1-3	4-5	6-7	8-9	10-12

Total No. of Section	Plot No. Grid Zone	Block Centre Grid Ref.	Inventory Design
67-68	69-70	71-78	79-80

Section	Height above the base	No. of Rings on the section	D.O.B. MM	D.U.B. MM	Radius No.	Centrudy Code	GROWTH OF DECADES (10 YEARS)										Width of incomplete Decade
							1	2	3	4	5	6	7	8	9	10	
13-14	15-18	19-21	22-25	26-29	30	31	32-34	35-37	38-40	41-43	44-46	47-49	50-52	53-55	56-58	59-61	62-64

PART II

DATA PROCESSING

Contents

(Section I)

TECHNICAL REPORT ON DATA PROCESSING

INTRODUCTION

1.1 In the year 1970 -71 the Project ' Preinvestment Survey of Forest Resources' carried out a comprehensive survey in Chenab Valley of Jammu & Kashmir State with a view to finding out the economic availability of raw material for forest industries development in the region. The project covered a total geographical area of 984,623 ha. and its boundaries are delineated in the map on the opposite page.

1.2 Starting from planning stage to presentation of final report, a series of data processing operations are involved. The present report describes salient features relating to data processing and forms a technical report to the main report. The data processing operations were mainly concerned with processing of inventory and cost data. Therefore, discussion in this report is restricted to these activities.

1.3 For the purpose of this report, the data processing activities are discussed under the following sections:-

Section II	- Design and Collection of Data.
Section III	- Editing and Storage of Data.
Section IV	- Estimation of Tree Volume.
Section V	- Estimation of Sampling Error.
Section VI	- Tabulations.
Section VII	- Special and Cost Studies.

1.4 The data have been processed using mainly IBM/1620 Model II Computer of the Planning Commission.

Contents

(Section II)

DESIGN AND COLLECTION OF DATA

2.1 Design of Field Survey

Field survey is essentially a systematic sampling of cluster blocks spread over the entire project area with an intensity of about .0125%. There are two types of elementary units viz. a plot and a point. Main reason for this is to compare two methods of survey viz. point sampling and plot sampling. Two elementary units - spaced 400 m. apart, constitute a cluster. A group of four such clusters arranged on the sides of a square with side 2 km. x 2 km. form a block. Blocks span the whole area north-south and east-west systematically at distances of 8 km. centre to centre in each direction as depicted in the enclosed diagram (Fig. 1) For the purposes of statistical analysis, whole block is considered as sampling unit and ratio method of estimation is used for caluclating mean and error.

2.2 Description of Data collected on an Elementary Unit :-

The procedure of location, laying out of a sample, manner of collection of relevant data and of filling it in appropriate forms, have been laid down in the field manuals prepared for the purpose.

The field data have been recorded in the following field forms which have been specially designed for a computerised data processing system and punched on the cards.

Form Type	Card design	No. of sheets	No. of cards.
Inventory Data Forms			
Plot Description	01	443	1217
Plot Enumeration	02	907	2055
Tally Sheet	03	885	1243
Sample Tree Form	04	475	3100
Form & Cull Factor Forms			
Tree Volume Study Form (Before felling)	05	45	714
Tree Volume Study Form (Felled Trees)	06	437	6155
Growth Forms			
Seedling Height Form	07	24	144
Growth Study Form	08	-194	1416

The layout of data of these forms on 80-column cards is given in Enclosure -1.

Contents

2.3 Field Checking :

Independent field check crews were formed for checking. They were required to visit selected points in all the blocks and redo the work independently of the previous work.

2.4 Office Checking :

All the forms received from the field were scrutinized in the field office for mistakes in coding and other inconsistencies. In case of any doubt which the crew leader might have had in the field in assigning the proper code, the position was discussed with the Officer-in-charge and corrected where necessary. This step was suggested to the zone to ensure that all the forms were properly and fully filled in.

Contents

EDITING AND STORAGE OF DATA

3.1. Editing :-

Computer Editing is attached maximum attention and care because many errors come to light which are difficult to detect with the help of manual checking. Many peculiar kinds of errors are observed while carrying out the edit operation which are of great importance for the designer.

The edit operations consist of.

i) Manual checking of field forms;

ii) Punching and Verification ;

iii) Sorting and Loading of data ;

iv) Checking of the field data with the help of electronic computer;

v) Comparison of error list with the field form;

vi) Finalization of correction; and

vii) Incorporation of the corrections in source documents and punched cards.

When the forms are received from the Zonal office, they are thoughly checked. For this purpose a set of instructions for each form is dictated to the checker.

For feeding to the Computer the field form data are punched on cards which are subsequently verifed by verifying machine. All the card decks are further sorted by appropriate sort keys with sorting machine (See Enclosure-II for sort keys). The sorting order is subsequently checked by a collactor also. The edit programme has 6 sub-routines which serve the following functions :

I) "RCHECK" :- This checks upper and lower limit of fields of a card design.

ii) "CCHECK" :- This sub-routine examines logical inter-relation between two different fields of the same record.

Iii) "LISTC":- This sub-routine checks codes in a particular field against a specified set of code numbers for that field.

Contents

iv) "CARDAC":- This sub-routine Cumulates values for different levels, e.g. number of cards in the plot, No of plots in a block, total number of plots, total number of blocks etc. and prints them out at the end of a run wherever necessary.

v) "SCHECK":- This sub-routine checks sequence of values for various sub-units of a given unit, e.g. in form factor data the diameter measurement at various heights above the ground should be in decreasing sequence. Height above the base, however, should always be in increasing sequence.

vi) " CUMUL":- This sub-routine cumulated the values for sub-units and compares in the end whether the number cumulated within a unit is different from the number specified for that unit; e.g. total number of section for a given tree is compared with the value given for total number of sections in the form factor data. If both of them differ, an error message is printed. For purposes of reference, Edit Package Programme has been documented indetail.

All the error meassages are carefully checked and compared with values written in the original form. In case an error is detected, corrections are made in the following 3 files all related, to the same form; (1) Field form (2) Punch card deck, and(3) Disk File. The third type of correction has to be made in case the data has already been loaded on the disk file before editing.

It has been found advisable to check the correction card with the help of another edit programme because unknowingly new types of errors may creep in while correcting the cards.

3.2 Data Layout:

The basic data file consisting of plot description and enumeration data, is organised in a variable length record file format on the disk. This system is introduced for the first time in the project. Uptil now the method adopted being to use a fixed length record file. The main advantage of the variable length record file is the saving in disk storage space to a large extent and in processing to a considerable extent. Layout of the variable length record file and other data files are given in Enclosures III-VI.

(Section IV)

ESTIMATION OF TREE VOLUMES

4.1 Some definitions about volume of Trees:

Volume of a tree has been distinguished into two portions--stem and branch. Both together viz. stem and branch volume constitute total Volume of a tree . F.R.I. distinguishes stem volume (definition of stem is given subsequently) into two parts, stem timber volume and stem small-wood volume, The volume (underbark) of stem upto 20 cm diameter over bark is defined as standard stem timber volume. The volume (over bark) of stem from 20 cm. overbark diameter to 5 cm overbark diameter is defined as Standard Stem Smallwood Volume. The practice of measuring stem timber underbark but stem small wood overbark causes some difficulty in estimating the total volume of stem under bark. In the project, therefore all volumes timber or small wood are measured underbark. Similarly F.R.I. distinguishes branch volume into two parts - Branch timber volume & branch small wood volume. In the project definitions of the timber and small wood for branch are same as those defined for main stem.

The estimated stem or branch volume without deduction for defect is called as Gross Volume. In case cull factor is available, we get the net volume i.e. the volume with deduction made for defects.

The volumes of main stem and branch are measured for four top diameter limits :-

Volume	upto	40 cm.	top
"	"	20 cm.	"
"	"	10 cm.	"
"	"	5 cm.	"

4.2 Definition of stem

For trees of the excurrent form to which the coniferous species belong stem includes the length of the trunk between the ground level and the tip of the tree. For trees of the deliquescent form to which most of the broad leaved species belong it denotes the clean bole plus one leading branch connecting the bole with the tip of the tree.

4.3 Tree Volume Computation:

There are two types of studies;-

1) Volume Table ; and
2) Cull study.

For computing volume, Samalian formulae given below is used.

$$\text{Gross volume of a Section} = \left(\frac{B_1 + B_2}{2}\right) L$$

Where B_1 and B_2 are basal area of two ends of a section of length L.

Contents

Volume is computed from both over as well as under bark diameter measurements.

4.4 Volume Types:

A. Gross Volumes

1. Total volume - This is equal to stem volume plus branch volume (obtained by cumulating over all the tree portions).

2. Stem Volumes.

(a) Clear bole volume - It is obtained by cumulating over tree portion 01.

(b) Leading branch volume - It is obtained by cumulating over tree portion 02.

3. Branch volume - It is obtained by cumulating over all other tree portions except 01 and 02.

B. Sound Volume (Net volume)

(for those trees only where cull study has been made). This is equal to Gross Volume - Cull volume.

4.5 Formula for Calculation of Cull Volume :-

For cull, formula is -

$$\left(\frac{A_1 + A_2}{2}\right) L$$

where A_1 and A_2 are cumulated cull areas at two ends of the sections and L is the length of section. A_1 is calculated by multiplying the length and breadth of cull and adding for all regions in the section.

4.6 The Method of Estimating Volume of Trees measured in the Plot Enumeration Form

The volume of talied trees on the plots (CD 05) is estimated with the help of volume equation connecting the diameter at the breast height of a tree with their expected volume. This has the form V=f(d) where V is the volume of a tree with diameter d, for a species and f is the functional relation between the diameter and volume for the species concerned. The volume equation is developed in two stages. In the first stage, a small sample of trees representing the crop surveyed is felled and following measurements are made :

Contents

Before felling

i) Diameter at breast height of the tree.
ii) Total height of the tree.

After felling

iii) Sectional diameter of the felled tree.
iv) Estimation of cull and the defective area on each section.
v) For coniferous species counting of total rings at the section is also done.

Felled tree data provide basic information for developing the multiple regression equations connecting the measured volume of the trees with their diameter at breast height and the total height (both standing). These equations are known as general volume equations because they are based upon two variables viz. diameter and height of trees.

In the second stage, after calculating Volume of the sample tree recorded in sample tree form (CD 04) using general volume equations, local volume equations were derived using diameter and volume of these sample trees. Since sample tree data was available for sufficiently large number of trees and felled tree data was available for very few trees the volume equations were derived in the manner described above.

The selected general and local volume equations for Chenab Valley are given below :-

4.6.1 General Volume Equations of Chenab Valley

Sl. No.	Species		Equation Selected
1.	Chir	$\frac{V}{D2H}$	$= 0.297110 + 0.019541/D^2H$
2.	Blue pine FOR $D^2H < 10$	V	$= 0.070572 + 0.296062\ D^2H$
3.	Blue pine FOR $D^2H > 10$	$\frac{V}{D^2H}$	$= 0.239729 + 0.724684/D^2H$
4.	Deodar FOR $D^2H < 10$	V	$= 0.091531 + 0.294023\ D^2H$
5.	Deodar FOR $D^2H > 10$	$\frac{V}{D^2H}$	$= 0.253916 + 0.354658/D^2H$
6.	Fir/Spruce FOR $D^2H < 10$	V	$= 0.070762 + 0.302174\ D^2H$

Contents

Sl. No.	Species	Equation Selected
7.	Fir/Spruce FOR $D^2H>10$	$V = 0.859831 + 0.250497\,D^2H$
8.	Miscellaneous (Broadleaved Spp.)	$\frac{V}{D^2H} = 0.296846 + 0.050260/D^2H$.

NOTE : Diameter and Height in metres; Volume in cu.m.

4.6.2. Selected Local Volume Equations of Chenab Valley.

Sl. No.	Species	
1.	Chir	$V/D^2 = 11.950158 + 0.128812/D^2 - 2.285176/D$
2.	Blue pine	$V/D^2 = 12.631292 + 0.213315/D^2 - 2.519227/D$
3.	Deodar	$V/D^2 = 11.804879 + 0.166427/D^2 - 1.756483/D$
4.	Fir/Spruce	$V/D^2 = 13.434214 + 0.177741/D^2 - 2.448384/D$
5.	Miscellaneous (Broadleaved) Spp.	$V/D^2 = 9.872098 + 0.253546/D^2 - 2.358187/D$

NOTE: Diameter in metres. Volume in cu.m.

4.7 Calculation of Volume of Trees on Enumeration Plot and of tallied trees.

With the help of the local volume equations described above volume of trees measured in Card Design 02 is calculated.

In case of the volume of tallied trees this volume is further multiplied by a weight calculated by the formula -

Weight = (Basal Area Factor)/(Basal Area of the Tree, to arrive at the contribution of the tree towards volume per hectare. Simultaneously the weight is also the contribution of each tallied tree to the number of stems per ha.

Contents

ESTIMATION OF SAMPLING ERROR

5.1. Analytical Procedure :

Design of sample survey has already been described in Section - II, which may be referred to if necessary before going further.

For analysing the field data based on systematic cluster blocks sampling method of ratio estimates has been used assuming a simple random sample of blocks. It may be noted that this method tends to over estimate the sampling error (see billiography).

5.2. Formulas used

5.2.1 Stratified sampling using Ground Information alone.

Let following discussion be confined to a given stratum. The block of 8 plots points is considered as one sampling unit. Let be the number of sampling units measured in the field. Let z_i denote total area number of the i-th sampling unit (in this case, it is always equal to 0.8 ha. 8 points. y_i and x_i denote the contribution to volume and forest area respectively by i-th sampling unit to the given stratum. Then v, the estimated volume per ha. in the stratum is :

$$V = \frac{\sum y_i}{\sum x_i} \qquad \ldots \quad \ldots \quad \ldots \qquad (1)$$

The standard error percent (S_1) of volume per ha. for the strata is :

$$S_1\% = \frac{100}{v} \sqrt{\frac{(\sum y_i^2 - 2\, v \sum y_i x_i + v^2 \sum x_i^2)}{(\sum x_i)^2}} \qquad (2)$$

In this formula finite population correction factor has been ignored.

The proportion of forest area is estimated for the formula :

$$a = \frac{\sum x_i}{\sum z_i} \qquad \ldots \quad \ldots \quad \ldots \qquad (3)$$

The sampling error percent (S_2 %) for area ignoring finite population correction factor is given by :-

$$S_2\% = \frac{100}{a} \sqrt{\frac{\sum x_i^2 - 2a \sum x_i z_i + a^2 \sum z_i^2}{(\sum z_i)^2}} \qquad (4)$$

The total volume (V) in the forest area (F) is calculated by the

.....

Contents

formula – $V = v \times F$

Where $F = a \times$ total stratum area (5)

The percentage sampling error (S%) in estimating total volume is :

$$S\% = \sqrt{(S_1\%)^2 + (S_2\%)^2} \qquad (6)$$

This formula (6) does not take into account the following two types of errors :

i) Sampling error due to volume table

ii) Non-sampling error.

5.2.2 Calculation of Error Pooled over all strata

Normal formula for calculating the pooled error cannot be applied for the present survey because samples in various strata are not independently distributed due to post-stratification. To overcome this problem a modification of Matern Method (1962) has been used for the present report.

As before let z_i be the total area of i-th sampling unit out of which an area x_{ik} falls in the stratum k and has volume y_{ik}. For each sampling unit the summation $\sum_k (y_{ik} - v_k \; x_{ik})^2$ and $\sum_k x_{ik}$ is built; where v_k is average volume per ha. in the stratum k. The present sampling error in volume per ha. (finite population correction factor has been ignorted) is given by ;

$$S_1\% = \frac{100}{v} \sqrt{\frac{\sum_i \left(\sum_k (y_{ik} - v_k \; x_{ik}) \right)^2}{\left(\sum_i \sum_k x_{ik} \right)^2}} \quad \ldots \qquad (7)$$

Where v(volume/ha.) is a weighted average of volume per ha. over all the strata. Symbolically :

$$v = \frac{\sum F_k \; v_k}{\sum F_k} \quad \ldots \qquad (8)$$

where F_k is forest area in stratum k.

The error in area estimation is obtained by formula :

$$S_2\% = \frac{100}{a} \sqrt{\frac{\sum_i \left(\sum_k (x_{ik} - a_k \; z_i) \right)^2}{\left(\sum z_i \right)^2}} \quad \ldots \qquad (9)$$

Where a_k is proportionate area under stratum k and a is proportionate area of total forest.

****

Contents

5.3. Main Results

Results of error calculations from point sampling on the basis of ground inventory are given below :-

Stratum	Area		Volume		Total	No. of plots.	
	% age to total forest area.	S.E. %	Vol./ha. m^3	S.E. %	S.E. %	Total	Enumerated
1. Fir	35.3	8.8	351.4	7.6	11.6	157	134
2. Blue pine	19.6	8.5	205.2	10.5	13.4	87	81
3. Deodar	17.6	13.4	378.7	6.4	14.8	78	72
4. Chirpine	5.2	12.7	127.5	16.0	20.4	23	19
5. Others	22.3	7.2	154.4	10.8	13.0	99	77
Total	100.0		272.0	6.0	6.0	444.0	383

Bibliography

i) Cochran, W.G. (1946) Relative Accuracy of Systematic and Stratified Random Samples for a certain class of population. Ann. Math. Stat. 17, 164-177.

ii) Finney, D.J. (1948) Random and Systematic Sampling in Timber Surveys. Forestry 22, 1-36.

iii) Finney, D.J. (1950) An example of periodic Variation in Forest Sampling. Forestry 23, 96-111.

iv) Matern, Bertil (1962) Estimating the Standard Error in stratified Sampling with systematic Sampling inside Strata.

Contents

(Section VI)

TABULATIONS

6.1. Plan of Tabulation :

Final tables presented for this report can be divided in-to three parts :

(i) Area and Volume Tables.

(ii) No. of stems and volume/ha.

(iii) Error calculations.

6.2. Area Distribution

All area related informations were obtained from maps prepared from complete aerial photointerpretation. The distribution of total area and plots into various land classes is as follows :-

SL.NO.	LAND CLASS	NO. OF PLOTS	AREA(Ha.)
1.	Forest Land		
	a) Vegetation Forest	444	374433
	b) Vegetation scrub etc.	37	29207
2.	Farm Woodland	35	27628
3.	Non-forestry plantation	6	4736
4.	Agricultural crop land	91	71833
5.	Pasture land	92	72623
6.	Urban village & Industrial	6	4736
7.	Barren Land	470	371009
8.	Others	36	28418
	All land classes	1217 Q=152	984623

6.3. Stratification and species group-ing

All tabulations have been made in terms of five strata formed as below :-

.....

Stratum	Forest Types in stratum
Fir	Fir, fir, Bluepine
Bluepine	Bluepine, Bluepine-Fir
Deodar	Deodar
Chirpine	Chirpine
Other mainly broad leaved	Broadleaved.

In stand and stock tables information has been provided by 10 cm. dia. classes. All conifers have been tabulated by species but broadleaved species as only one group.

Detailed results by different strata are provided for volume, area, volume/ha. and stems/ha. In addition to these, area and volume tables are also presented by strata and by some variables of plot descrip-tion form like top height, age, etc. as required. These replace the interim results which were based on partial returns and were estimated using F.A.O.'s general volume equations of U.P. and Himachal Pradesh. Moreover, the p resent estimates have been arrived at after running the consistency checks on the data and reclassification of a substantial No. of plots from one strata to another after discussion with the zone.

Important tables are reproduced in Part I of the report.

Contents

(Section VII)

SPECIAL AND COST STUDIES

7.1. Assessment of Cull :

It has been found that cull is distributed in a very complicated pattern within various species. The use of one equation for the entire range of species is found to be unsuitable as it does not explain the variations completely. In view of very limited fellings done in Chenab the use of an equation approach was abandoned. Instead the data has been summarised in the form of graphs (Figures 1 and 2). In the case of Chir and Deodar occurance of cull was negligible. Therefore, it is not being given.

7.2 Growth Study :

Diameter age relationship study has been made for Chenab Valley in respect of Fir, Blue Pine, Chir and Deodar. The results are given in Figures 3-6. By studying the age diameter relationships, growth of these forests can be distinguished from growth of natural forests.

7.3. Cost Study

Methodology :

The following steps were followed in cost calculation, in Chenab Valley :-

1. Cost Calculation was done only for the blocks which were accessible.

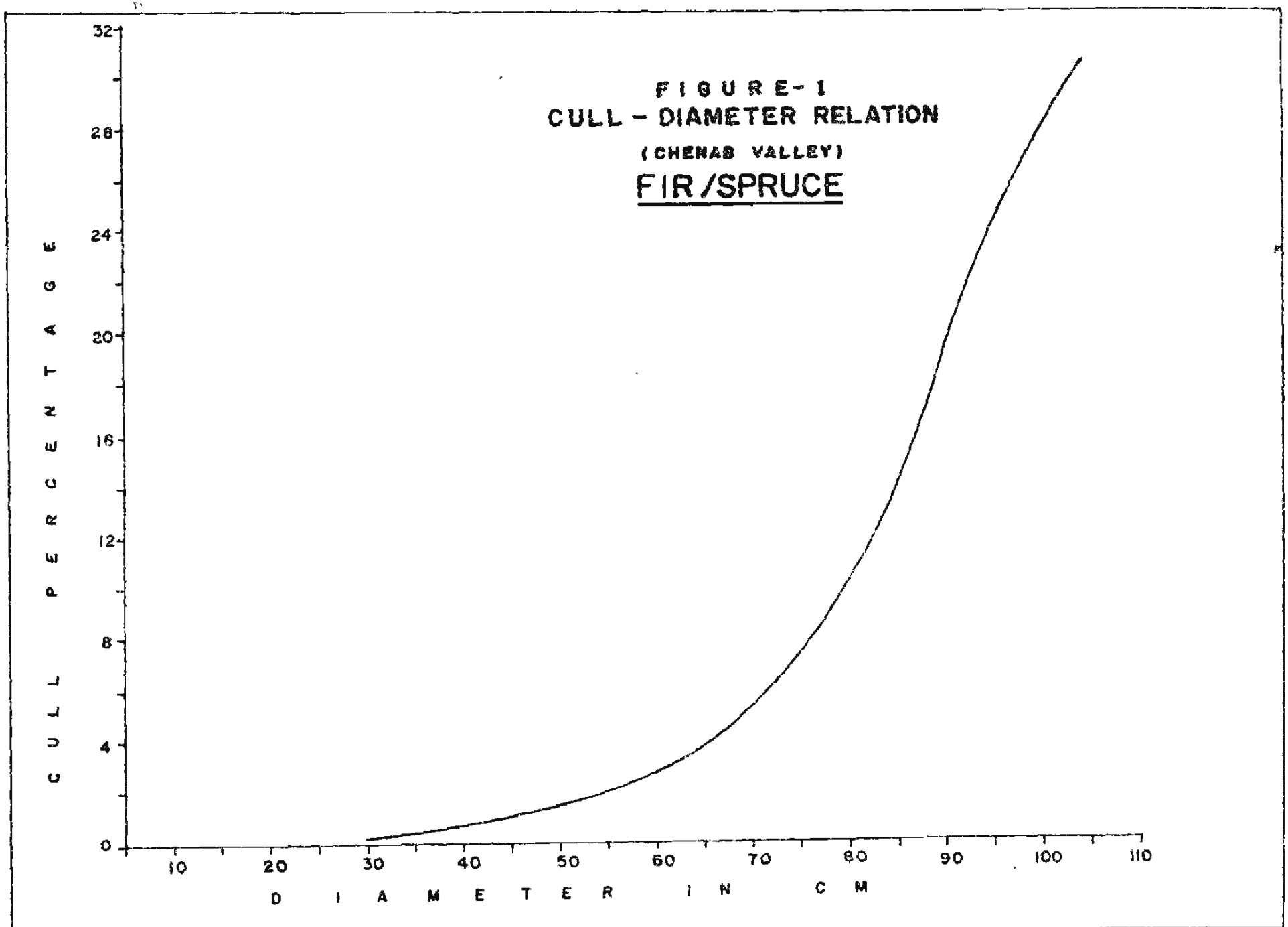
2. It was first checked whether log making is possible. If so, the log costs were applied where log making is not possible, the costs have been calculated separately for removal as "Hakaris" and "Sleepers".

3. The following components of cost were calculated and added together to get at total cost :

   (1) Marking (2) Felling (3) Bucking (4) Sleeper making/ Hakari making (5) Engraving logs/scants (6) Minor transport (7) Major transport (8) Overheads.

.....

Contents



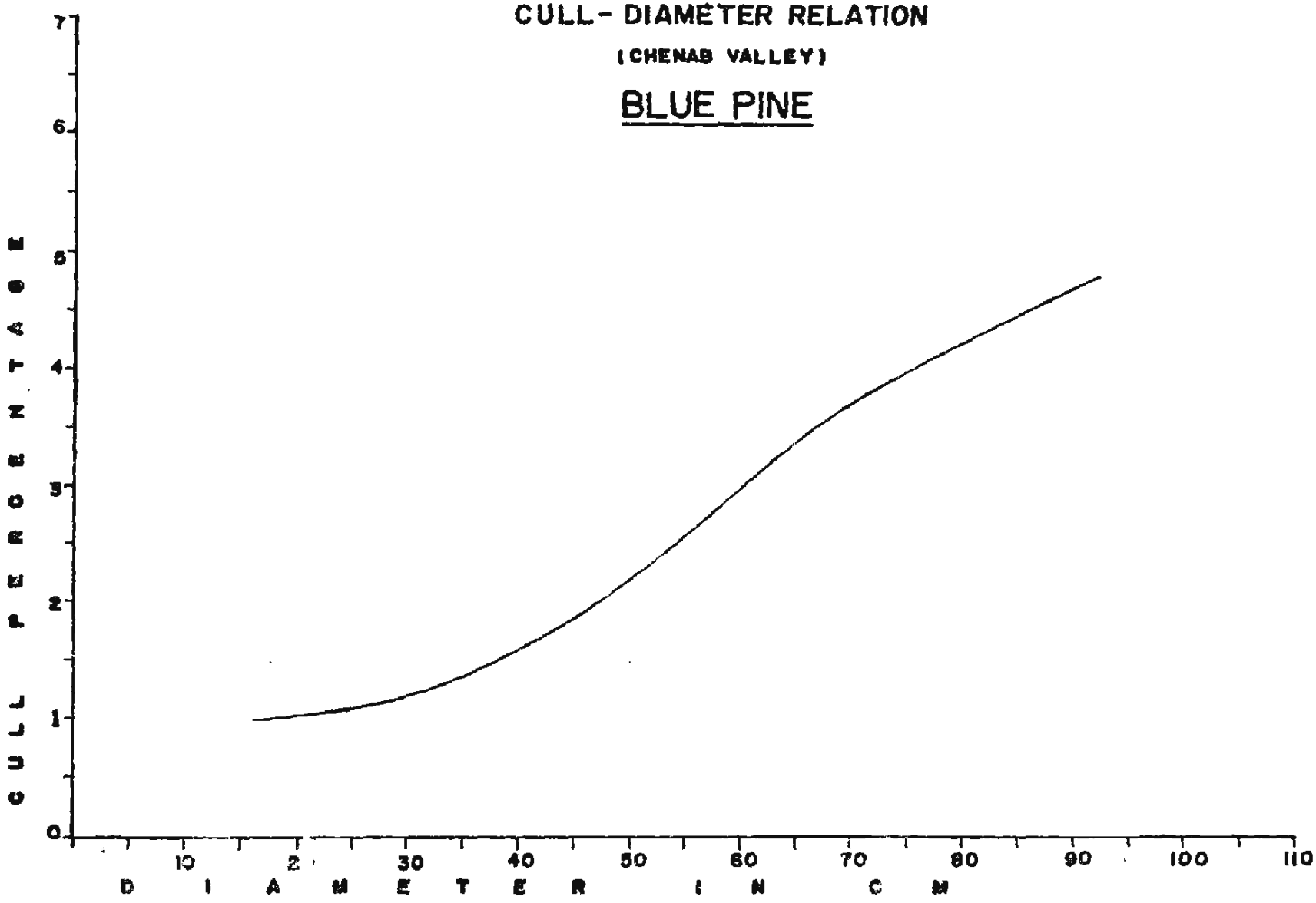
CHECKED BY- [illegible] TRACE BY- S. ROY.

FIGURE-2

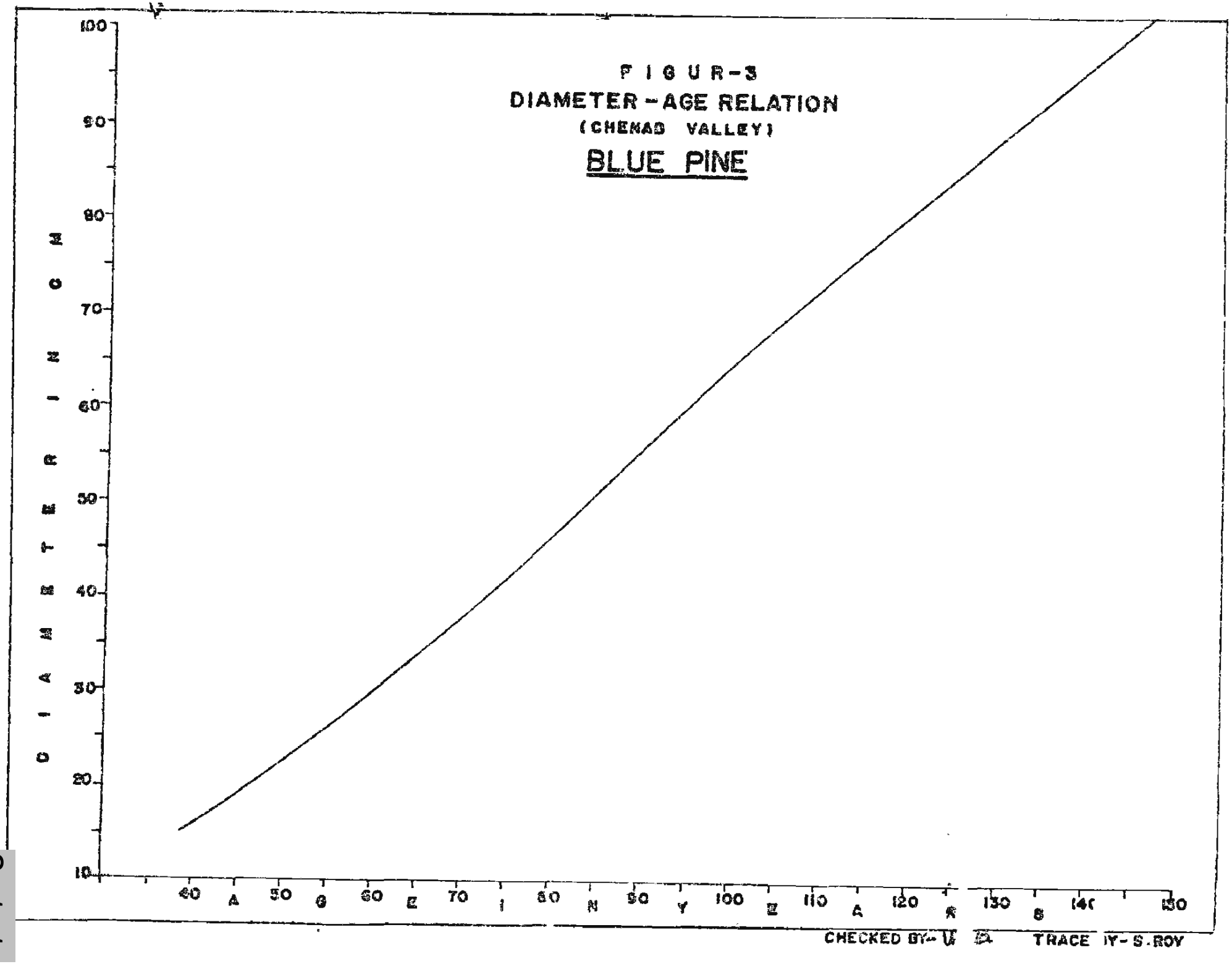
CULL- DIAMETER RELATION

(CHENAB VALLEY)

BLUE PINE



CHECKED BY- [illegible] TRACE BY- S. ROY


FIGUR-3
DIAMETER-AGE RELATION
(CHENAB VALLEY)
BLUE PINE
DIAMETER IN CM
100
90
80
70
60
50
40
30
20
10
40 A 50 G 60 E 70 I 80 N 90 Y 100 E 110 A 120 R 130 S 140 150
CHECKED BY-
TRACE BY-S.ROY

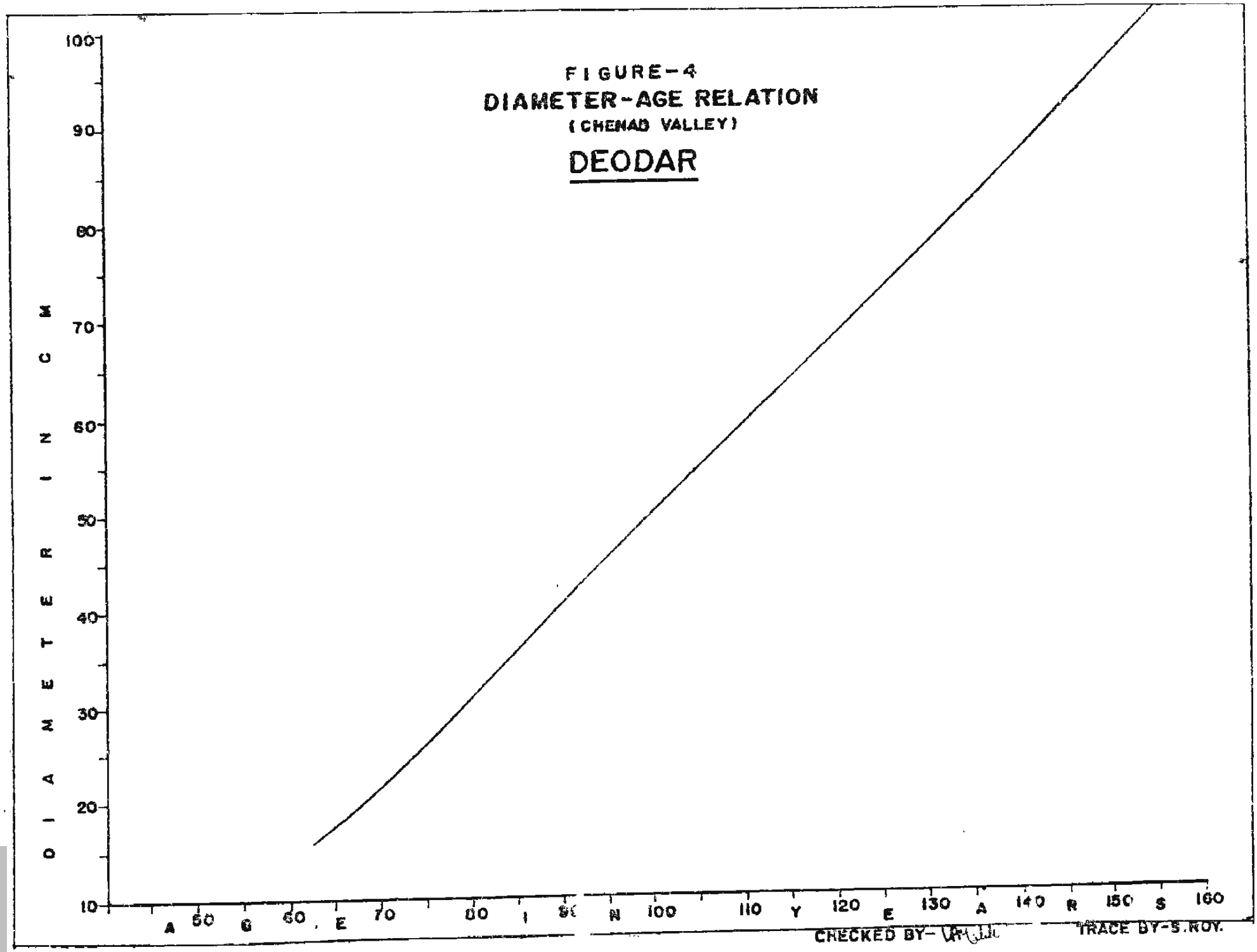
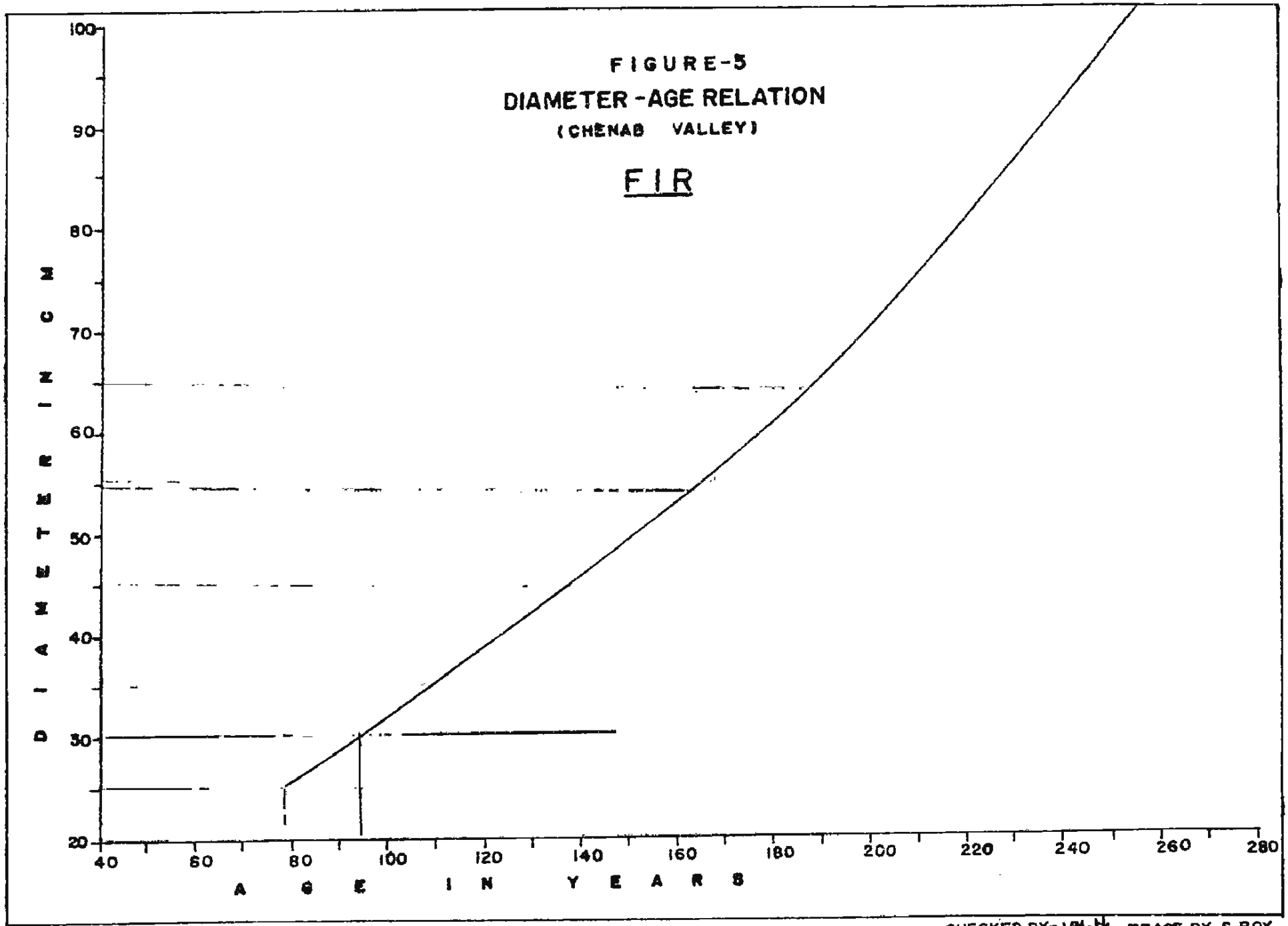


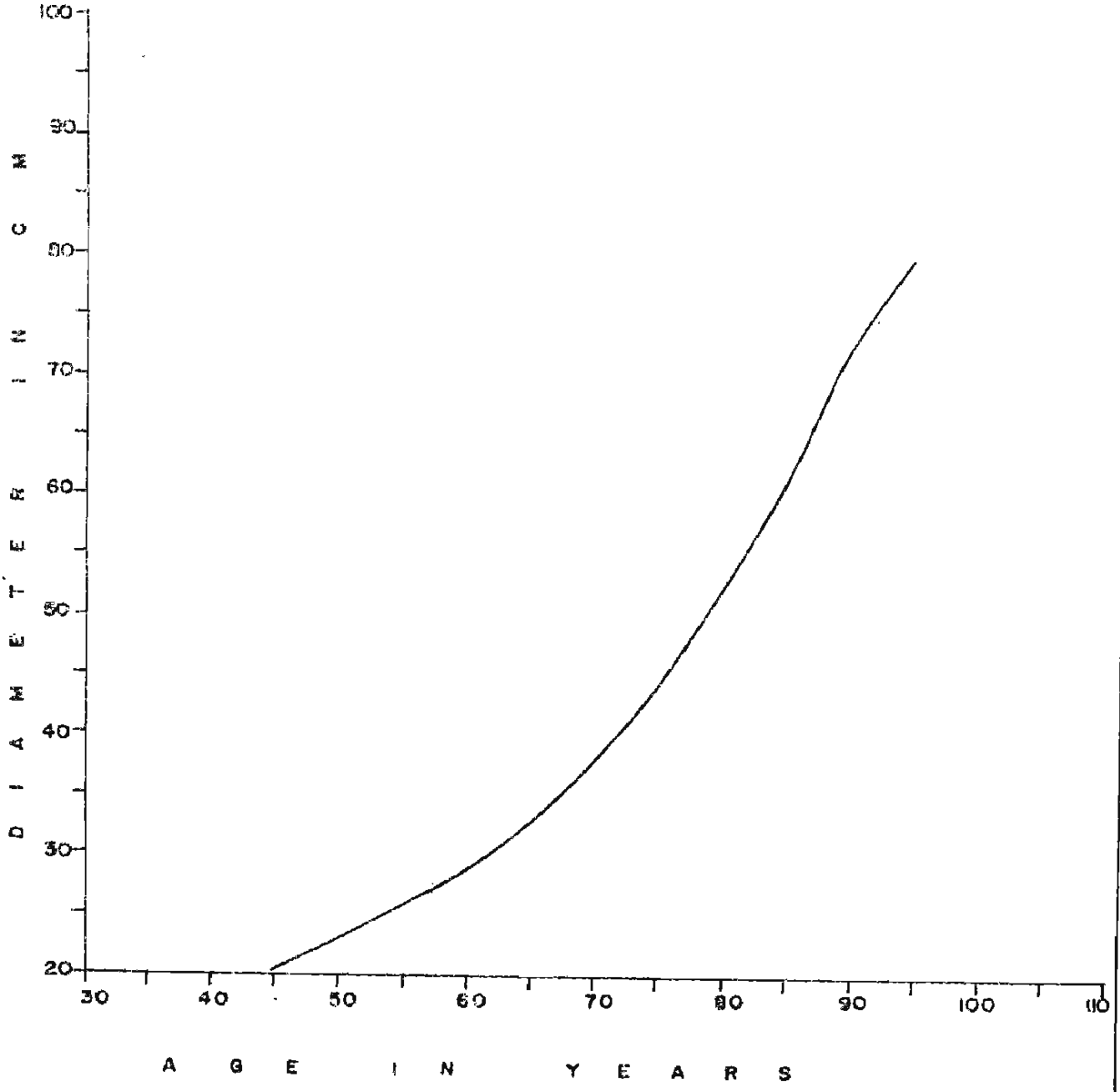
FIGURE-4
DIAMETER-AGE RELATION
(CHENAB VALLEY)
DEODAR
DIAMETER IN CM
100
90
80
70
60
50
40
30
20
10
AGE IN YEARS
50
60
70
80
100
110
120
130
140
150
160
CHECKED BY-
TRACE BY-S.ROY.



CHECKED BY- TRACE BY-S.ROY.

FIGURE-6
DIAMETER-AGE RELATION
(CHENAB VALLEY)

CHIR



CHECKED BY- TRACE BY- S. ROY.

Contents

MARKING, FELLING AND BUCKING COSTS:

The rates per cu.m. are applied to the total standing volume. For logs, engraving cost is applied to log volume (95% of the standing volume).

FIXED HAULAGE AND MINOR TRANSPORT COSTS:

A fixed haulage cost by manual carriage for 200 ms. is added. This will be @ Rs. 8.62 per cu.m. / km. or Rs. 1,724 per cu.m. Cost on minor transport i.e. the distance multiplied by the rate for the mode of transport is calculated for the entire log volume.

MAJOR TRANSPORT COSTS:

There are 3 alternative modes of major transport cost by each of these alternatives is calculated and the lowest of the three is adopted. All these costs added together will give the cost of delivery of logs at Jammu. 10% of the total cost upto minor transport is added being the cost of amenities to labour. Similarly 10% of the total cost on all items is added as over-head charges (except marking & amenities to labour).

Where log removal is not feasible, the wood is removed either as hakaris or as sleepers. This is possible by two methods, by machine sawing and by hand-sawing. If machine sawn, the out-turn is 60% and for hand sawn, it is only 50%. Cost by both methods is calculated and lesser of the two is adopted.

As for logs, the minor transport cost is calculated and the lowest of the three alternative major transport costs is taken.

The distribution of volumes in each of the cost class is shown for removal as logs, logs and hakaris, logs and sleepers, Hakaris alone and sleepers alone. The steps in the calculations are:-

1. Check whether the block is forested i.e. at least one of the plots is forested.

2. Check whether the block is accessible.

3. Calculate volume of the block No. of plots in the stratum x 843-3175 x volume per hectare in the stratum.

4. Total cost = 0

5. Calculate marking cost = Total volume x Rs. 0.025 and add to total cost.

6. Calculate felling cost = Total volume x Rs. 1.17 add to total cost.

7. Calculate bucking cost = 0.95 x total volume x Rs. 3.92 add to total cost.

CONTD.....

8. Log volume = Total volume x 0.95.

9. Check whether log removal is possible. If so, follow 10 to 18. If not, follow 19 to 26.

10. Log cost = 0.

11. Add total cost to log cost.

12. Calculate Engraving cost = Log volume x Rs. 0.18, add to log cost.

13. Calculate fixed haulage cost = Log volume x Rs. 1.724, add to log cost.

14. Calculate Minor transport cost = Log volume x distance x Rs. 0.787, add to log cost.

15. Add 10% of fixed haulage and minor transport cost to log cost.

16. Calculate major transport cost by the three alternative, A,B,C. = Log volume x Distance x Rate.

17. Check which of the tree is least and x vo. and add to log cost.

18. Add 10% of log cost and divide by log volume to get cost per cu.m.

19. Add total cost as at step 7, to Hakari cost which is initially '0'.

20. Calculate conversion cost = 0.95 x total volume x Rs. 12.92, add to hakaris cost.

21. Calculate Engraving cost = 0.95 x volume x Rs. 0.3.

22. Calculate fixed haulage cost = 0.95 x volume x Rs. 1.724- add to hakari cost.

23. Calculate minor transport cost by machine sawing and hand sawing and check which is lower and; add it to hakari cost.

24. Add 10% of fixed haulage and minor transport costs and add to hakari cost.

25. Calculate major transport cost by the three alternatives A,B,C. and adopt the lowest of the three, add to hakari cost = vol. x 0.95 x distance x rate.

26. Add 10% of hakaris cost, and divide hakaris cost by (volume x 0.95) to get cost per cu.m.

27. Add total cost as at step 7, to scant cost which is initially '0'.

CONTD.....

28. Calculate conversion cost and minor transport cost by sawing and machine sawing. Check which is less and adopt.

Hand sawing vol. x 0.5 (scant volume) x Rs. 33.26.

Machine sawing vol. x 06 (scant volume) x Rs. 21.79

Add conversion cost to scant cost.

29. Calculate engraving cost = scant volume x 0.3; to scant cost.

30. Add fixed haulage cost to scant cost.

31. Add 10% of fixed haulage x minor transport cost to scant cost.

32. Calculate major transport cost by the three alternatives, A,B,C; adopt the lesser of the three and add to scant cost.

33. Add 10 % of scant cost to scant cost and divide scant cost by scant volume to get cost per cu.m.

AHUJA/5.2.

@@@@@@@

TYPE OF CARD

C.D. 01

ITEM NO.	Group	Field	Format	Columns
1		JOB	999	1–3
2		CARD DESIGN	99	4–5
3		REPORT NUMBER	99	6–7
4		SUB.R. NUMBER	9	8
5		CREW LEADER	99	9–10
6		STATE	99	11–12
7		REVENUE DISTT	99	13–14
8		FOREST DIVISION	99	15–16
9		LAND CLASS	9	17
10		LEG. STATUS	9	18
11	TERRAIN	ALTITUDE	99	19–20
12	TERRAIN	TOPO	9	21
13	TERRAIN	SLOPE	9	22
14	TERRAIN	P.O.H	9	23
15	TERRAIN	ASPECT	9	24
16		STONINESS	9	25
17	SOIL	HUMUS	9	26
18	SOIL	BLANK	9	27
19	SOIL	CONSISTANCY	9	28
20	SOIL	TEXTURE	9	29
21	SOIL	DEPTH	9	30
22		VEGETATION	9	31
23	FOREST & OPEN FOREST	ORIGIN	9	32
24	FOREST & OPEN FOREST	FOREST TYPE	99	33–34
25	FOREST & OPEN FOREST	STOREYS	9	35
26	FOREST & OPEN FOREST	TOP HEIGHT	99	36–37
27	FOREST & OPEN FOREST	SIZE / AGE	9	38
28	FOREST & OPEN FOREST	STOCKING	9	39
29	FOREST & OPEN FOREST	REGN.	9	40
			9999999999	41–50
30		F.TYPE PHOTO	9	51
31		DENSITY PHOTO	9	52
32		STRATUM NO	9	53
33		PLOT CLASS.	9	54
34	SPECIE STOCKING IN FOREST	SPP.	999	55–57
35	SPECIE STOCKING IN FOREST	%	9	58
36	SPECIE STOCKING IN FOREST	SPP.	999	59–61
37	SPECIE STOCKING IN FOREST	%	9	62
38	SPECIE STOCKING IN FOREST	SPP.	999	63–65
39	SPECIE STOCKING IN FOREST	%	9	66
40	SPECIE STOCKING IN FOREST	%	9	67
41		FOREST POTENTIAL	9	68
42		PLOT NO.	9	69
43		GRID ZONE	9	70
44, 45		BLOCK CENTRE GRID REFERANCE	99999999	71–78
46		INVENTORY DESIGN	99	79–80

C.D. 02

ITEM NO.	Field	Format	Columns
1	JOB	999	1–3
2	CARD DESIGN	99	4–5
3	REPORT NUMBER	99	6–7
4	SUB.R. NUMBER	9	8
5	SPECIES CODE	999	9–11
6	DIA.	999	12–14
7	SPECIES CODE	999	15–17
8	DIA.	999	18–20
9	SPECIES CODE	999	21–23
10	DIA.	999	24–26
11	SPECIES CODE	999	27–29
12	DIA.	999	30–32
13	SPECIES CODE	999	33–35
14	DIA.	999	36–38
15	SPECIES CODE	999	39–41
16	DIA.	999	42–44
17	SPECIES CODE.	999	45–47
18	DIA.	999	48–50
19	SPECIES CODE	999	51–53
20	DIA.	999	54–56
21	SPECIES CODE	999	57–59
22	DIA.	999	60–62
		999	63–65
23	TOTAL NO OF TREES	999	66–68
24	PLOT NO.	9	69
25	GRID ZONE	9	70
26, 27	BLOCK CENTRE GRID REFERENCE	99999999	71–78
28	INVENTORY DESIGN	99	79–80

C.D. 03

ITEM NO.	Field	Format	Columns
1	JOB	999	1–3
2	CARD DESIGN	99	4–5
3	REPORT NUMBER	99	6–7
4	SUB.R. NUMBER	9	8
5	SPECIES CODE	999	9–11
6	DIA.	999	12–14
7	SPECIES CODE	999	15–17
8	DIA.	999	18–20
9	SPECIES CODE	999	21–23
10	DIA.	999	24–26
11	SPECIES CODE	999	27–29
12	DIA.	999	30–32
13	SPECIES CODE	999	33–35
14	DIA.	999	36–38
15	SPECIES CODE	999	39–41
16	DIA.	999	42–44
17	SPECIES CODE	999	45–47
18	DIA.	999	48–50
19	SPECIES CODE	999	51–53
20	DIA.	999	54–56
21	SPECIES CODE	999	57–59
22	DIA.	999	60–62
		9999	63–66
23	TOTAL NO. OF TREES	99	67–68
24	PLOT NO.	9	69
25	GRID ZONE	9	70
26, 27	BLOCK CENTRE GRID REFERENCE	99999999	71–78
28	INVENTORY DESIGN	99	79–80

C.D. 04

ITEM NO.	Group	Field	Format	Columns
1		JOB	999	1–3
2		CARD DESIGN	99	4–5
3		REPORT NUMBER	99	6–7
4		STRATUM	9	8
5		S. NO.	99	9–10
6		SPECIES CODE	999	11–13
7		DOMINANCE	9	14
8		D.B.H.O.B (C.M)	999	15–17
9		TOTAL HEIGHT (M)	99	18–19
10		CLEAR BOLE (M)	99	20–21
11		DEFECT NATURAL	9	22
12		DEFECT OTHERS	9	23
13		LAST 10 YEARS HEIGHT GROWTH (M)	99	24–25
14	TOWARDS P.C AT B.H	BARK THICKNESS (mm)	99	26–27
15	TOWARDS P.C AT B.H	LAST 10 YEARS RADIAL INCREMENT (mm)	99	28–29
16	TOWARDS P.C AT B.H	LAST 20 YEARS RADIAL INCREMENT (mm)	99	30–31
17	OPP. TO P.C AT B.H	BARK THICKNESS (mm)	99	32–33
18	OPP. TO P.C AT B.H	LAST 10 YEARS RADIAL INCRE (mm)	99	34–35
19	OPP. TO P.C AT B.H	LAST 20 YEARS RADIAL INCRE (mm)	99	36–37
			99999999999999999999999999999	38–66
20		TOTAL NO. OF TREES	99	67–68
21		PLOT NO.	9	69
22		GRID ZONE	9	70
25, 24		BLOCK CENTRE GRID REFERENCE	99999999	71–78
25		INVENTORY DESIGN	99	79–80

①

LAYOUT OF DATA IN CARD DESIGN
CHENAB VALLEY (J & K)

R. K. Das

TYPE OF CARD

CD-05

ITEM NO.	Columns	Field
1	1-3	JOB. NO.
2	4-5	CARD DESIGN
3	6-7	CREW LEADER
4	8-9	TREE NO.
5	10-12	SPECIES
6	13	DOMINANCE
7	14-17	D.B.H. OB: TOWARDS P.C. (M.M)
8	18-21	D.B.H. OB: Pr. DIRECTION (M.M)
9	22-23	TOTAL HEIGHT (M)
10	24-25	CLEAR BOLE (M)
11	26	DEFECT-NATURAL
12	27	DEFECT OTHERS
13	28	TREE F/N
14	29-30	INCREMENT TOWARDS: PC. 10 yrs.
15	31-33	INCREMENT TOWARDS: PC. 20 yrs.
16	34-35	INCREMENT TOWARDS: Pr. PC. 10 yrs.
17	36-38	INCREMENT TOWARDS: Pr. PC. 20 yrs.
18	39-40	NO. OF PARTS
19	41-42	C.W. TOWARDS P.C. (M)
20	43-44	C.W. TOWARDS Pr (M)
	45-50	
21	51-52	TOTAL NO. OF TREES
22	53-54	STATE
23	55-56	FOREST DIVISION
24	57-58	ALTITUDE
25	59	SLOPE
26	60	ASPECT
27	61	ORIGIN
28	62-63	FOREST TYPE
29	64-65	NO. OF STOREYS
30	66	TOP HEIGHT
31	67	SIZE/AGE
32	68	STOCKING
33	69	PLOT NO.
34	70	GRID ZONE
35, 36	71-78	BLOCK CENTRE GRID REFERENCE
37	79-80	INVENTORY DESIGN

CD-06

ITEM NO.	Columns	Field
1	1-3	JOB NO.
2	4-5	CARD DESIGN
3	6-7	NO. OF THE TREE
4	8-10	SPECIES CODE
5	11-12	TREE PORTION SL. No
6	13-14	SL. NO. OF SECTION
7	15-18	HEIGHT ABOVE THE BASE/ORIGIN SECTION (C.M)
8	19-22	D.O.B TOWARDS P.C.
9	23-26	D.O.B PR. TO P.C.
10	27-30	D.U.B TOWARDS P.C.
11	31-34	D.U.B. PR. TO P.C.
12	35-37	NO. OF RINGS AT THE SECTION
13	38	CULL PRESENCE
14	39-40	TYPE OF DEFECTS
15	41-43	SIZE OF RECTANGLE L. (M.M)
16	44-46	SIZE OF RECTANGLE B. (M.M)
17	47-48	TYPE OF DEFECTS
18	49-51	SIZE OF RECTANGLE L. (M.M)
19	52-54	SIZE OF RECTANGLE B. (M.M)
20	55	STRAIGHTNESS
21	56	SHAPE OF SECTION
22	57	U %
23	58	S %
24	59-62	AVERAGE D.B.H. (STANDING TREES)
25	63-66	TOTAL HEIGHT OF TREE (AFTER FELLING)
26	67-68	TOTAL NO. OF SECTIONS
27	69	PLOT NO.
28	70	GRID ZONE
29, 30	71-78	BLOCK CENTRE GRID REFERENCE
31	79-80	INVENTORY DESIGN

CD-07

ITEM NO.	Columns	Field
1	1-3	JOB NO.
2	4-5	CARD DESIGN
3	6-7	CREW LEADER
4	8-9	SEEDLING NO.
5	10-12	SPECIES
6	13-16	DIA. AT COLLAR (M.M)
7	17-20	DIA. AT B.H. (M.M)
8	21-23	HEIGHT IN (C.M)
9	24-26	NO. OF RINGS AT COLLAR
10	27-29	NO. OF RINGS AT B.H.
	30-68	BLANK
11	69	PLOT NO.
12	70	GRID ZONE
13, 14	71-78	BLOCK CENTRE GRID REFERENCE
15	79-80	INVENTORY DESIGN

CD-08

ITEM NO.	Columns	Field
1	1-3	JOB NO.
2	4-5	CARD DESIGN
3	6-7	CREW LEADER
4	8-9	TREE NO.
5	10-12	SPECIES CODE
6	13-14	SECTION
7	15-18	HEIGHT ABOVE BASE ✓
8	19-21	NO. OF RINGS ON THE SECTION
9	22-25	D.O.B (M.M)
10	26-29	D.U.B (M.M)
11	30	RADIUS NO.
12	31	CENTURY CODE
13	32-34	GROWTH OF DECADES (10 YEARS): 1
14	35-37	GROWTH OF DECADES (10 YEARS): 2
15	38-40	GROWTH OF DECADES (10 YEARS): 3
16	41-43	GROWTH OF DECADES (10 YEARS): 4
17	44-46	GROWTH OF DECADES (10 YEARS): 5
18	47-49	GROWTH OF DECADES (10 YEARS): 6
19	50-52	GROWTH OF DECADES (10 YEARS): 7
20	53-55	GROWTH OF DECADES (10 YEARS): 8
21	56-58	GROWTH OF DECADES (10 YEARS): 9
22	59-61	GROWTH OF DECADES (10 YEARS): 10
23	62-64	WIDTH OF INCOMPLETE DECADE
	65-66	
24	67-68	TOTAL NO. OF SECTIONS
25	69	PLOT NO.
26	70	GRID ZONE
27, 28	71-78	BLOCK CENTRE GRID REFERENCE
29	79-80	INVENTORY DESIGN

②

LAYOUT OF DATA IN CARD DESIGN
CHENAB VALLEY (J&K)

S.K. Das

ENCLOSURE - II

SORTING ORDER

CD-01	Job No.	1-3 Major	1 - 3x4 - 5x 71-78 x69
	C.D.	4-5 Inter	Sequence checking on collator.
	Block centre		
	Grid Ref.	71-78 Minor	
	Plot No.	69	
CD-02	Job No.	1-3	1-3 x 4-5 x 71-78 x 69
	C.D.	4-5	Sequence checking on collator
	Block Centre		
	Grid Ref.	71-78	
	Plot No.	69	
CD-03	Job No.	1-3	1-3 x 4-5 x 71 x 69
	C.D.	4-5	Sequence checking on collator
	Block centre		
	Grid ref.	71-78	
	Plot No.	69	
C.D-04	Job No.	1-3	1-3 x 4-5 x 71-78 x 69 x 9-10
	C.D.	4-5	Sequence checking on collator
	Block centre		
	Grid ref.	71-78	
	Plot No.	69	
	Sl.No. of tree	8-10	
CD-05	Job No.	1-3	1-3 x 4-5 x 71-78 x 69 x 8-9
	C.D.	4-5	Sequence checking on collator.
	Block centre		
	Grid ref	71-78	
	plot No.	69	
	Sl.No. of tree	8-9	
CD-06	Job No.	1-3	1-3 x 4-5 x 71-78 x69 x6-7 x 11-12 x13-14
	C.D.	4-5	Sequence checking on collator.
	Block centre		
	Grid ref.	71-78	
	Plot No.	69	
	No. of tree	6-7	
	Tree position	11-12	
	S.No. of Section	13-14	
CD-07	Job No.	1-3	1-3 x 4-5 x 71-78 x 8-9
	C.D.	4-5	Sequence checking on collator.
	Block Centre		
	Grid ref.	71-78	
	Plot No.	69	
	Tree No.	8_9	

Contents

	Job No.	1-3	)
	G.D.	4-5	)
CD-08	Block Centre		) 1-3 x 4-5 x 71-78 x 69 x 13-14
	Grid ref.	71-78	) Sequence checking on collator.
	Plot No.	69	)
	Sl.No. of trees	13-14	)

Contents

ENCLOSURE - III

LAYOUT OF VARIABLE LENGTH RECORD FILE
(Card Designs 1,3 merged)

Marged file of Chenab valley CD 01 and CD 03 is loaded on disk as a variable length record file. Starting record is always that of CD 1 which takes two sectors in fixed point mode, The 50th item of this record shows the No. of CD 3 records following. If item 50 of CD 1 happens to be zero the next record again is that of another CD 1. If item No.50 is a positive number say 2 - two records of CD 3 each with 1 sector in fixed point mode follow. Description of items of different records is as under :-

Description of items of CD 1

Item No.	Description
1.	Job
2.	Card Design
3.	Report number
4.	Sub report number
5.	Crew Leader
6.	State
7.	Revenue District
8.	Forest Division
9.	Land Class
10.	Legal status
11.	Altitude
12.	Topography
13.	Slope
14.	P.O.H.
15.	Aspect
16.	Stoniness
17.	Humus
18.	Soil Consistency
19.	Texture
20.	Depth
21.	Vegetation
22.	Origin
23.	Forest Type
24.	Storeys
25.	Top height
26.	Size/Age
27.	Stocking.
28.	Regeneration.
29.	Forest Type photo
30.	C. Density photo
31.	Stratum No.
32.	Plot class
33.	Spp.
34.	%

.....

Contents

Item No.	Description
35.	Spp.
36.	%
37.	Spp.
38.	%
39.	%
40.	F. Pot
41.	Plot No.
42.	Grid zone.
43.	Block Centre
44.	Grid Reference
45.	Inventory Design
46.-49.	Blanks
50.	No. of records of CD 3 following.

Description of items of CD 3

1.	Card Design
2.	Species Code
3.	Diameter (cm)
4.	Species code
5.	Diameter (cm)
6.	Species code
7.	Diameter (cm)
8.	Species code
9.	Diameter (cm)
10.	Species code
11.	Diameter (cm)
12.	Species code
13.	Diameter (cm)
14.	Species code
15.	Diameter (cm)
16.	Species code
17.	Diameter (cm)
18.	Species code
19.	Diameter (cm)
20.	Total No. of trees
21.	Plot No.
22.	Grid zonw.
23)	Block centre and
24)	Grid reference
25)	Inventory design.

Contents

ENCLOSURE - IV

LAYOUT OF FELLED TREE VOLUME FILE OF CHENAB VALLEY ON THE DISK

Summary of each tree is in 4 sectors in fixed point mode.

Item No.	Description
1.	Tree No.
2.	Species Code
3.	Average D.O.B. at breast height
4.	Average D.U.B. at breast height.
5.	No. of rings
6.	D.O.B. last section
7.	D.U.B. last section
8.	Height to last section
9.	No. of rings at last section.
10.) 11)	Cull sectional area at B.N.
12.) 13.)	Cull volume at B.N.
14.	Total sections.
15.	Dominance
16.	D.B.H. O.B. towards PC.MM.
17.	D.B.H. O.B. perpendicular to PC. MM.
18.	Total height M.
19.	Clear Bole M.
20.	Defect Natural
21.	Defect Others.
22.	Tree F/N

.....

Contents

Item No.	Description
23.	Increment towards PC 10 years
24.	Increment towards PC 20 years
25.	" perp. to PC 10 "
26.	" perp to PC 20 "
27.	No. of parts.
28.	Crown width towards PC.
29.	Crown width perpendicular to PC
30.	Total trees.
31.	State.
32.	Forest Division
33.	Altitude
34.	Slope.
35.	Aspect.
36.	Origin.
37.	Forest Type.
38.	No. of storeys.
39.	Top height.
40.	Size/Age
41.	Stocking
42.	V.O.B upto 40 CM top diameter.
43.	V.U.B. upto
44.	Ref. 1 "
45.	Ref. 2 "
46.	V.O.B. Upto 20 Cm.

.....

Contents

Item No.	Description
47.	V.U.B. Upto 20 CM.
48.	Ref. 1 "
49.	Ref. 2 "
50.	V.C.B. Upto 5 Cm.
51.	V.U.B. " "
52.	Ref. 1 " "
53.	Ref. 2 " "
54.	Total sections.
55.-75.	Blanks.
76.	Plot
77.	Grid X-Coordinate
78.	Grid Y "
79-86	Blanks.
87.	Tree portion I volume upto 40 cm. O.B.
88.	" " " " " " U.B.
89.	" " " " " 23 cm O.B.
90	" " " " " " U.B.
91.	" " " " " 10 cm. O.B.
92.	" " " " " " U.B.
93.	" " " " " 05 cm. O.B.
94.	" " " " " " U.B.
95-102	Same as items (87-94) for tree portion II
103-110	" " " " Tree portion III

Contents

ENCLOSURE V.

LAYOUT OF SAMPLE TREE VOLUME FILE

Item No.		Description.
1.	..	Job.
2.	..	Card Design.
3.	..	Report No.
4.	..	Sub Report No.
5.	..	S. No.
6.	..	Sp. Code.
7.	..	Dominance
8.	..	D.B.H. O.B. in cm.
9.	..	Total height in M.
10.	..	Clear Bole "
11.	..	Defect Natural
12.	..	Defect Others
13.	..	Crown width towards sample point in D.M.
14.	..	Bark thickness " " "
15.	..	Last 10 years radial increment towards S. Point in MM.
16.	..	Last 20 years radial increment towards S. Point in M.M.
17.	..	Bark thickness opposite to sample point in MM.
18.	..	Last 10 years radial increment opposite to S. point in M.M.

CONTD.....

Item No.	Description.
19.	Last 20 years radial increment opposite to S. point in M.M.
20.	Total No. of trees.
21.	Forest Types.
22.	Point No.
23.	Cluster No.
24.,25.	Cluster centre grid ref.
26.	Volume.

NOTE:-

Volume converted into fixed point by multiplying with 100. To get the actual volume in cu.m. The figure is to be divided by 100.

AHUJA/5.2.

@@@@@@

ENCLOSURE- VI.

LAYOUT OF PLOT SUMMARY FILE.

Item No.	Description of item.
1.	Running serial No. of the plot.
2-3.	Block No. & Grid ref.
4.	Plot No.
5.	Revenue District.
6.	Forest Division.
7.	Land class.
8.	Vegetation.
9.	Forest type (ground)
10.	Top height.
11.	Age.
12.	Regeneration.
13.	Stratum.
14.	Plot status.
Vol.	Vol./ha.
B.A.	Basal Area/ha.

NOTE:- The plot summary data is laid out in an ascending order of the Grid No. and also within a Grid the plots follow an increasing order.

Vol. is given in cu.m. and basal area is given sq. metres.

AHUJA/5.2.

@*@*@*@*@

PART - III.

P H C T C - I N T E R P R E T A T I O N.
REPORT

Contents

REPORT ON PHOTO-INTERPRETATION IN CHENAB CATCHMENT.

1. INTRODUCTION:

1.1. The total geographical area covered by the Preinvestment Survey of Forest Resources Project in Chenab Catchment is 9845 sq. km. (map enclosed scale 1:16,miles) and comprises the following forest divisions:

(1) Doda Forest Division.
(2) Bhadarwah Forest Division.
(3) Kishtwar Forest Division.
(4) Ramban Forest Division.

The only way to complete the survey expeditiously was to use the available vertical aerial photography. Except for some small gaps the survey area was covered by the aerial photographs of two specifications No. 480 A and 381 A and full particulars of these are as under:-

Particulars	Specification No. 480 A	Specification No. 382 A
1. Scale of photography.	1:40,000	1:60,000
2. Year of photography.	June, 1965	Oct: 1961.
3. Aerial Cameras lens	Eagle IX with 6" focal length lens.	Eagle IX with 6" focal length lens.
4. Format size	9" x 9"	9" x 9"
5. END lap	Over 80%	Over 80%
6. Side lap	10% to 25%	10% to 25%
7. Film and Filter.	Panchromatic film with minus blue filter.	Panchromatic film with minus blue filter.
8. Map sheets covered.	43 C/2,3,4,5,6,7,8,9, 10,11,12,13,14,15 16. 43 P/5,9,13 52 C/1,2,3,4.	43 N/8,12 52 C/1,2,3,4,5,6 7,8. 52 D/1.

CONTD.....

An examination of these photographs indicated that the following information could be interpreted and collected from them. In view of this and the likely delay in fresh photography it was decided to use the existing photography.

(1) Classification of land area into main forest types, scrub and non-forested land.

(2) To obtain reliable estimates of areas under different forest types and

(3) To prepare forest types map for management and planning.

2. OBJECTIVE:

Considering the scale and quality of existing aerial photograph, the aerial photographs were used for:-

(a) interpreting the following forest type and land use classes:-

Forest type	Symbols.	Remarks
1. Fir	F	Spruce is included
2. Fir-Blue Pine	FB	Fir more than 50%
3. Blue Pine	B	Rest blue pine atleast 20%.
4. Blue Pine-Fir	BF	Blue pine more than 50%(Fir atleast 20%)
5. Deodar	D	
6. Chir pine	C	
7. Broad leaved(hardwoods)	H	
8. Scrubs with tree density less than 5%	S	
9. Other non-forested land such as agriculture river beds, blanks in forests, and side areas, snow clad areas, margs, habitations and industrial sites and orchards etc.	N	Blanks in the forest include area where tree density is less than 5% and there are no scrubs.

(b) interpreting the following crown density classes within the forested areas:-

Crown density	Code No.	Note.
5-20%	1	Density classes were referred only to tree density not to scrub and hence no density was shown for scrub type.
20-40%	2	
40-60%	3	
60-80%	4	
80 & above	5	

CONTD.....

(c) To prepare a forest type map on the basis of 100% interpretation and

(d) to assess the areas of different strata by dot grid sampling.

3. METHODOLOGY:

3.1. 100% interpretation was carried out by stereoscopic examination of the aerial photographs. As the end lap was 80% only alternate AP's were used. Instructions on the subject are contained in the "Manual of Photointerpretation and Mapping of J & K. Forests."

3.2 In forest type composition, if a species constituted more than 80% of the crop, it was considered as Pure and the species forming less than 20% of the mixture was ignored in Forest type delineation. In mixed crop of conifers (Fir and Blue Pine) if a species constituted more than 50% and other species at least 20% in the mixture, then the forest type was delineated as is given in table at para 2. above. In a mixed crop of conifers and broad leaved the forest symbol of coniferous species was given if it formed at-least 60% of the mixture and that of hardwoods if they formed more than 60% of the mixture.

3.3 Minimum area for delineation of forest type or other land use classes on aerial photographs was 10 hectares.

3.4. While delineating the forest type boundaries on aerial photographs, roads, rivers etc; were ignored unless they are about 120 m. or more in width (at least 3 m.m. on aerial photographs).

3.5. Existing gaps in photography were covered by the helicopter flights over sheet No. 43 C/4,8, 12, 13 and 53 P/13 and the forest type delineation was done on topo sheet (1:50,000) by ocular estimation and this was matched with aerial photographs for rest of the area.

3.6. Total number of alternate aerial photographs interpreted for the area are as follows:-

Specification.		No. of Photos.
382 A	..	122
480 A	..	330
	TOTAL:	452.

4. MAPS AND MAPPING:

4.1. The following topo maps of scale of 1:50,000 or 1:1 mile were used for making base maps:-

CONTD.....

Sheet No.		No. of maps.
43 N/8, 12	..	2
43 C/2,3,4,5,6,7,8,9, 10, 11, 12, 13, 14, 15, 16	..	15
43 P/5,9, 13	..	3
52 C/1,2,3,4,5,6,7,8	..	8
52 D/1	..	1
	TOTAL:	29

5. TRANSFER OF INTERPRETED DETAILS FROM AERIAL PHOTOGRAPHS TO BASE MAPS:

5.1 Interpreted details from the AP's were transferred on the above mentioned topo-sheets by the 70 (Forest) Survey Party in Survey of India, assisted by the Photointerpreters. Transference was done by visual method and a fair amount of accuracy was expected. The local details on aerial photographs and topo sheets were tallied while transferring the stand boundaries and edge matching of type between adjoining topo sheet was ensured.

6. AREA CALCULATION:

6.1. Due to small scale of photography and for other reasons certain discrepancies were noticed in P.I. work. In order to calculate the effect of these discrepancies caused by misinterpretation and to make a comparison possible, forest type classes were grouped together into 5 classes only and the distribution of 1215 points into different classes both from P.I. and ground work was compared and it was decided that area figures for different strata may be adopted on the basis of sample plots falling in that strata.

6.2. A further analysis of area proportions by forested and non-forested land use classes or by combining all the conifers as one group gives the following results:-

a) Distribution of Forested and Non-Forested land

Stratum	Area proportion* %	SE %
Forested	38.0	0.13
Non-Forested	62.0	0.08

(*Note:- The area proportions and their standard errors are arrived at after adjusting for misinterpretation).

CONTD.....

b) Distribution of Conifers, Others & Non-Forested Land.

Stratum	Area proportion*	
	%	SE%
Conifers	29.3	2.03
Others	8.7	6.80
Non-Forested	62.0	0.80

(* Note: The area proportions and their standard errors are arrived at after adjusting for misinterpretation).

7. PREPARATION AND PRINTING OF FOREST TYPE MAPS:

7.1. Koda-line prints on 1:50,000 scale showing distribution of various forest types, drainage features, administrative and catchment boundaries roads, some heights and names of important places and towns have been prepared. No contours have been shown. Forest types have been shown by using dot symbols. The forest type maps can be printed with the help of these koda-line prints, for further use by different agencies, such as State Forest Departments or other authorised agencies for management and planning purposes.

AHUJA/5.2.

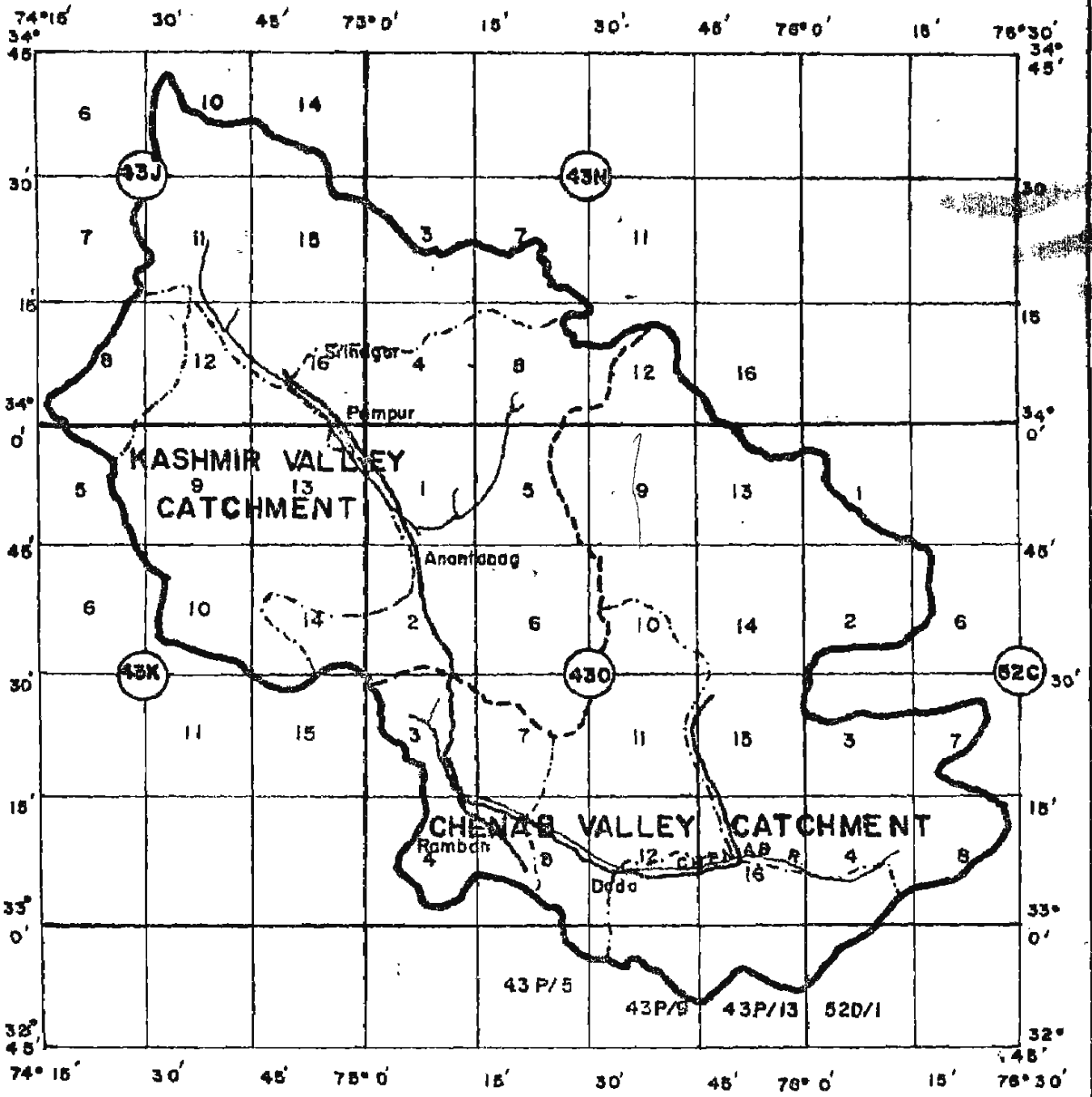
@*@*@*@

PREINVESTMENT SURVEY OF FOREST RESOURCES

JAMMU & KASHMIR

LOCATION MAP

SCALE : 1" = 20 Miles



REFERENCES

1. Project Boundary . . . . .
2. Catchment Boundary . . . .
3. Road (Metalled) . . . . .
4. River . . . . . .
5. Forest division boundary . . .

R. K. DAS

Contents