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**INVENTORY SURVEY
(Non - Forest Area)
OF
KURUKSHETRA DISTRICT**

(HARYANA STATE)

INVENTORY RESULTS

**FOREST SURVEY OF INDIA
NORTHERN ZONE
SHIMLA-I**

1995



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P R E F A C E

Forest Survey of India, for the first time took up inventory surveys in the rural areas with the primary objective of assessing the distribution of trees and the growing stock in the rural areas and to have an overview of the various social forestry schemes implemented by the State Forest Departments. The inventory survey was carried out by stratified random sampling. One of the important points in this survey was to categorise various types of trees in a village. The categories were farm forestry, roadside plantations, village woodlots, block plantations, plantations done along canals, railway lines, ponds etc., This report pertains to district Kurukshetra of Haryana state.

The geographical area of Kurukshetra district is 3740 Sq.km. The survey was carried out during 1991-92 in the rural areas of the district covering an area of 3727.6 sq.km.

Out of the total species inventoried, 17 of them on the basis of their predominance and commercial importance have been presented separately. Other species have been grouped together as miscellaneous.

The total number of trees in the district have been assessed at 44.65 laths i.e. 11.98 trees/ha and the corresponding volume has been assessed at 8.82 lakh cubic metres i.e. 2,284 cum/ha. Eucalyptus have been found to have the largest representation with 16.34 lath trees (36.59) while Acacia species and Tamarix aphylla

have the lowest representation amongst important species of the State.

It is hoped that this report will be of use, not only to the State Forest Department of Haryana but also to others.

The inventory survey was carried out by Forest Survey of India, North Zone, Shimla. The data of this survey was processed by the Headquarter Office, Dehra-dun. The work of the staff and officers who were associated in carrying out the inventory survey, data processing and writing of this report, is appreciated.

(Dr. S.N. Raj)
Director
Forest Survey of India
Dehra-dun.

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SUMMARY

1. To assess the availability of forest resources for the production of lumber, fuelwood and raw material for paper pulp, matchwood, packing cases and essential oils etc. in areas outside the traditional Reserved Forests and those forest areas which could not be covered during the course of regular Inventory Survey of the district, it was proposed to carry out the inventory of such areas. The Inventory Survey has been carried out in the Kurukshehra district during 1991-92.

2. As per 1991 Census, Kurukshehra district had a total of 743 villages having a total area of 3727.60 Sq. Km. out of which 100 villages having an area of 120.83 Sq. Km. were randomly selected and surveyed.

3. In the entire rural area of Kurukshehra district 44.65 lakh trees (11.98 trees/ha.) have been estimated. The analysis shows that when all the species are combined, the maximum number of the estimated trees occur in 10-20 cm. dia-class i.e. 36.16 lakh trees (69.79%) and the minimum in 40 cm. and above dia-class i.e. 1.21 lakh trees (2.71%).

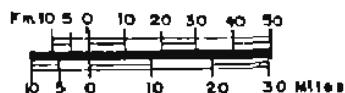
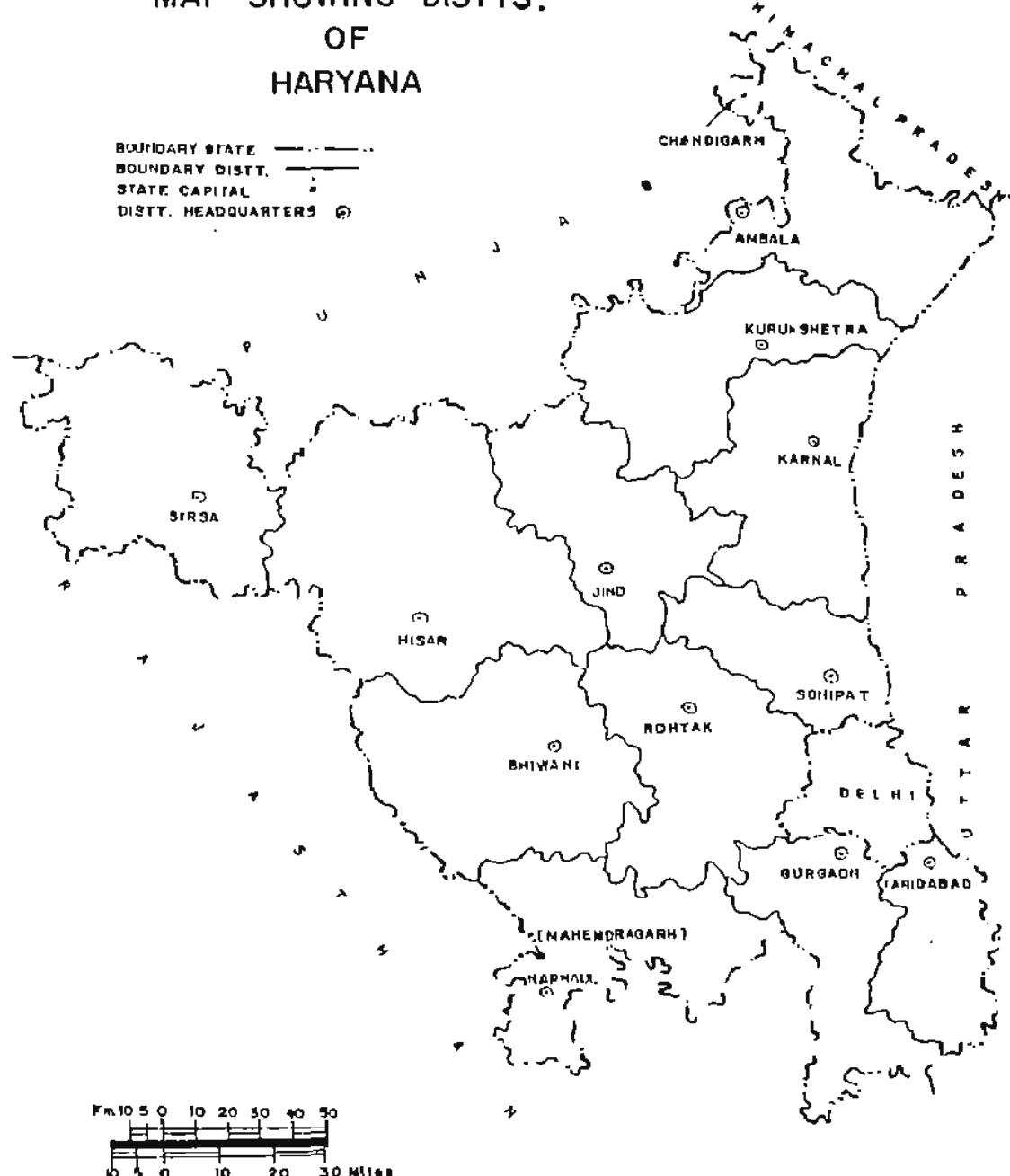
4. The specieswise distribution of total number of estimated trees shows that *Eugalyptus* spp. has the largest representation i.e. 16.34 lakh trees (36.59%), followed by *Acacia nilotica* (Babul) 11.35 lakh trees (25.41%), *Populus* spp. 5.19 lakh trees (11.54%), *Melia azedarach* 2.27 lakh trees (6.08%), *Dalbergia sissoo* 1.92 lakh trees (4.40%), *Horus* spp. 1.43 lakh trees (3.20%), *Mangifera indica* 1.33 lakh trees (3.08%), *Azadirachta indica* 0.68 lakh trees (1.53%) and *Syzygium cumini* 0.52 lakh trees (1.17%). The representation of the rest of the species is less than 1% each.

5. The distribution of total number of trees categorywise and dia-classwise, when all the species are combined, shows that the representation of trees is maximum in the category-I - Farm Forestry i.e. 22.20 lakh trees (49.72%) and minimum in the category-V - Fruits i.e. 0.16 lakh trees (0.36%) for the combined dia-classes.

6. In the entire rural area of Kurukshehra district, total estimated volume of all the species and dia-classes combined comes to 8.52 lakh cubic meter i.e. 2,330 cum/cum.

MAP SHOWING DISTTS.
OF
HARYANA

BOUNDARY STATE ———
BOUNDARY DISTT. ———
STATE CAPITAL
DISTT. HEADQUARTERS @



CHAPTER I

1.1 Introduction:

The aim of carrying out the inventory survey was to assess the availability of forest resources for the production of timber, fuelwood and raw material for paper pulp, packing cases, matchwood and essential oils etc. in areas outside the traditional Reserved Forests and those forest areas which could not be covered during the course of regular Inventory Survey of Haryana State.

1.2 Description of the District

Kurukshetra district is a part of Eastern Haryana Plain. Its name is derived after its headquarter's town, Kurukshetra which is a very famous historical place. The name of Kurukshetra is associated in the Puranas and the great epic with the legendary king Kuru although it appears to be more logical to trace it to the tribe of Kuru's which was borne as a result of merger of various classes of the Great Bharat who are described in the Rigveda as kindling sacrificial fires on the banks of the sacred Sarasvati and Drishadvati. The Kurus also were known to the Rigveda as mention of king Kurushayana indicates. Kurukshetra is regarded as the cradle of Indian Civilization and Culture. The great battle of Mahabharata was fought here. It was the birth place of Bhagvat Gita.

1.3 Location, Area, Population etc.

The district lies between $29^{\circ} 34' 15''$ and $30^{\circ} 15' 15''$ North Latitudes and $76^{\circ} 10' 10''$ and $77^{\circ} 17' 05''$ East Longitudes. On its North lies the district of Ambala and Patiala district of Punjab has its boundaries with Kurukshetra extended up to North-west. To its West and Southwest is the district of Jind. Karnal district lies on its South and South-east. Yamuna river makes the eastern boundary of the district and across the river lies Saharanpur district of Uttar Pradesh.

As per 1981 Census, the area of district was 3740 sq. km. and its population was 1,130,026 i.e. 302 persons/sq. km.

1.4 Physical Features

Soil, geology and topography

The geographical structure of the district is alluvium (recent). The district on the whole is divided into four sub-micro regions on the basis of soils, natural vegetation and topography.

(a) Yamuna Khadar

The region spreads over the eastern part of Thanesar tehsil of Kurukshetra district. It makes its boundary with the state of Uttar Pradesh in the East, Karnal district in the South, Petic Kurukshetra in the West and Ambala district in the North.

From relief point of view, the maximum height of the region is 268 meters above m.s.l. near village Lachharpur, while the minimum height of 259 meters above m.s.l. is found near village Bumthala Rao. Both the heights are in Thanesar tehsil.

The region is built and drained by Yamuna river, so it contains various interlinking channels of streams, rivulets, ponds and swamps.

The soil found in the region is silty loam (Khadar). Soil as classified by the ISSS & IUP (ICAR), Nagpur, the region has Aquents-Fluvents types of soils.

Aquents : Recently formed hydromorphic alluvial soils.

Fluvents: Alluvial soils (Recent alluvium) silty loam.

Since silty loam soil is easily workable and productive, therefore, the entire region is under cultivation except a few patches of land near the river bed covered by scrub type of vegetation which are seen near villages Bumthala Rao, Pahladpur and Nagli. The soil is river borne silt and loam which is locally known as Khadar of Yamuna river.

Modern facilities of communication and transportation are not well developed due to river action. Main villages are linked with minor roads and footpaths.

(b) Kaithal Plain

The region extends over Kaithal tehsil except villages Ruan, Sarwa, including villages Budha Khera,

Sangatpura of Buhla tahsil and Rasulpur, Jandala, Bindrana, Kheri and Raiwali of Pehowa tahsil.

From relief point of view, the maximum height of the region is 247 metres above m.s.l. near village Lohar Haire in Kaithal tahsil while the minimum height is 233 metres near village Kotra in Kaithal tahsil. This plain comprises the higher ground than the flood plains of the district. In general, it slopes gently from the Northeast to Southwest.

The soil of the region is loam (Bhangar and Nardak). Soils as classified by the NDSR and LPP (ICAR), Nagpur, this region has Arrepts-Ochrepts and Ochrepts-Orthents types of soils.

Arrepts : Brown soils (Hydromorphic).

Ochrepts: Shallow blackish brown and alluvial soils of northern region.

Orthents: Recently formed soils.

The soil of the region is less granular and has a low water holding capacity. On the whole, the region is under extensive agriculture. Canal system is one of the important sources of irrigation Western Yamuna canal (Sirsa branch) is serving the region with its minor branches and distributaries.

As far as means of communication are concerned, the region has good network of roads and railways. Roads connect Kaithal town to various important villages. Minor metalled roads connect villages to the main roads. A broad gauge railway line passes through the region connecting Thanesar to Narwana.

(c) Bet Kurukshetra

The region spreads over the maximum parts of Buhla, Pehowa and Thanesar tahsils of the district and also covers two villages viz. Riar and Rarse of the Kaithal tahsil.

From physiographic point of view, the maximum height in the region is 268 metres above m.s.l. near village Dandipur in Thanesar tahsil while the minimum height is 229 metres near village Bhamak in the Buhla tahsil. Important rivers of the region are, Markanda, Chautana, and Saraswati which drain the entire region. A large patch of land near village Dhauntari and Nachhraudi of Thanesar tahsil, Kakheri, Resulpur, Mandi, Sadri and

Soths of Gohla tahsil are covered with swamps.

Soils of the region are silty clay or loam and coarse loam (Dahar and Charknote). In this Bet region, the proportion of silty deposits is significant. Soils as classified by the NBSS & IUP (ICAR), Naopur, this region has Aquerts-Ochrepts, Ochrepts-Orthents and Ustalfs-Fluvents types of soils.

Ustalfs : High base status-red loamy, red sandy and alluvial soils.

Fluvents: Alluvial soils (Recent alluvium).

Other types are the same as already described above in the case of Kahlia Plain.

The proportion of silt and clay is quite high and these soils have the appearance of red hard clay. They have compact hard structure. They tend to become puddled under direct impact of rainfall and flood.

With regard to means of communication and transportation, all types of roads are found in the region, radiating in all directions from Thanesar and Shahbad. Two broad gauge lines serve the region.

(d) Ghaggar Flood Plain

The region spreads over North-west and northern parts of Gohla tahsil. It makes its boundary with state of Punjab in the West.

The physiography of the region indicates that the maximum height of the region is 242 metres above m.s.l. near village Bhunalan while the minimum height is 736 metres near village Adondi. Both the heights are falling within Gohla tahsil. This region is gently sloping from North-east to South-west in which direction the river flows.

The soils in the region are river borne sand, soft loam and silty clay. Their power of holding moisture is less. The region is largely cleared off natural vegetation for cultivation due to long human occupancy. The soils are capable of producing a large variety of crops. A land patch under Reserved Forests is also seen near village Kasur and Khushhal Maira on the left bank of the river. Soils as classified by the NBSS & IUP (ICAR), Naopur, this region has Ustalfs-Fluvents types of the soils as already described above in the case of

District Kurukshetra.

With regard to means of transportation and communications two metalled roads are passing through the region from South to North and from East to West. Mostly the villages are interlinked with each other by minor metalled roads.

1.5 Climate

Kurukshetra District lies in the Eastern Haryana Plain which has Gangaic type Sub-tropical Continental Monsoon climate.

1.6 Rain

Monsoon brings rain from July to September. From October to June, the weather is generally dry except a few showers from western cyclones. Within the district also rainfall varies. The northern part of the district gets more rainfall than southern part due to its proximity to the mountains. The rainfall in the district varies from 650 mm. in the South-western part to 1000 mm. in the North-eastern part. From year to year also the rainfall varies considerably. The rainfall during 1979-80 was 367 mm. against 706 mm. during 1976-77. During 1977-78 it was 567 mm. as against 719 mm. during 1978-79. The climate in the district is attributed to short wet months and long dry spells. Humidity is very high during rainy season from July to September and very low during dry hot months of May and June.

1.7 Temperature

Due to its distance from the sea, there is great difference between the temperature of the day and night as well as during winter and summer. The maximum daily temperature during summer reaches as high as 48° C in May-June. Hot dry winds blow during the day due to its proximity to the semi-arid areas of Haryana and Rajasthan. During the winter, the minimum temperature sometimes falls as low as below 5° C in December-January.

1.8 Frost, Fog and Hails

Ground frost occurs when there is snowfall in the hills of Himachal Pradesh and Uttar Pradesh. Foggy weather conditions are also observed during January-February. Occasional spells of hailstorms also occur

during February to April. During May-June, severe dust storms occur in the district.

1.9 Socio-economic conditions

The economy of the district is primarily agricultural. At the time of 1981 census, 69% of total main workers were cultivators and agricultural labourers. The infrastructure is well developed in the district. National Highway No. 1 and broad gauge line pass through the district. The district is fast coming up as an industrial belt. The large and medium scale units in the district are engaged in manufacturing milk foods, vanaspati ghee, oxygen gas, washing soap, sulphuric acid, copper sulphate, alum, fertilisers, pesticides, rice bran oil. There are many small scale units in the district engaged in manufacturing paper board, hand made paper, menthol, steel, conduit pipes etc. The district is also known for supplying sewing machine parts.

Irrigation in the district is generally done by tubewells and canals. There is a good network of canals. Underground water level is relatively high. Tubewell irrigation is also common in the district. It is one of the most prosperous districts of Haryana from agricultural point of view. Out of the total area of the district 89.78% is cultivable area, out of which 89.55% is irrigated. Among the food grains mostly wheat and rice are grown. Basmati rice is grown over a considerable area. A very small area of 55 Sq. km. is under Reserved Forests. As per 1977 Livestock census the district had about 718,700 animals which mostly included cattle, buffaloes, sheep and pigs. During 1979-80 the district had 5709 vehicles of various types on the road.

People of the district are hardworking and enterprising. Wheat and rice are the main food items of the people. Milk consumption is high in comparison to the national average.

Out of the total population, 83.84% is rural population. 32.40% of the total population are literates. Literacy percentage among male and female population is 41.75 and 21.56 respectively. Literacy percentage among rural and urban population is 37.80 and 55.73 respectively. Out of total population only 31.63% are workers

while 68.37% are non-workers. In rural areas 32.26% are workers while in urban areas 28.47% are workers. While 52.14% are male workers only 7.87% are female workers.

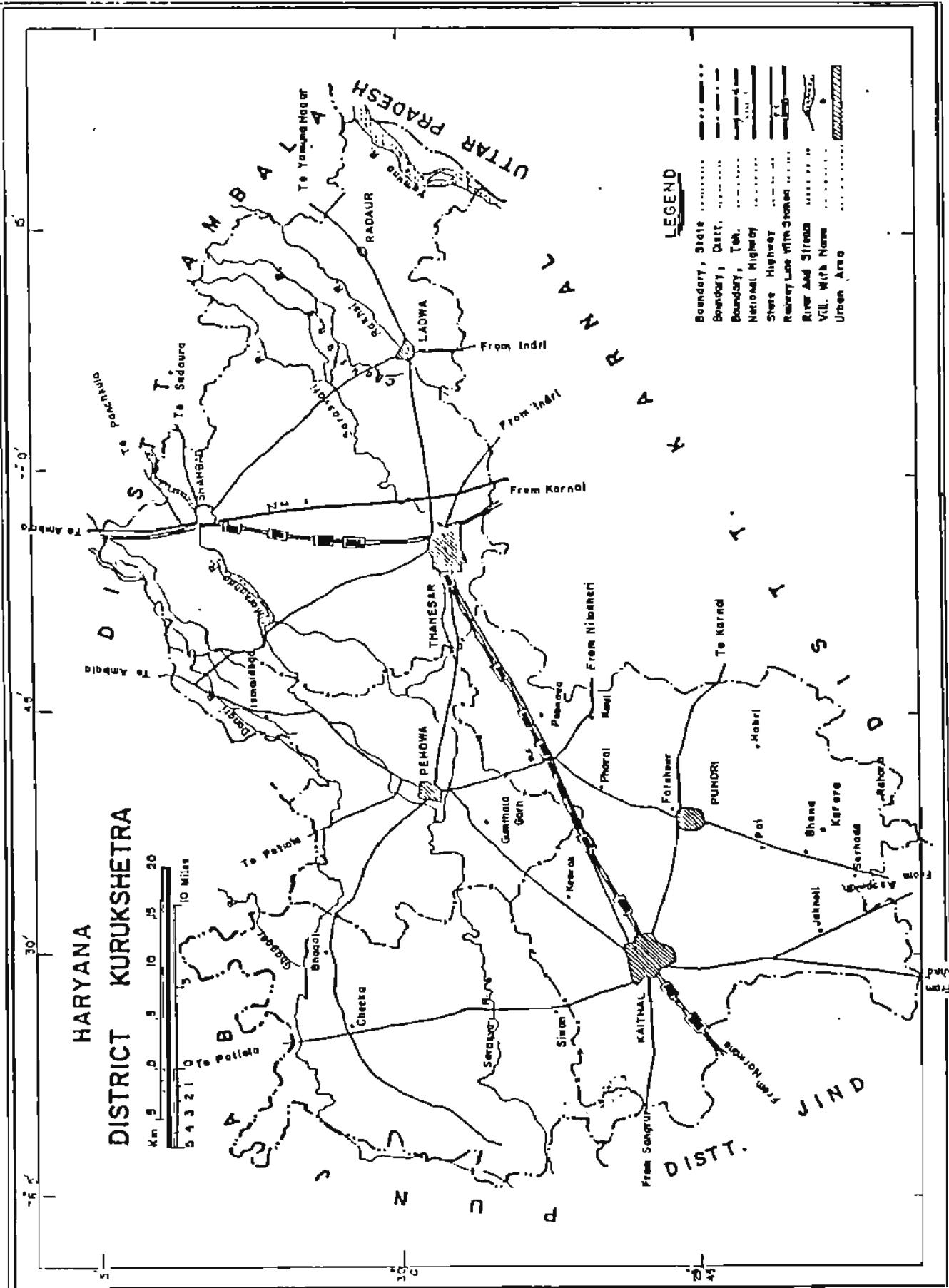
1.10 Uses

The trees provide mainly timber, fuelwood, fodder, fruit and shade. Timber is obtained mainly from *Dalbergia sissoo*, *Eucalyptus* spp., *Melia azedarach*, *Syzygium cumini*, *Morus alba*, *Mangifera indica*, *Azadirachta indica*, *Albizia* spp. etc. Soft timber is mainly obtained from *Acacia nilotica*, *Acacia* spp., *Nexus zeylanica*, *Prosopis* spp. etc. All the above mentioned tree spp. provide fuelwood also. Trees of *Acacia nilotica*, *Albizia* spp., *Morus alba*, *Pithecellobium* spp. etc. also provide fodder in the form of leaves or pods. *Morus* spp. provides wood for manufacturing hockey sticks and other sports goods. *Eucalyptus* spp. provide matchwood and *Eucalyptus* spp. paper pulpwood. Fruits are obtained from *Eucalyptus* spp. and *Syzygium cumini*. Katha is extracted from *Acacia catechu*. Neem oil is obtained from *Azadirachta indica*.

It has been seen that due to felling green trees in Bihar/Pradesh, packing cases for apples and other fruits/vegetables are being supplied from wood of *Eucalyptus* spp. Eucalyptus wood is also used for making cheap furniture and as a fuelwood.

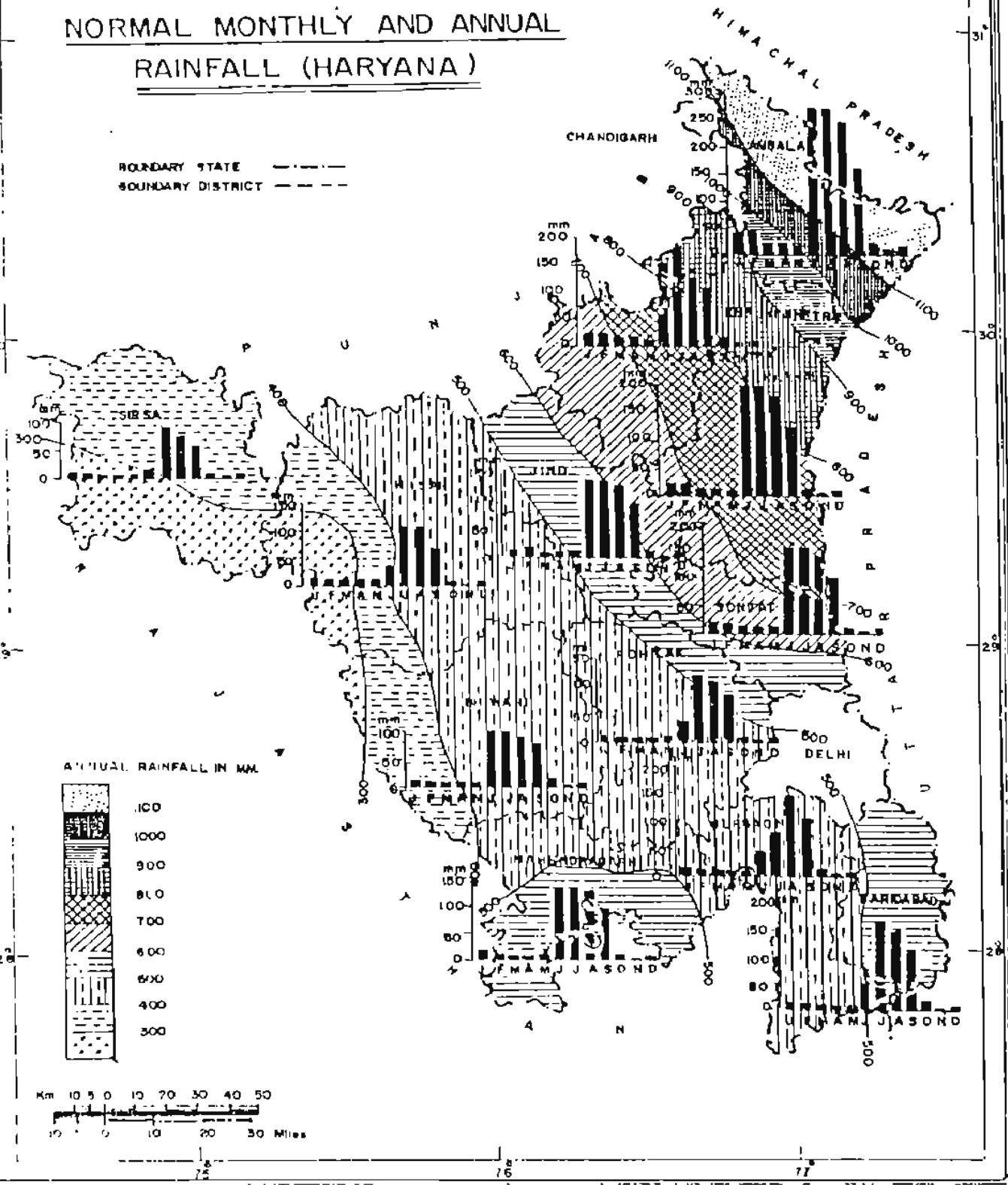
HARYANA DISTRICT KURUKSHETRA

Scale
Km 0 5 10 15 20
Miles 0 3 6 9 12



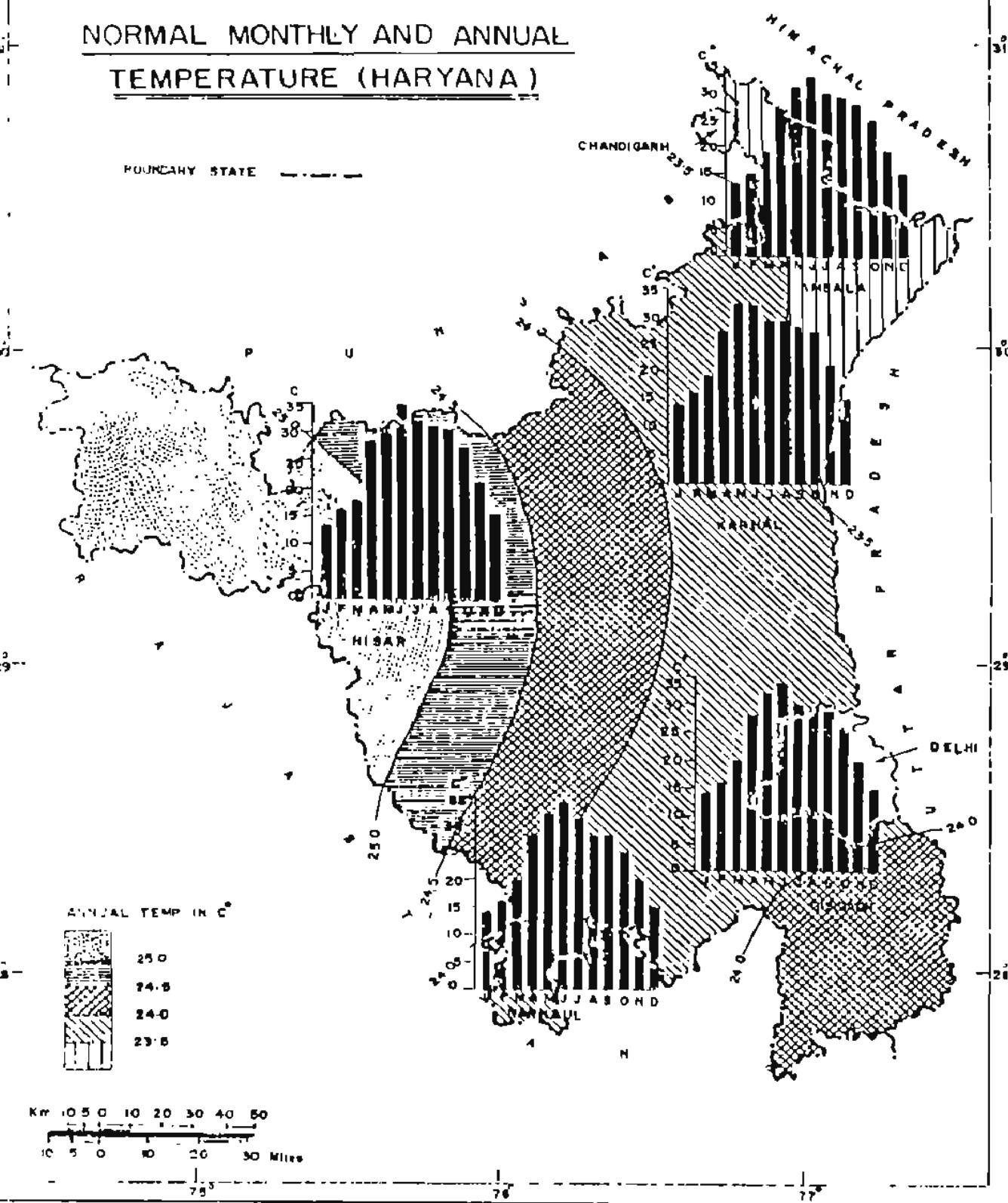
NORMAL MONTHLY AND ANNUAL
RAINFALL (HARYANA)

BOUNDARY STATE — - - -
BOUNDARY DISTRICT — - - -



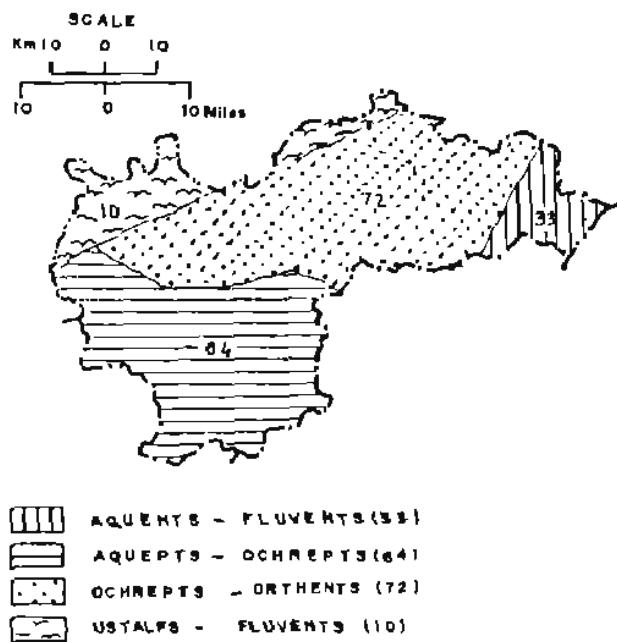
NORMAL MONTHLY AND ANNUAL
TEMPERATURE (HARYANA)

BOUNDRY STATE

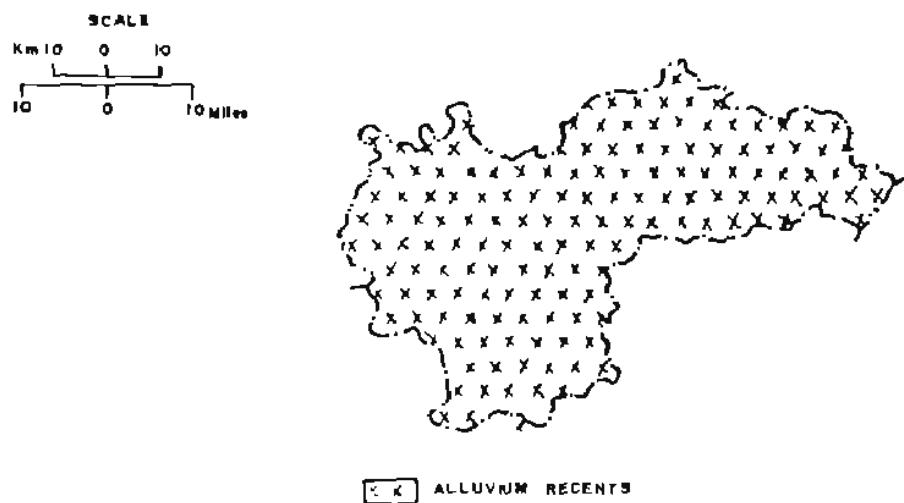


HARYANA
District Kurukshetra

SOILS



GEOLOGY



CHAPTER 2

2.1 Design and Methodology of Non-Forest Inventory Survey

District Census Books of Census Survey 1981 were used as basis of Inventory of Non-Forest Areas. A list of villages in the district was prepared and each village was given a serial number.

2.2 Definition of Non-Forest Area

For the purpose of this survey

(1) All those areas were taken which were outside the Traditional Reserved Forest Areas.

(2) All those areas which satisfied the following conditions were also excluded:-

(a) All places within the Municipality, Corporation, Cantonment Board or a notified area Committee etc.

(b) All other places which satisfied the following criteria:-

(i) A minimum population of 5,000;

(ii) At least 75% of the male working population engaged in non-agricultural pursuits and

(iii) A density of population of at least 400 per Sq.Km. (1,000 per Sq.Mile).

In addition to all municipal areas/Cantonment Board, four villages namely (1) Jhabbiyal in Ambala district, (2) Smalakha in Karnal district, (3) Gurgaon (rural) and (4) Jharsa in Gurgaon district satisfying the above criteria had been treated as Census towns (non-municipal) in 1981 Census. Panchkula Urban Estate in Ambala district had also been treated as a town. The Faridabad Complex Administration consisting of Faridabad, Faridabad Township and Dallebari towns of 1971 and some surrounding villages in Faridabad district had been treated as towns.

2.3 Sampling Design and Method of Selection of Sample Villages

The inventory survey was undertaken in the rural area (non-forest area only) of the state. The design followed in the field inventory was random sampling with the villages as sampling units. A list of villages of Kurukshetra district was prepared according to 1981 Census and each village was given a serial number.

Firstly, the number of sample villages to be surveyed in the state was decided by taking a pilot survey such that the results of the survey at State level would be at the precision level of $\pm 10\%$ at 95% probability.

For carrying out pilot survey, 2 to 3 villages were taken from each district of Haryana State. Total 31 villages were selected for pilot survey in Haryana State. A list of the villages selected for pilot survey is given in Appendix-I.

The villages selected for pilot survey were taken up one by one for carrying out complete enumeration of all the trees of 10 cms. and above diameter at B.Ht(DB). Each of those selected villages, with its area and boundaries as per the revenue records, was treated as a sampling unit.

After completing the pilot survey the data was processed for obtaining number of trees/Ha. in each village for calculation of sample size by using the formula

$$n = \frac{\left(\frac{2 * c.v.}{10} \right)^2}{1 + \frac{1}{N} \left(\frac{2 * c.v.}{10} \right)^2}$$

where $c.v. = \frac{s}{\bar{x}} * 100$ and

N = total no. of villages in the State.

For large N , it will be equal to

$$n = \left(\frac{2 * c.v.}{10} \right)^2$$

The method used was ratio method of estimation. The sample size obtained from pilot survey was 219 villages.

These 219 villages were distributed over all the districts proportional to the rural area of the district. A list of number of villages selected for each district is given in the Appendix-II.

These randomly selected villages in each district were taken up one by one for carrying out complete enumeration of all the trees of 10 cms. and above diameter. Each of these randomly selected villages, with its area and boundaries as per the revenue records, was treated as a sampling unit.

2.4 Field Methodology

The field data is collected by a Crew, consisting of one Junior Technical Assistant (Crew Leader), a Deputy Ranger, two Fieldmen, a Khalasi and unskilled labourers engaged locally wherever necessary for showing the boundary of the village as well as helping in the survey work.

Each Crew Leader is provided with a list of villages to be tackled alongwith a set of 1:50,000 scale maps with location of villages duly marked. The Crew Leader is required to find the nearest convenient route so that they can reach the village with minimum traverse by jeep or on foot. After reaching the village the next job is to determine the boundary of the village. For this purpose, the maps of the Revenue department are referred and in addition the help of village level authorities are obtained. The unit of sampling is the whole of sample village. To begin the data collection it is necessary to select the starting/reference point preferably centre of the village. This reference point/centre is not necessarily to be the centre of the area. The details of the location of the reference point/centre and its description are recorded in the village description form. This is very important to enable the checking crew to reach this point and commence checking.

After fixing the starting/reference point, the enumeration work is started from the reference point by dividing the entire village into suitable sized angular quadrants with the help of compass in such a way that enumeration within each angular quadrant could be completed in one working day. The size of each angular quadrant is decided by the Crew Leader accordingly. Enumeration of trees/bamboo is commenced from the line marking due North from the centre/reference point and is proceeded in clockwise direction (i.e. North to East).

This procedure is important to avoid duplication/omission of trees when the enumeration work is continued on the next day. Further, all the enumerated trees are suitably marked with chalk to achieve this objective. The

informations regarding number of angular quadrants, the size of each angular quadrant and number of trees enumerated in each quadrant are recorded in the prescribed Field forms given below:

- (1) Village Description Form
- (2) Village Tree Enumeration Form
- (3) District Tree Form

Samples of the above field forms may be seen in the Appendix-VI. The field forms are briefly described below:

(1) Village Description Form

The information regarding the conspicuous features of the point selected as the Centre for starting the enumeration, number of angular quadrant, Size of each angular quadrant and number of trees enumerated in each quadrant are recorded in this form.

(2) Village Tree Enumeration Form

In this form the data of all trees of 10 cms. and above diameter at breast height over bark (DBH(OB)) in a sampled village are recorded. The dead trees having utility less than 70% and all trees of less than 10 cms. diameter are ignored.

(3) District Tree Form

This form has to be filled in for each sampled village selected in the district.

While carrying out the survey, i.e. enumeration and measurement of trees, the category of each tree - indicating the type of plantation it belongs to is also recorded in the columns of Village Tree Enumeration Form. The definitions used for this classification are as under:

Farm Forestry: Trees along the farm bunds and in small patches up to 0.1 ha. in area.

Road side Plantation: For trees planted along the road side.

Village Woodlot: Naturally growing trees on community/ private land.

Block Plantations: Patches covering an area of more than 0.1 ha. and not falling in any of the above.

Ponds: For trees planted in and around water ponds.

Railway Lines: For trees planted along the railway lines.

Canals: Trees planted along the canals.

Rest: Trees not falling in any of the above categories.

CHAPTER 3

Data Processing

3.1 Processing of the Data

After completion of field work, the field forms of the villages surveyed were consolidated and checked for inconsistencies and Coding mistakes, if any. Forms for each village were then processed manually and information was filled in the tables. The species found in sample villages of Kurukshetra district during survey are given in Appendix-III. Since many of the species in the region were having a very small number of trees, they were clubbed together under Miscellaneous species. Twenty main species were selected for calculating the number of stems on the basis of their numerical occurrence, commercial importance and regional importance. After manual processing of the data the tabulated data was then transferred to the data files in the Personal Computer (PC) using suitable softwares. The data files were then processed for making various tables in desired formats required to be incorporated in the Report.

3.2 Area Computation

Rural area of the district was calculated by adding up the areas of the villages given in the Census Book of 1981 of that district.

3.3 Procurement of Volume factors

Collection of felled tree data has been discontinued by zones, for developing volume equations. The volume factors have been obtained from the Lounding Divisions and Territorial Forest Divisions of the State Forest Department of Haryana.

The volume factors used for different tree species have been given in the volume table at the end of this chapter.

3.4 Estimation Procedure

The estimation procedure is given below:

Let

x_i = area of the i th village

v_i = volume/no. of trees for the i th village

n = no. of sample villages in the district/state
 N = total no. of villages in the district/state

$$\bar{x} = \frac{1}{n} \sum x_i = \text{average area per village in the sample}$$

$$\bar{X} = \frac{1}{N} \sum X_i = \text{average area per village in the population (District/State)}$$

$$\bar{v} = \frac{1}{n} \sum v_i = \text{average volume/no. of trees in the sample}$$

$$\bar{Y} = \frac{1}{N} \sum Y_i = \text{average volume/no. of trees in the population (District/State)}$$

$$A = \sum x_i = \text{total area of all villages in the population (District/State)}$$

Then the mean volume/no. of trees per unit area for the population (District/State) is given by

$$\hat{R} = \frac{\bar{Y}}{\bar{x}}$$

The estimate of R is the sample ratio

$$\hat{R} = \frac{\frac{1}{n} \sum v_i}{\frac{1}{n} \sum x_i} = \frac{\bar{v}}{\bar{x}}$$

The estimate of total volume/no. of trees in the population (District/State) is given by

$$\hat{T} = \frac{A * \bar{v}}{\bar{x}} = A * \hat{R}$$

Estimated variance of \hat{R} is given by

$$\hat{V}(\hat{R}) = \frac{N-n}{N(n-\bar{x}^2)} * \frac{1}{(n-1)} \left[\sum_{i=1}^n v_i^2 - 2\hat{R} \sum_{i=1}^n v_i x_i + \hat{R}^2 \sum_{i=1}^n x_i^2 \right]$$

When N is large, then

$$\hat{V}(R) = \frac{1}{n(n-1)x^2} \left[\sum_{i=1}^n x_i^2 - 2R \sum_{i=1}^n x_i \bar{x}_i + R^2 \sum_{i=1}^n \bar{x}_i^2 \right]$$

Estimated variance of \hat{T} is given by

$$\hat{V}(\hat{T}) = A * \hat{V}(R)$$

$$\text{S.E. of } \hat{R} = \sqrt{\hat{V}(R)} \quad \text{and} \quad \text{S.E.\%} = \frac{\text{S.E.}}{R} * 100$$

$$\text{S.E. of } \hat{T} = \sqrt{\hat{V}(\hat{T})} \quad \text{and} \quad \text{S.E.\%} = \frac{\text{S.E.}}{T} * 100$$

Volume table - specieswise and dia-classwise

S.No. Name of Species	10-20	20-30	30-40	40-50	50-60	60-70	70+
1 <i>Acacia catechu</i>	0.10	0.21	0.51	1.13	1.98	2.83	3.54
2 <i>Acacia nilotica</i>	0.06	0.14	0.57	1.13	1.98	2.83	3.54
3 <i>Acacia spp.</i>	0.05	0.14	0.57	1.13	1.98	2.83	3.54
4 <i>Acacia tortilis</i>	0.06	0.14	0.57	1.13	1.98	2.83	3.54
5 <i>Albizia spp.</i>	0.06	0.14	0.57	1.13	1.98	2.83	3.54
6 <i>Azadirachta indica</i>	0.06	0.14	0.57	1.13	1.98	2.83	3.54
7 <i>Dalbergia sissoo</i>	0.06	0.14	0.57	1.13	1.98	2.83	3.54
8 <i>Eucalyptus spp.</i>	0.0972	0.415	0.954	1.714	2.695	3.897	5.32
9 <i>Ficus spp.</i>	0.06	0.14	0.57	1.13	1.98	2.83	3.54
10 <i>Mangifera indica</i>	0.06	0.14	0.57	1.13	1.98	2.83	3.54
11 <i>Melia azedarach</i>	0.06	0.14	0.57	1.13	1.98	2.83	3.54
12 <i>Morus spp.</i>	0.06	0.14	0.57	1.13	1.98	2.83	3.54
13 <i>Populus spp.</i>	0.07	0.349	0.732	1.256	1.921	3.897	5.32
14 <i>Prosopis cineraria</i>	0.06	0.14	0.57	1.13	1.98	2.83	3.54
15 <i>Prosopis juliflora</i>	0.06	0.14	0.57	1.13	1.98	2.83	3.54
16 <i>Psidium guava</i>	0.06	0.14	0.57	1.13	1.98	2.83	3.54
17 <i>Salvadora spp.</i>	0.06	0.14	0.57	1.13	1.98	2.83	3.54
18 <i>Syzgium cumini</i>	0.06	0.14	0.57	1.13	1.98	2.83	3.54
19 <i>Tamarix aphylla</i>	0.06	0.14	0.57	1.13	1.98	2.83	3.54
20 <i>Zizyphus spp.</i>	0.06	0.14	0.57	1.13	1.98	2.83	3.54
21 Misc. spp.	0.06	0.14	0.57	1.13	1.98	2.83	3.54

CHAPTER 4

Stand and Stock Tables

As per 1981 Census, Kurukshetra district has a total of 743 villages having an area of 3727.60 Sq. km. Out of these, 20 villages having an area of 120.83 Sq. km. were randomly selected and surveyed (see Appendix-IV).

During the course of inventory, data have been collected for trees having 10 cms. and above diameter only. The data collected from 20 villages have been statistically analysed for variability in respect of stand and stock parameters of trees and "number of trees/ha." and "volume/ha." The analysis shows that the estimated number of trees/ha. is 11.98 and the corresponding volume is 2.284 cum./ha. for the entire district of Kurukshetra.

The distribution of total number of stems and stems/ha. as well as corresponding total volume and volume/ha. which have been estimated on the basis of survey for the entire district have been included as table nos. 1 to 6.

In the entire rural area of Kurukshetra district 44.65 lakh trees having volume of 8.52 lakh cubic meters have been estimated and the distribution thereof is discussed below:

1. The distribution of total number of trees (estimated), specieswise and dia-classwise (all categories combined), is given in table no. 1. The specieswise distribution of total number of trees in the State has been estimated by ratio estimation method.

The analysis shows that, when all species are combined, the maximum number of the estimated trees occur in 10-20 cms. dia-class i.e. 31.16 lakh trees (69.79%) followed by 9.48 lakh trees (21.23%) in 20-30 cms. dia-class, 2.80 lakh trees (6.26%) in 30-40 cms. dia-class and 1.21 lakh trees (2.71%) in 40 cms. and above dia-class.

It also shows that in the rural area of Kurukshetra district, when all the dia-classes are combined, Eucalyptus spp. has the largest representation i.e. 16.34 lakh trees (36.59%) followed by Acacia nilotica (Babul) 11.35 lakh trees (25.41%), Populus spp. 5.15 lakh trees (11.54%), Melia azedarach 2.27 lakh trees (5.08%),

Dalbergia sissoo 1.99 lakh trees (4.45%), Morus spp. 1.43 lakh trees (3.20%), Mangifera indica 1.11 lakh trees (2.48%), Azadirachta indica 0.68 lakh trees (1.53%) and Syzygium cumini 0.52 lakh trees (1.17%). The representation of the rest of the species is less than 1% each.

2. The distribution of total number of trees (estimated), categorywise and dia-classwise (all species combined), is given in table no. 2.

It shows that, when all the dia-classes are combined, the representation of trees in Category-I - Farm Forestry is the highest i.e. 22.20 lakh trees (49.72%) followed by Category-IV - Block Plantations 10.41 lakh trees (23.31%), Category-II - Roadside Plantations 5.33 lakh trees (11.94%), Category-III - Village Woodlots 3.79 lakh trees (8.49%) and Category-VII - Canals 2.76 lakh trees (6.18%). The representation of trees in Category-V i.e. Fonds is found to be very poor while the remaining categories have been found to be absent.

The dia-classwise distribution of total number of stems, for combined categories, are the same as in table no. 1 i.e. dia-classwise total number of trees for all species combined as already described above in para 1.

Though the overall distribution of stems per hectare is 11.98, the dia-classwise distribution of stems per hectare is maximum in dia-class 10-20 cms. i.e. 8.36 followed by 2.54 in 20-30 cms dia-class, 0.75 in 30-40 cms. dia-class and 0.32 in 40 cms. and above dia-class.

3. The distribution of total number of estimated trees, specieswise and categorywise (all dia-classes combined), has been presented in table no. 3.

The specieswise total number of trees (all categories combined) and the percentage thereof are the same as in table no. 1 i.e. specieswise distribution of total number of trees for combined dia-classes as already described above in para 1.

Similarly, categorywise total number of trees estimated (all species combined) and the percentage thereof are also same as in table no. 2 i.e. categorywise total number of trees for combined dia-classes as described in para 2 above.

The analysis shows that the specieswise total number

of estimated trees (in order of decreasing order) in the various prescribed categories are as under:

Category-I - Farm Forestry

As per the estimate, this category has a total number of 22.20 lakh trees (49.72%) which is the highest amongst all the categories. It is mainly comprised of *Eucalyptus* spp. 10.34 lakh, *Acacia nilotica* 2.96 lakh, *Melia azederach* 1.76 lakh, *Dalbergia sissoo* 1.58 lakh, *Morus* spp. 1.24 lakh, *Populus* spp. 1.01 lakh, *Azadirachta indica* 0.56 lakh, *Hancifera indica* 0.50 lakh, *Syzygium cumini* 0.38 lakh and *Ziziphus* spp. 0.16 lakh. The remaining species are represented very poorly.

Category-II - Roadside Plantation

As per the estimation there are 5.33 lakh trees (11.94%) in all in this category. It is mainly represented by *Acacia nilotica* 3.00 lakh, *Eucalyptus* spp. 1.90 lakh, *Dalbergia sissoo* 0.17 lakh and *Prosopis juliflora* 0.13 lakh. The representation of the remaining species is very poor and hence not presented here.

Category-III - Village Woodlots

In this category the total number of trees, as per the estimation, is 3.79 lakh (8.49%). The predominant species in this category are *Acacia nilotica* 2.49 lakh, *Melia azederach* 0.47 lakh, *Morus* spp. 0.16 lakh, *Dalbergia sissoo* 0.15 lakh and *Salvadora* spp. 0.11 lakh. The remaining species have a poor representation.

Category-IV - Block Plantations

There are 10.41 lakh trees (23.31%) in all in this category. The main species forming bulk of the crop (in decreasing order) are *Populus* spp. 4.03 lakh, *Eucalyptus* spp. 3.19 lakh, *Acacia nilotica* 0.79 lakh, *Hancifera indica* 0.60 lakh, *Ziziphus* spp. 0.14 lakh and *Syzygium cumini* 0.137 lakh. The representation of the remaining species being very poor are not mentioned here.

Category-V - Ponds

As per the estimate, there are only 0.16 lakh trees (0.36%) in this category.

Category-VI - Railway Lines

This category has been found to be absent in this district.

Category-VII - Canals

It is estimated that this category in total has 2.76 lakh trees (6.18%). The main species in order of predom-

inference are *Acacia nilotica* 2.00 lakh, *Eucalyptus*, spp. 0.58 lakh and *Populus* spp. 0.10 lakh. The representation of the rest of the species is very poor.

Category-VIII - Rest

This category is found to be altogether absent.

Analysis of Volume (Stock)

As per the estimate the entire rural area of Kurukshetra district has a total volume (all species and dia-classes combined) of 8.52 lakh cubic meters corresponding to estimated total of 44.65 lakh trees. The distribution of this stock is discussed below:

i. An assessment of dia-classwise and specieswise distribution of volume (all categories combined) has been presented in table no. 4. The dia-classwise total estimated volume of trees (in decreasing order) of all species is as given below :

Dia-class 10-20 cms. having a volume of 2.39 lakh cubic meters (28.04%) followed by dia-class 20-30 cms. having a volume of 2.34 lakh cubic meters (27.50%), 40 cms. and above dia-class having 2.06 lakh cubic meters (24.17%) and dia-class 30-40 cms. having 1.73 lakh cubic meters (20.29%).

It also shows that the total volume per hectare contributed by trees of all species of all dia-classes combined is 2.284 cum. The volume per hectare for different dia-classes (in decreasing order) are as below:

10-20 cms. dia-class (0.641 cum.), 20-30 cms. dia-class (0.628 cum.), 40 cms. and above dia-class (0.552 cum.) and 30-40 cms. dia-class (0.463 cum.).

It may also be seen from the said table that the bulk of the volume, for combined dia-classes, is mainly contributed by the following species (in decreasing order):

Eucalyptus spp. 3.07 lakh cubic meters (36.08%), *Acacia nilotica* 2.16 lakh cubic meters (25.35%), *Populus* spp. 0.73 lakh cubic meters (8.59%), *Dalbergia sissoo* 0.56 lakh cubic meters (6.62%), *Mengifera indica* 0.26 lakh cubic meters (3.00%), *Melia azedarach* 0.23 lakh cubic meters (2.73%), *Morus* spp. 0.22 lakh cubic meters (2.61%), *Azadirachta indica* 0.16 lakh cubic

meters (1.83%), *Salvadora* spp. 0.11 lakh cubic meters (1.61%), *Syzygium cumini* 0.10 lakh cubic meters (1.18%), and *Eicus* spp. 0.09 lakh cubic meters (1.12%). The volume contributed by the rest of the species is very less.

2. The distribution of total volume (estimated), categorywise and dia-classwise (all species combined), is given in table no. 5.

It shows that when all dia-classes are combined, category-I has the maximum volume of 4.32 lakh cubic meters (30.77%) followed by category-II having 1.42 lakh cubic meters (16.71%), category-IV having 1.29 lakh cubic meters (10.13%), category-III having 0.81 lakh cubic meters (9.47%) and category-VII having 0.65 lakh cubic meters (7.63%). Categories-V has a very poor stock due to its poor representation while categories VI and VIII have been found to absent.

It also shows that the dia-classwise total volume of all categories combined and the percentage thereof are the same as in Table no. 4 i.e. dia-classwise total volume of all species combined as described in para 3 above.

3. The distribution of total estimated volume, specieswise and categorywise (all dia-classes combined), is given in table no. 4.

The specieswise total volume of trees (all categories combined) and the percentage thereof are the same as in Table no. 4 i.e. specieswise distribution of total volume of trees for combined dia-classes as described above in para 1.

Similarly, the categorywise total volume of trees (all species combined) and the percentage thereof are also same as in table no. 5 i.e. categorywise total volume of trees for combined dia-classes as described in para 2 above.

Table No. 1

Total number of stems - specieswise and dia-classwise
(All categories combined)

Rural area of KURUKSHETRA DISTT. : 3727.60 Sq. km.							
S.No.	Name of Species	10-20	20-30	30-40	40+	Total	% age
1	Acacia catechu	0	0	0	0	0	0.00
2	Acacia nilotica	651650	294585	146988	41273	1134596	25.41
3	Acacia spp.	0	0	154	0	154	0.00
4	Acacia tortilis	0	0	0	0	0	0.00
5	Albizia spp.	2776	308	154	0	3238	0.07
6	Azadirachta indica	42322	14807	7125	4194	68448	1.53
7	Balberoria sissoo	88007	60306	35568	14652	198533	4.45
8	Eucalyptus spp.	1275694	316308	32913	8759	1633674	36.59
9	Ficus spp.	6755	2561	1542	3239	14097	0.32
10	Mamoifera indica	63391	30446	9161	7618	110616	2.48
11	Melia azedarach	170245	47690	6910	2005	226850	5.08
12	Morus spp.	90690	36646	12370	3238	142944	3.20
13	Populus spp.	432573	69468	4226	9162	515429	11.54
14	Prosopis cineraria	2128	2128	0	771	5027	0.11
15	Prosopis juliflora	16565	7033	617	154	24369	0.55
16	Psidium guava	0	0	0	0	0	0.00
17	Salvadora spp.	1357	2714	2869	4319	11258	0.25
18	Syzygium cumini	29335	17089	3887	1850	52161	1.17
19	Tamarix aphylla	0	154	0	0	154	0.00
20	Zizyphus spp.	25572	4813	617	154	31156	0.70
21	Misc. spp.	217290	40779	14622	19711	292402	6.55
Total		3116350	947935	279723	121098	4465106	100.00
% age		69.79	21.23	6.26	2.71	100.00	

Table No. 2

Total number of stems - categorywise and dia-classwise
(All species combined)

Rural area of KURUKSHETRA DISTT. : 3727.60 Sq. Km.

S.No.	Category	10-20	20-30	30-40	40+	Total	% age
1	I	1535736	503861	126999	53332	2219929	49.72
2	II	258253	171634	78999	24245	535131	11.54
3	III	243385	84274	33348	18170	379177	8.49
4	IV	887170	133353	13048	7277	1040848	23.31
5	V	12245	3268	370	246	16129	0.36
6	VI	0	0	0	0	0	0.00
7	VII	179561	51545	26959	17828	275893	6.18
8	VIII	0	0	0	0	0	0.00
Total		3116330	947935	279723	121098	4465106	100.00
% age		69.79	21.23	6.26	2.71	100.00	
Stems/ha		8.36	2.54	0.75	0.32	11.98	

Table No. 3

Total number of stems - specieswise and categorywise
(All dia-classes combined)

Rural area of KURUKSHETRA DISTT. : 3727.60 Sq. km.

S.No. Name of Species	I	II	III	IV	V	VI	VII	VIII	Total	% age
1 <i>Acacia catechu</i>	0	0	0	0	0	0	0	0	0	0.00
2 <i>Acacia nilotica</i>	295919	300700	248909	78707	9500	0	200661	0	1134596	25.41
3 <i>Acacia spp.</i>	0	154	0	0	0	0	0	0	154	0.00
4 <i>Acacia tortilis</i>	0	0	0	0	0	0	0	0	0	0.00
5 <i>Albizia spp.</i>	2498	0	463	154	123	0	0	0	3238	0.07
6 <i>Azadirachta indica</i>	55741	4473	6508	925	493	0	308	0	68448	1.53
7 <i>Balberoria sissoo</i>	157908	16782	14806	6200	0	0	2837	0	198533	4.45
8 <i>Eucalyptus spp.</i>	1033819	189432	740	348760	2869	0	58054	0	1633674	36.59
9 <i>Ficus spp.</i>	9747	308	3672	0	370	0	0	0	14097	0.32
10 <i>Mangifera indica</i>	50465	308	0	59843	0	0	0	0	110616	2.48
11 <i>Melia azedarach</i>	176046	1943	46518	1388	493	0	462	0	226850	5.08
12 <i>Morus spp.</i>	123914	308	15639	2498	123	0	462	0	142844	3.20
13 <i>Populus spp.</i>	101303	154	463	403237	0	0	10272	0	515429	11.54
14 <i>Prosopis cineraria</i>	1850	154	2561	0	0	0	462	0	5027	0.11
15 <i>Prosopis juliflora</i>	6818	13295	1820	771	246	0	1419	0	24369	0.55
16 <i>Psidium guava</i>	0	0	0	0	0	0	0	0	0	0.00
17 <i>Salvadora sep.</i>	462	0	10550	0	246	0	0	0	11258	0.25
18 <i>Syzygium cumini</i>	37880	0	616	13665	0	0	0	0	52161	1.17
19 <i>Tamarix aphylla</i>	154	0	0	0	0	0	0	0	154	0.00
20 <i>Ziziphus spp.</i>	15362	0	1820	13974	0	0	0	0	31156	0.70
21 Misc. spp.	150042	5120	24092	110526	1666	0	956	0	292402	6.55
Total	2219928	533131	379177	1040848	16129	0	275893	0	4465108	100.00
% age	49.72	11.94	8.45	23.31	0.36	0.00	6.18	0.00	100.00	

Table No. 4

Distribution of Total volume (cu.m.) - specieswise and dia-classwise
(All categories combined)

Rural Area of JUPUKSHETRA DISTT. : 3727.60 Sq.Km.

S.No. Name of Species	10-20	20-30	30-40	40+	Total	% age Vol./ha.
1 <i>Acacia catechu</i>	0	0	0	0	0	0.00 0.000
2 <i>Acacia nilotica</i>	39100	41257	83783	51750	215890	25.35 0.579
3 <i>Acacia spp.</i>	0	0	88	0	88	0.01 0.000
4 <i>Acacia tortilis</i>	0	0	0	0	0	0.00 0.000
5 <i>Albizia spp.</i>	166	43	88	0	297	0.03 0.001
6 <i>Azadirachta indica</i>	2539	2072	4062	6923	15596	1.83 0.042
7 <i>Balberoria sissoo</i>	5281	8447	20274	22388	56386	6.62 0.151
8 <i>Eucalyptus spp.</i>	123997	131267	31399	20586	307249	36.08 0.824
9 <i>Ficus spp.</i>	405	359	879	7902	9545	1.12 0.026
10 <i>Manoifera indica</i>	3803	4263	5222	12235	25523	3.00 0.068
11 <i>Melia azedarach</i>	10214	6677	3939	2396	23226	2.73 0.062
12 <i>Morus spp.</i>	5440	5131	7051	4577	22199	2.61 0.060
13 <i>Populus spp.</i>	30290	24244	3094	15562	73180	9.59 0.196
14 <i>Prosopis cineraria</i>	127	298	0	1133	1558	0.18 0.004
15 <i>Prosopis juliflora</i>	993	985	352	174	2504	0.29 0.007
16 <i>Psidium guyava</i>	0	0	0	0	0	0.00 0.000
17 <i>Salvadora spp.</i>	81	380	1635	9355	11451	1.34 0.031
18 <i>Syzgium cumini</i>	1760	2393	2216	3641	10010	1.18 0.027
19 <i>Tamarix aphylla</i>	0	22	0	0	22	0.00 0.000
20 <i>Zizyphus spp.</i>	1534	674	352	305	2865	0.34 0.008
21 Misc. spp.	13039	5709	8335	46878	73961	8.59 0.198
Total	238759	234217	172769	205805	851550	100.00 2.284
% age	28.04	27.50	20.29	24.17	100.00	
Vol./ha.	0.641	0.628	0.463	0.552	2.284	

Table No. 5

Distribution of total volume (cum.) - categorywise and dia-classwise
(All species combined)

Rural area of KURUKSHETRA DISTT. : 3727.60 Sq. km.

S.No.	Category	10-20	20-30	30-40	40+	Total	% age
1	I	122131	136802	81348	92052	432333	50.77
2	II	20394	36235	47816	37819	142264	16.71
3	III	14623	11823	19008	35164	80678	9.47
4	IV	69215	39018	9575	12998	128806	15.13
5	V	795	721	306	679	2501	0.29
6	VI	0	0	0	0	0	0.00
7	VII	12601	9558	15716	27093	64968	7.63
8	VIII	0	0	0	0	0	0.00
Total		232759	234217	172759	205805	851550	100.00
% age		23.04	27.50	20.29	24.17	100.00	

Table No. 6

Distribution of total volume (cum.) - specieswise and categorywise
(All dia-classes combined)

Rural area of KURUKSHETRA DISTT. : 3727.60 Sq. km.

S.No. Name of Species	I	II	III	IV	V	VI	VII	VIII	Total	% ade
1 <i>Acacia catechu</i>	0	0	0	0	0	0	0	0	0	0.00
2 <i>Acacia nilotica</i>	55470	80882	34570	6001	739	0	38228	0	215990	25.35
3 <i>Acacia spp.</i>	0	88	0	0	0	0	0	0	88	0.01
4 <i>Acacia tortilis</i>	0	0	0	0	0	0	0	0	0	0.00
5 <i>Albizia spp.</i>	253	0	28	9	7	0	0	0	297	0.03
6 <i>Azadirachta indica</i>	12483	497	1689	68	39	0	350	0	15596	1.83
7 <i>Dalbergia sissoo</i>	42536	4182	5499	3929	0	0	274	0	56386	6.42
8 <i>Eucalyptus spp.</i>	193518	54023	170	49882	795	0	8851	0	307249	31.05
9 <i>Ficus spp.</i>	6345	183	2975	0	42	0	0	0	9545	1.12
10 <i>Mangifera indica</i>	15710	16	0	12185	0	0	0	0	25525	3.00
11 <i>Melia azedarach</i>	17799	176	5451	121	39	0	49	0	23228	2.73
12 <i>Morus spp.</i>	19565	18	1756	382	7	0	271	0	22199	2.61
13 <i>Populus spp.</i>	15422	113	32	41583	0	0	16030	0	73180	8.53
14 <i>Prosopis cineraria</i>	481	9	1016	0	0	0	52	0	1558	0.18
15 <i>Prosopis juliflora</i>	495	1380	358	46	24	0	201	0	2504	0.29
16 <i>Psidium guava</i>	0	0	0	0	0	0	0	0	0	0.00
17 <i>Salvadora spp.</i>	467	0	10305	0	679	0	0	0	11451	1.34
18 <i>Syzygium cumini</i>	7075	0	129	2807	0	0	0	0	10010	1.13
19 <i>Tamarix aphylla</i>	22	0	0	0	0	0	0	0	22	0.00
20 <i>Ziziphus spp.</i>	1794	0	146	925	0	0	0	0	2825	0.34
21 Misc. spp.	45726	725	16345	10872	130	0	161	0	73351	8.27
Total	432333	142264	80678	128806	2501	0	64968	0	891550	100.00
% ade	50.77	16.71	9.47	15.13	0.28	0.00	7.63	0.00	100.00	

Appendix-1

**List of villages selected for Pilot Survey
in Haryana State.**

S.No.	Name of the village	Area of Village (Ha.)
1.	Baghana	1479.51
2.	Daidwala	1416.38
3.	Bhandari	677.00
4.	Bhetoo	583.00
5.	Bondkalan	2353.00
6.	B. Husne	248.00
7.	B. Tauru	184.94
8.	Bachaur	2708.00
9.	Dighal	2211.00
10.	Dobhi	2894.00
11.	Gorakhpur	4370.00
12.	Gurauthi	1720.00
13.	Hajiali	120.00
14.	Kahnaur	2762.00
15.	Khandalheri	2324.00
16.	Khartkara	979.00
17.	Kona	266.28
18.	Kurramanwali	1479.00
19.	K. Ladhasiunh	140.00
20.	Lalberi	267.09
21.	Mammonmaira	199.51
22.	Mohammedpur	1731.00
23.	Nandgaon	825.14
24.	Nathusari	1741.00
25.	Phadani	208.00
26.	Ratour	130.00
27.	Saundbad	2752.00
28.	Shampura	1017.00
29.	Shoadapur	316.05
30.	Siwara	1126.00
31.	Sulehria	372.00
Total		40182.90

Appendix - II

**Districtwise number of the villages selected
for Inventory Survey in Haryana State.**

S.No.	Name of the District	Total no. of villages	No. of villages selected for the District Survey
1.	Ambala	1306	39
2.	Bhiwani	428	23
3.	Faridabad	505	11
4.	Gurgaon	721	14
5.	Hisar	510	33
6.	Jind	354	16
7.	Kurukshetra	743	20
8.	Karnal	634	18
9.	Mohindergarh	743	16
10.	Rohtak	458	19
11.	Sirsa	323	21
12.	Sonipat	348	11
Total		7075	244

Appendix - III

List of species found in Sample villages in Kurukshetra district.

S.No.	Botanical name	Common name
1	2	3
1.	<i>Acacia nilotica</i>	Babul, Kikar, Bawar, Baval
2.	<i>Acacia spp.</i>	
3.	<i>Aegle marmelos</i>	Bel, Belpara, Bil, Billi
4.	<i>Albizia lebbek</i>	Kala siris, Kalbaje, Koko, Siris, Bhandar, Sarsaoda
5.	<i>Albizia procera</i>	Safed siris/siras, Karha, Karhar, Karhai
6.	<i>Albizia spp.</i>	Hiharu, Morai, Mog, Sundi, Kunis
7.	<i>Artocarpus heterophyllus</i>	Plavu/Thannas, Phannas Kathal
8.	<i>Azadirachta indica</i>	Neem, Nimbo, Nibbaro, Vepa
9.	<i>Bauhinia spp.</i>	Kachnar, Papri, Jhingora
10.	<i>Bombax ceiba</i>	Semal, Savar, Semer, Shimola
11.	<i>Butea monosperma</i>	Palas, Dhak, Palasin, Kakhar
12.	<i>Casuarina graveolens</i>	Dedak, Gilchi, Maiya, Mango
13.	<i>Cassia fistula</i>	Amaltas, Bahra, Bhawa, Sonari
14.	<i>Cordia spp.</i>	Lassora, Bairula, Borala
15.	<i>Crataeva unilocularis</i>	Barna, Barun, Gundu
16.	<i>Dalbergia sissoo</i>	Sisco, Shisham, Tahli
17.	<i>Ebrietia laevis</i>	Chamror, Khoba
18.	<i>Emblica officinalis</i>	Amla, Aonla, Amlaki, Nelliimara
19.	<i>Eucalyptus spp.</i>	Nilniri, Safeda
20.	<i>Ficus bengalensis</i>	Bargat, Bar, Fiji
21.	<i>Ficus religiosa</i>	Pipal, Pipli, Papada, Pripari
22.	<i>Ficus spp.</i>	Anjar, Akhar, Budita
23.	<i>Fiacourtia indica</i>	Kakai, Kangu
24.	<i>Gardenia resinifera</i>	Damkuruda, Karinga, Papada
25.	<i>Grevillea robusta</i>	Silver oak
26.	<i>Grewia spp.</i>	Diamjul, Guarbhimi, Pharasai
27.	<i>Holoptelia integrifolia</i>	Abal, Chielbil, Kaneji
28.	<i>Jonesia lasoca</i>	Ashoka
29.	<i>Madhuca latifolia</i>	Mohwa, Mahudo, Jappa
30.	<i>Mangifera indica</i>	Am, Amb, Ambo, Mavu, Moru
31.	<i>Melanorrhoea usitata</i>	Mansonia

32. <i>Melia azedarach</i>	Dijain, Baknia, Betain, Bakain
33. <i>Mitragyna parvifolia</i>	Phaldu, Mundi, Kaiz, Battaganum
34. <i>Moringa spp.</i>	Sajna, Soljna, Sanjna, Sajjna
35. <i>Morus spp.</i>	Tut, Kimu, Shahtoot
36. <i>Phoenix sylvestris</i>	Khajur, Betha
37. <i>Pometia pinnata</i>	Jhit, Kandam
38. <i>Eupulus spp.</i>	Banpipal, Godhpipal, Pahari Pipal
39. <i>Prosopis cineraria</i>	Jand, Jant
40. <i>Prosopis juliflora</i>	Juliflora
41. <i>Protium serratum</i>	Mirteuna, Neur, Hern
42. <i>Prunus spp.</i>	Arju, Arja, Gont, Khurmani Hathi palli
43. <i>Pterospermum caesescens</i>	Bed, Bhainshara, Gadhbhains, Bashroi, Manju
44. <i>Salix spp.</i>	Jal, Jhal
45. <i>Salvadora spp.</i>	Jamun, Jamoon, Jamak
46. <i>Syzygium cumini</i>	
47. <i>Syzygium spp.</i>	
48. <i>Tamarindus indica</i>	Imli, Amli, Ambli, Chinch
49. <i>Tamarix apphylla</i>	France, Farash
50. <i>Tectona grandis</i>	Saqwan, Saqun, Teak, Sheku
51. <i>Terminalia acuminata</i>	Arjun, Kahuwa, Sadadeo
52. <i>Terminalia bellirica</i>	Behera, Beldn, Gowa, Phomra, Tharala, Thannia, Thavale, Kamia, Thani
53. <i>Toona ciliata</i>	Tun, Toon, Mathagiri, Vedi
54. <i>Zizyphus mauritiana</i>	Beri, Beri
55. <i>Zizyphus spp.</i>	

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Appendix-IV

List of the villages Surveyed in Kurukshetra District.

S.No.	Name of the village	Name of Tehsil	Area (Ha)	Map sheet No.
1.	Chonchak	Guhla	176.00	53 B/ 8
2.	Dhandota	-do-	451.00	53 B/ 8
3.	Hariqarh Kinned	-do-	525.00	53 B/ 8
4.	Kharkhara	-do-	979.00	53 C/ 5
5.	Mand Kalian	-do-	196.00	53 B/ 8
6.	Deen	Kaithal	993.89	53 C/10
7.	Franewala	-do-	308.77	53 C/ 5
8.	Jakholi	-do-	1927.87	53 C/ 6
9.	Bibipur Kalan	Pehowa	536.61	53 C/ 9
10.	Ismailabad	-do-	1199.00	53 B/12
11.	Naisi	-do-	199.00	53 B/12
12.	Rattangarh	-do-	524.00	53 B/ 8
13.	Takoran	-do-	266.00	53 C/ 9
14.	E/garh Jharauli	Thaneswar	369.47	53 B/16
15.	Kalsana	-do-	920.00	53 B/16
16.	K. Lakhasingh	-do-	140.00	53 F/ 4
17.	K. Purkohlian	-do-	439.00	53 B/16
18.	Mammon Majra	-do-	199.51	53 B/16
19.	Magli	-do-	282.00	53 B/ 1
20.	Nalvi	-do-	851.00	53 B/16
Total			12083.12	

Appendix - V

Definitions of Categories

Code No.	Category	Definition
1.	Farm forestry	Trees along the farm bunds and in small patches upto 0.1 ha. in area.
2.	Roadside plantation	Trees planted along the roadside.
3.	Village woodlot	Naturally growing trees on private/ community land.
4.	Block Plantation	Block plantation having an area of more than 0.1 ha. and not falling in any of the above categories.
5.	Ponds	Trees planted in and around water ponds.
6.	Railway lines	Trees planted along the railway lines.
7.	Canals	Trees planted along the canals.
8.	Rest	Trees not falling in any of the above categories.

APPENDIX-VI
FIELD FORMS

DISTRICT TREE FORM

(ABSTRACT OF ENUMERATION IN SAMPLE VILLAGES)

JOB NO.	CARD DESIGN NO.	STATE	DISTRICT	NO. OF VILLAGES IN THE DISTRICT	NO. OF VILLAGES IN THE DISTRICT	TOTAL AREA OF THE VILLAGES IN THE DISTTY. (Km ²)	SAMPLE GEOGRAPHICAL AREA OF THE VILLAGE (Hact.)	CATEGORY OF VILLAGE, THE SAMPLE
1- 3	4- 6	7- 8	9- 10	11- 15	16-17	18- 22	23- 27	28- 31
								32

Number Of Trees In The Sample Village According To Category Of The Plantation / Trees

FARM FORESTY	ROAD SIDE PLANTATION	VILLAGE WOODLOT	BLOCK PLANTATION	PONDS	RAILWAY LINES	CANALS	REST	TOTAL

DATE 199

Page No. Total No. Of Pages

Page No.

Total No. Of Pages

Sign. Of Crew Leader

Name Of Crew Leader

VILLAGE DESCRIPTION FORM

1. State and code
2. Division and code
3. District and code
4. Mapsheet and code
5. Name of the Village
6. Area of the Village
7. Crew Leader (Name)
8. Date of commencement of survey
9. Date of completion of survey
10. Conspicuous feature selected as the centre for starting the survey
11. Description of this centre and approach to this point
12. Number of angular quadrants into which the area of village has been divided (give size of quadrants in degrees)
13. Compassing done by
14. Tree enumeration done by
15. Height measurements taken by

P.T.O.

16. B.T. and other measurements
taken by

17. Quadrant-wise summary of enumerations

QUADRANT NO.	DATE OF SURVEY	TOTAL NO. OF TREES
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Dated :

Signature of
Crew Leader

Diagram etc. of village

आँख वृक्ष सामग्री कार्यक्रम VILLAGE TREE ENUMERATION FORM

Job No.	Card design	State	District	प्रतिनिधि गांव Sample Vill.	Geographical Area of the Sample Village (Hect.)	प्राचीन गांव प्राचीन गांव
1-3	4-6	7-8	9-10	11-15	16-19	

वृक्षों का कुल संख्या	Total No. of Trees
42,47	

दिनांक 19
Date 19

प्राप्त नं.....
Page No.....
कुल पृष्ठ सं.....
Total No. of Pages.....

नाम दख नायक
Name of Crew Leader
Soc. of Crew Leader