FOREST RESOURCES

OF

DADRA & NAGAR HAVELI

(UNION TERRITORY)

FOREST SURVEY OF INDIA

CENTRAL ZONE

NAGPUR

1991

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P R E F A C E

This report contains the results of inventory carried out by the Central Zone of Forest Survey of India in the Union Territory of Dadra and Nagar Haveli.

The field work was carried out in two stages, firstly in the month of October, 1985 and then in January-February 1988. A total of 62 plots were inventoried in the entire territory spread over 19935.42 ha. forest area. The inventory was followed by the wood consumption studies.

The inventory results reveal that the union territory has an average growing stock of 52.995 m^3 per hectare. The crop composition is mainly of teak and mixed species. The regeneration of important forest speoies is absent in about 80% of the area. The grazing incidence too is quite high. Same is the case with fire incidence. The stock of bamboo is almost insignificant. I hope this report will prove useful to the Forest Department of the Union Territory.

The report has been compiled by Shri Anil Biala, Junior Technical Assistant under the guidance of Shri S.C. Gupte, IFS., Joint Director, Forest Survey of India, Central Zone, Nagpur.

DIRECTOR,
FOREST SURVEY OF INDIA
DEHRADUN

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SHOWING
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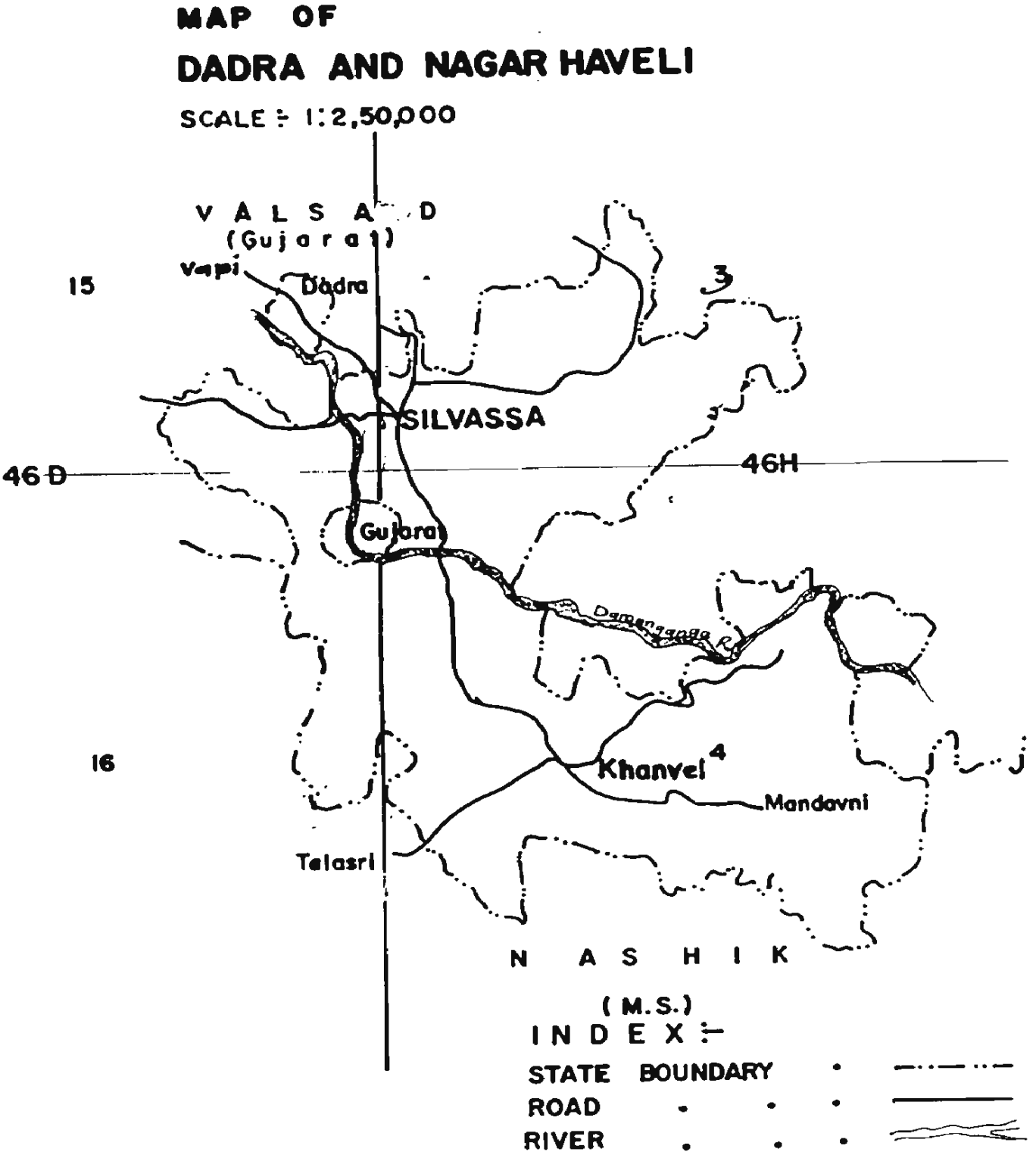
MAP OF
DADRA AND NAGAR HAVELI
SCALE :- 1:2,50,000
V A L S A D
(Gujarat)
Vapi
Dadra
15
3
SILVASSA
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CHAPTER-I

INTRODUCTION

1.Ø GENERAL;

The tract dealt with in this report comprises of two enclaves - (i) Dadra and (ii) Nagar Haveli. The area is administered by the Union Government and is thus called union territory. This territory remained under the Portuguese colonial rule from the years 1783 to 1954. It was finally liberated on 2nd August, 1954 by the local nationalist workers. During the period from 1954 to 1962, the administration of Dadra and Nagar Haveli was run by the selected village panchayat members. In the year of 1962, it was declared as union territory under the Dadra and Nagar Haveli Act, 1961 and was integrated with the Indian Union. Consequently, the free Dadra and Nagar Haveli administration was succeeded by a formal statutory Administration headed by an Administrator.

Silvassa, the capital town of the territory is 185 kms. from Bombay and 142 kms. from Surat. The territory is bounded on various sides as follows:

1. North : Pardi and Dharampur talukas of Valsad district of Gujarat state.
2. East : Dharampur taluka of Valsad district of Gujarat state.
3. South : Dahanu and Jawahar talukas of Thane district of Maharashtra state.
4. West : Dahanu taluka of Thane district of Maharashtra state and Umargaon taluka of Gujarat state.

1.1 SITUATION AND BOUNDARIES;

The territory dealt with in this report is situated in the western part of India between the parallels of 20^{o}-Ø0' and 20^{o}- 25' of North latitude and between the meridian 72^{o}-5Ø' and 73^{o}- 15' of East longitude.

1.2 ADMINISTRATIVE UNITS AND AREA:

The territory comprises of two enclaves viz; Dadra and Nagar Haveli. The former consists of three villages and the later 68 villages with the capital town of Silvassa which is a non-municipal town and is administered by a Village Panchayat. This territory is a single district, single taluka territory with Silvassa town as its state, district and

taluka headquarters. Total geographical area of the territory is 48882 ha. spread over two parts separated by a small territory of Gujarat state. The territory is administered by ten Group Gram Panchayats spread all over.

The total forest area under this territory is 19935.42 ha. of Reserved forests. Apart from these 440 ha. of road side plantations and canal plantations are added as Protected forests but these protected forests are not included in this survey.

The whole of the forest area is administered by a single Forest Division with headquarter at Silvassa.

1.3 CLIMATE AND RAINFALL:

The climate of the territory is moderate and generally healthy in winters. During summer the forests are unbearably hot especially in the months of April and May. The rainy season is normally from June to September. The territory receives an average rainfall of 2000 to 2500 mm. and average no. of rainy days are 65 to 80 per year. The humidity in Dadra and Nagar Haveli varies from 30 percent in May to 85 percent in August. The months of October and November are warm, cloudy and humid and are followed by pleasant spell of cold winter which lasts for a short period upto February.

1.4 TOPOGRAPHY

General topography of the territory is hilly and undulating except in the central, northern and western parts. The area forms the foothills of the Western Ghats (the Sahayadri hills) which gradually merge with the plains of Gujarat in the west and the north-west. Northern and southern parts of the territory are more hilly with highest altitude being 433 m. above MSL situated in the southern part of the territory. These hills are not very steep. In the northern parts of the territory the highest point is 294.13 m. above MSL. Towards the west and north-west the terrain is easy and gentle.

1.5 DRAINAGE:

The terrain is intersected by the river Damanganga and its tributories. This river rises at a distance 64 kms. from the sea coast in the ghats and drains into the Arabian sea at the port of Daman. The river is seasonal and floods in the monsoon season. Important tributories of the river Damanganga in the tract are: i) Dongavkhadi, ii) Sakartond, iii) Kenai, iv) Ababar in the south, v) Piparia, vi) Nar and vii)Kolak in the north-east. A major irrigation project viz: Damanganga Irrigation Project is nearing completion in the territory near village Sailly. The reservior of this project is situated in Valsad district of Gujarat state but

the main canal originating from the dam site traverses a distance of 40 kms. through the territory creating a vast potential for irrigation.

1.6 GEOLOGY, ROCK AND SOIL:

The geological strata of the tract belongs to Deccan Trap formations which are mainly made up of basic volcanic rocks of basaltic composition. The composition of the soil is a varying mixtures of clay and murrum. Depth of the soil depends upon the degree of disintegration and extent of erosion. The soil is clayey in the central and western parts. Soils in the northern and southern parts of the territory are shallow and murummy on account of shifting cultivation practised in the past. On the slopes of hilly areas and the plateaus the soil is shallow and rocky and supports stunted vegetation. The soil in the forest areas is devoid of humus content. The absence of humus is mainly due to its collection and burning in Rabs by the tribals.

1.7 LAND USE PATTERN:

The total geographical area of the territory is 48882 ha. and its land use classification is as under:

TABLE SHOWING LANDCOVER PATTERN IN THE U.T. (AREA IN HA.)

Total geographical area	Forest	Irriga-ted	Unirri-gated	Culti-vable waste	Balance area not available for cultivation.
48882	19935.42(RF) 440.00(PF)	500	235	11	277760.58

1.8 SOCIO-ECONOMIC CONDITION:

The population of Dadra and Nagar Haveli is 103676 persons as per 1981 census of which 52515 were males and 51161 were females. Rural population of the territory is 96762. The only urban area i.e. Silvassa town has population of 6914 persons. Of the total population 78.82% belong to Scheduled Tribes and just 1.97% belong to Scheduled Caste. Thus, the territory is predominated by tribals. The main tribes of the tract are:

1. Dhodia
2. Dubla including Halpati
3. Kathodi
4. Kokna
5. Koli Dor including Kolgha
6. Nayaka
7. Varli.

Looking towards the predominantly tribal population of this union territory, most of the developmental programmes of the Administration are aimed at tribal welfare. Education facilities are provided in all the villages (numbering 70).

Power supply is available to most of the villages even in remote areas. Rice, wheat and ragi form the main staple food of the people.

Agriculture is the main occupation of the people. The main agricultural crops are paddy, ragi, small millets and pulses. Of the total cultivated area only 500 ha are irrigated but on completion of the Damanganga Irrigation Project, approximately 7000 ha area will come under irrigation.

The territory being predominantly tribal, the Administration is implementing various developmental schemes aiming mainly to train them in modern methods of cultivation. Development in the field of animal husbandry is also remarkable with establishment of a well equipped veterinary hospital at Silvassa and two veterinary aid centres at Dapoda and Khanvel.

Many voluntary organisations are playing significant role in the socio-economic welfare of the tribals. In various developmental schemes launched by the Administration members of Scheduled Tribes are given preference. They are also being encouraged to start cottage or small scale industries to improve their standard of living.

The table below gives at a glance the important statistics (as per 1981 census) pertaining to the union territory of Dadra and Nagar Haveli:-

Population	1,03676
Population density (per sq.km.)	211
Sex ratio (no. of females per 1000 males)	974
Literacy rate	26.67
Percentage of urban population to total population	6.67
Percentage of Scheduled Caste population to total population	1.97
Percentage of Scheduled Tribe population to total population	78.82
No. of occupied residential houses	19183
No. of villages: Inhabited	70
Uninhabited	1
No. of towns	1

1.9 INFRASTRUCTURE:

As regards transport and communication facilities, 83 percent of the villages comprising about 90 percent of rural population are served with this facility. Most of the villages are linked by fair weather roads. The roads in the territory are well maintained and useable throughout the year. In addition, there are forest roads many of which cannot be used during rainy season. The capital town of Silvassa is well connected by roads with the important commercial towns in the adjoining states such as Vapi, Valsad, Surat in Gujarat and Dahanu, Bombay etc. in Maharashtra. Vapi in Gujarat is the nearest railway station.

1.10 FOREST PRODUCE AND FOREST BASED INDUSTRIES:

Important forest produces of the territory are timber, fuel wood, ballies, tendu leaves, mahua flowers and seeds, etc. With the setting up of industrial estates within the territory, the pressure on the forests has increased considerably. Apart from teak which is the most demanded timber species, other species like haldu, bio and tivas are also in great demand. In fact inadequate supply of timber has caused a phenomenal increase in its price. Timber and fuel was usually extracted from Silvassa and Khanvel areas.

Vapi is the nearest market, 20 kms from Silvassa and 40 kms from Khanvel. Forest produces are transported to Vapi by road and from there to various places by rail (if required) or by road. With the imposition of moratorium on fellings, the needs of timber are being met by importing the timber from Vapi or other places. Govt. departments are generallly supplied their required quota of timber from the forests of the territory itself.

An important forest based industry manufacturing 'katha' from khair trees was established in the territory about twenty years back and it is still working.

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CHAPTER - II

THE FORESTS

2.Ø GENERAL DESCRIPTION:

The forest cover is spread over an area of 19935.42 ha of the territory. It forms an important economic resource of Dadra and Nagar Haveli. The forest area is spread over 58 villages. These forests are owned by the Government and have been declared Reserved Forest. Forestry plantations along road-side and canal-side have been declared Protected Forest since the year 1982. Teak and khair are the two predominent species found in the tract. The clear felled areas have been planted with teak and khair to meet the local demand of timber and fuel. Emphasis is also being laid on road-side and canal-side plantations. The Administration of Dadra and Nagar Haveli has placed a moratorium on commercial felling of timber since the year 1982 and it is still continuing.

2.1 FOREST TYPES:

As per the classification of Champion and Seth, the forests of this territory fall under GROUP $3BC_2$: SOUTH INDIAN TROPICAL MOIST(MIXED) DECIDUOUS FOREST but the floristic composition of the crop indicates that it tends towards SEMI-MOIST DRY TEAK type forests. The reason for this may be attributed to presumably less moisture retention capacity of the soil. The composition of the forest crop is as follows:-

Tectona grandis (Teak), Terminalia crenulata (Sadad), Adina cordifolia (Haldwan), Ougeinia oojeinensis (Tiwas), Albizzia lebbek (Siras), Erythrina indica (Pangara), Lagerstroemia parviflora (Bondar), Garuga pinnata (Kekad), Madhuca latifolia(Mahua), Bridelia retusa (Asan), Acacia catechu (Khair), Acacia ferruginea (Kante), Pterocarpus marsupium (Bio), Albizzia procera (Killai), Sterculia urens (Kandol), Anogeissus latifolia (Dhawda), Salmalia malabarica (Sawar), Holoptelea integrifolia (Papda), Terminalia belerica (Bahadas), Grewia tiliaefolia (Dhaman), Dalbergia latifolia (Shisham), Dillenia pentagyna (Karmal), Mangifera indica (Amba), Gmelina arborea (Sivan), Syzygium cuminii (Jambul), Lannea coromandelica (Modad), Careya arborea (Kumbhio), Diospyros melanoxylon (Timru), Wrightia tinctoria (Kudi), Emblica officinalis (Amla), Butea monosperma (Khakhu), etc.

The quality of the forest crop as well as its condition are not uniform throughout the tract. Quality is slightly better in areas having deeper soils with less biotic interference. The forests of the territory have been degraded to varying degrees. The factors affecting this degradation are site/locality, intensity of biotic

interference/pressure and extent of protective measures. The degradation at many places is quite visible yet some places can be reclaimed through plantations and other conservation measures.

BAMBOO:

In addition to various tree species, Dendrocalamus strictus (Manvel bamboo) appear in damaged condition alongwith Bambusa arundinacea (Katas bamboo) along nalas. Bamboo crop is in a state of degeneration due to reckless and unabated hacking. The tract underwent gregarious flowering during late fifties but areas were not reestablished adequately. Although Bamboo clumps are noticed in the growing stock they are devoid of young and useful culms.

GRASSES:

Though this survey was confined exclusively to the estimation of growing stock of trees, yet following grass species were found in the territory during the course of this survey:

1. Spodiopogon rhizophus - Polad,
2. Cymbopogon martinii - Dab,
3. Vetiveria zizanoides - Valchond, and
4. Chloris incompleta - Gandheri.

2.2 FOREST MANAGEMENT:

Keeping in view the objectives of forest management following working circles are proposed to be constituted in the working plan under preparation.

1. MAIN WORKING CIRCLE:

It comprises all the forest areas of the territory except those put under the Nature Conservation Working Circle, wild life sanctuary and deer park. This working circle has been created to rehabilitate the degraded forests and to give total protection to the worked areas for ten years.

2. NATURE CONSERVATION WORKING CIRCLE:

This working circle covers the following areas:

1) Catchment area of Damanganga river falling within the territorial limits of Dadra and Nagar Haveli.

ii) Forest areas between the industrial estates of Khadoli and Masat, and

iii) Slopes of Athal hills.

This working circle has been created to give permanent protection to the ecologically endangered area. It also includes areas of a proposed wild life sanctuary.

3. WILD LIFE MANAGEMENT (OVERLAPPING) WORKING CIRCLE:

This working circle extends over entire forest area of the territory including the proposed area of 715 ha for a wild life sanctuary in Umber Kui and Bonta areas.

4. FODDER DEVELOPMENT (OVERLAPPING) WORKING CIRCLE):

This working circle extends over all the forest areas except those under Nature Conservation Working Circle. Special attention will be paid to the grass bearing areas of some villages.

5. MINOR FOREST PRODUCE (OVERLAPPING) WORKING CIRCLE:

This working circle overlaps the entire forest area in the territory. It aims at collection of minor forest produce in the territory.

6. COMMUNITY FORESTRY WORKING CIRCLE:

This working circle extends over all the non-forestry areas in the territory available for production forestry namely for raising fuelwood, small timber and fodder required by the local population for their domestic consumption.

7. TRIBAL WELFARE WORKING CIRCLE:

This working circle extends over entire tribal habitat of the territory. The object is to create ecological awareness amongst the tribals and to uplift their socio-economic condition so that the conservation of environment becomes meaningful and beneficial to the tribal population.

2.3 DAMAGE TO FORESTS:

Following agencies are mainly responsible for causing damge to the forests:

1. HUMAN INTERFERENCE

Growing population and rapid industrialisation in and around Dadra & Nagar Haveli has taken its toll of destruction of forests. Even during Portuguese regime forests were subjected to over-exploitation for commercial purposes. Grant of various rights and privileges to local tribals has also caused tremendous damage to the forest wealth of the territory. Adjoining areas of Maharashtra and Gujarat states have relatively sparse forests which has obviously resulted in the increase of biotic pressure on the territorial forests

beyond their capacity. Many industrial estates have mushroomed right amidst dense forest areas. The construction activities of Damanganga Irrigation Project in the territory have also resulted in the influx of people from outside the territory which too has resulted in pressure on the local forests. Over all phenomenal increase of human population of the territory has also influenced the demand rendering the forests more vulnerable to injuries caused by man. The plucking of leaves for rab burning and for thatching of houses is also an undesirable practise of the local tribals.

2. ILLICIT FELLING:

The illicit felling in the territory is attributable to many factors such as (i) absence of good forest in the adjoining states, (ii) escalating prices of timber and fuel wood, (iii) exploitation of poverty ridden tribals by illicit wood-cutters, (iv) inadequate number of check posts, & (V) development of good net-work of roads etc.

3. FIRE:

The fires are quite common in the territory and cause considerable damage to the forest regeneration. The tribals are responsible for initiating such fires for collection of minor forest produce and practicing rab burning in their agricultural fields.

2.4 RIGHTS AND CONCESSIONS:

The forest department has framed rules regarding free and concessional grant of timber viz;

a. Free grant of timber for construction of houses;
b. Free grant of timber for repair of houses;
c. Free grant of timber for agricultural implements; and
d. Concessional grant of timber.

2.5 WILD LIFE:

Owing to heavy degradation of forests, the wild life habitat has been badly affected. Many wild animals have disappeared from the territory. Whatever have managed to survive are likely to become extinct unless immediate appropriate protection and management is ensured. Loss of forest wealth in the adjoining states has also contributed to rapid disappearance of wild life in the territory. A working circle has been constituted to effect better wild life management in the entire forest areas of the territory. A wild life sanctuary is proposed to be created around Umberkui and Bonta villages over a proposed area of 715 ha. Such positive measures are likely to improve the present state of wild life in the territory.

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CHAPTER - III

RESOURCES SURVEY METHODOLOGY

3.Ø OBJECTIVES OF THE SURVEY:

The objectives of this resources survey were :

1. To collect information on distribution of forest with regard to various parameters such as topography altitude, aspect, slope, soil-depth etc.

2. To collect various informations on crop data including origin of crop (whether the crop is of seed origin, coppice origin or a plantation), its composition, height, size, quantum of regeneration, injury to crop, fire incidence, grazing incidence, presence of weeds and grasses etc.

3. To collect various informations under bamboo occurrence such as species found, their density, quality, quantity and regeneration etc.

4. To estimate the areas falling under various land covers.

5. To estimate the growing stock of trees and bamboos existing in various land covers.

6. To determine the plantation potential of the land which is poorly stocked or unstocked.

7. To focus attention of the planners and forest officials on the critical aspects and condition of the forests for timely remedial measures and for future planning.

3.1 AREA CONSIDERED FOR SURVEY:

For the purposes of this inventory the forest areas falling in the union territory of Dadra and Nagar Haveli were considered. In order to decide the forest areas, recent Survey of India toposheets on 1:5Ø,ØØØ scale were used. All those areas which were demarcated by double dotted forest boundaries on these toposheets and were having green wash within or outside such boundaries, were taken as forest areas for undertaking this inventory survey.

3.2 INVENTORY DESIGN:

A common inventory design for the whole organisation was evolved in consultation with the Central Statistical Organisation (Govt. of India) for undertaking inventory work in various parts of the country. The design

envisaged the survey of two randomly selected plots each of Ø.1 ha. area in each grid of 2 1/2' x 2 1/2' (latitudes and longitudes) on the toposheet of 1:5Ø,ØØØ scale. A grid bounded by 2 1/2' x 2 1/2' latitudes and longitudes covers about 2Ø sq.km. area in which Ø.2 ha. area is actually sampled. Thus the sampling intensity of the survey comes to Ø.Ø1%. The method of marking the plot centre on the map within a grid is as follows:-

Two sides (X - axis and Y - axis) of a grid were measured in millimeters. The length of these sides was divided by Ø.6324 mm (side of Ø.1 ha. square plot) for the maps on 1:5Ø,ØØØ scale. The quotient so obtained was rounded up. Let the numbers (quotient) for X axis be x and that for Y-axis be y. Actually the number x gives the no.of plots that may fall along X-axis and number y gives the no.of plots that may fall along Y-axis. The product x X y gives the total number of sample plots that may exist in a grid of 2 1/2' x 2 1/2'. Out of these plots (x X y), one plot has to be selected on the basis of random numbers and the second one with the help of the first plot which will be explained in next para. For the selection of 1st plot, one set of three random numbers was selected from random numbers table. If the random number selected for X-axis was less than x (quotient for X-axis), then it was retained and if the random number was more than x, then it was divided by x and the remainder was retained. Similar excercise was done for Y axis also by taking next three digit set of random numbers. The figure (remainder) so obtained was multiplied by the side of the plot i.e. Ø.6324 mm for 1:5Ø,ØØØ scale map so as to get the actual co-ordinates of the 1st plot. The plot no.1 of all the grids was marked on the map taking south- west corner of respective grid as origin. The distance along X-axis was measured towards east and along Y axis towards north. Thus the centre of plot no.1 was marked on the map at crossing of the two co-ordinates.

For marking the centre of second plot of each grid, the plot centre of 1st plot and centre of 2 1/2' x 2 1/2' grid were joined and the line extended to the same distance in opposite direction beyond grid centre. The point so reached was the plot centre of the second plot. The layout of 2 1/2' x 2 1/2' grid and the plots are shown in diagram nos.1 and 2. All such plots were marked on the toposheets and they were visited only if they were falling in areas covered by green wash or by double dotted forest boundaries on 1:5Ø,ØØØ mapsheets. Since the number of samples available from two plots in a grid were not adequate, two additional pairs of plots were laid in the same grids in the similar manner so as to get total 62 sample plots in the entire territory.

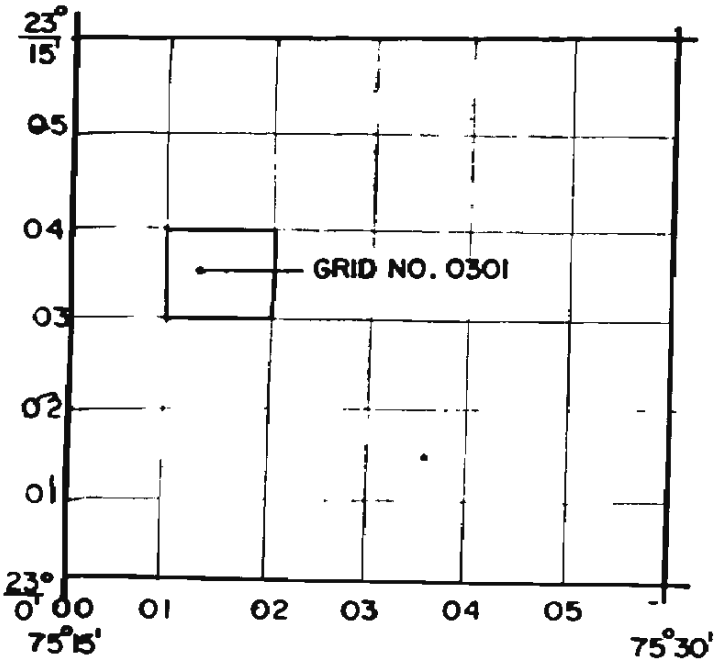


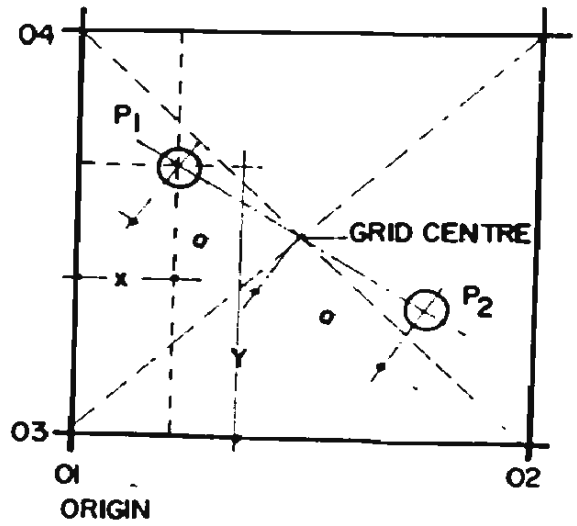
DIAGRAM-1

DIAGRAM SHOWING IDENTIFICATION OF GRIDS ON 1:50,000 OR 1:63,360 SCALE TOPOSHEETS

DIAGRAM-2

DIAGRAM SHOWING LAY-OUT OF PLOT IN 2½'X 2½' GRID

'X' & 'Y' ARE THE DISTANCE ALONG 'X' & 'Y' AXES WITH SW CORNER AS THE ORIGIN



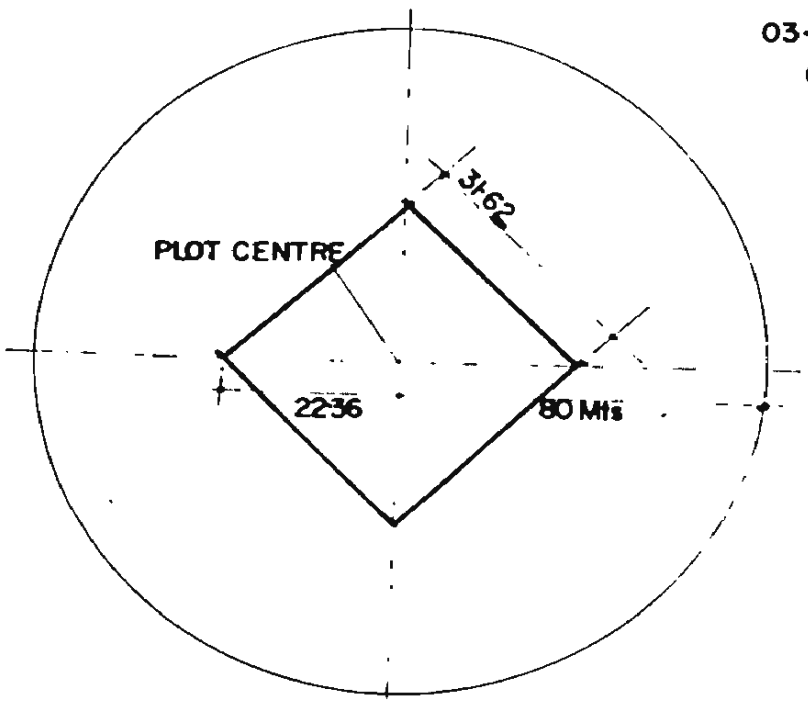


DIAGRAM-3

DIAGRAM SHOWING LAY-OUT OF PLOT

Contents

3.3 LOCATION OF PLOT ON THE GROUND:

As stated earlier, the survey was confined to the forest areas only. All the forested plots of the survey area of Dadra and Nagar Haveli, duly marked on toposheets, were allotted to the crew deputed for this inventory work . The crew had drawn up its programme of halts at some convenient places in order to tackle maximum plots from those camps. The plots marked on the toposheets had to be exactly located on the ground with the help of some conspicuous features which could be identified on the map as well as on the ground. Usually the following features were selected for this prupose:

1. Bench mark.
2. Triangulation point.
3. Village or road trijunction.
4. Old bridges and culverts.
5. Old temples, mosques and churches.
6. Crossing of rail tracks with roads, streams, rivers etc.
7. Confluence of rivers or streams and junction of roads.
8. Prominent bends in roads, rivers or streams.
9. Old ponds and wells.
10. Springs.
11. Prominent topographical features in hilly region such as spurs, knolls etc.
12. Mile stones or kilometer stones on the road side.
13. Pillars of international, inter state or inter-district boundaries and those of forest areas etc.
14. Prominent bends of boundary etc.

After locating the above reference points on the ground as well as on the map, the bearing and distance from referenoe point to the plot centre were marked. This distance was traversed at the bearing calculated for the plot using Silva Compass and distance measured with a nylon rope/tape etc. While using compass the magnectic declination as indicated on the concerned toposheet was also taken into account. Similarly, for distance measurement the slope correction was applied to get the actual horizontal distance.

On reaching the plot centre, a square plot was laid out by taking distance of 22.36 m. in all the four directions (north, south, east and west) from the plot centre. Thus an exact plot of Ø.1 ha. area (having each side of 31.62 m and diagonal of 44.72 m.) was laid out horizontally after making corrections for the slopes measured with the help of Blumleiss hypsometer along 4 semi-diagonals (north, south, east and west).

3.4 FORMAT FOR DATA COLLECTION:

After laying out the plots in the field, various data were collected in the following field forms in codified form (except in Plot Approach Form wherein information was

collected in descriptive manner) as described in the field manual issued to the crew for the purpose of data collection. This facilitated the transfer of data on punch cards, consistency checking of collected data and finally in processing the data on electronic computer at a later stage. The various field forms used in this survey are :-

1. Plot Approach Form.
2. Plot Description Form.
3. Plot Enumeration Form.
4. Sample Tree Form.
5. Bamboo Enumeration-cum-Clump Analysis Form, and
6. Bamboo Weight Form.

1. PLOT APPROACH FORM:

As the title indicates, the form is a record of approach to the plot centre from the field camp of a crew. It is filled in by the Crew Leader as he proceeds from his camp to some conspicuous feature called reference point existing near by the plot. The distance and bearing from this well defined reference point to the plot centre were also recorded. The exact location of plot centre, i.e. bearing and distance from two trees to the plot centre is also noted together with the time of departure from camp, time taken in various studies and time of arrival in the camp. This form helps the check crew or any other person to relocate the plot easily when required. The data on this form is recorded in descriptive manner with a neatly drawn sketch showing the location of reference point and the plot centre.

2. PLOT DESCRIPTION FORM:

This form is designed for recording qualitative description of 2 ha area around the plot centre. The information regarding administrative units, legal status, land use, topography, soil, vegetation, bamboo regeneration, biotic influence, accessibility and plantation potential etc. were recorded. The data was recorded in codified form and was transferred to punch cards for further computer analysis. The stratification of area and classification of growing stock was done on the basis of these descriptions only.

3. PLOT ENUMERATION FORM:

In this form, all the trees with dia 10 cm. and above and all the bamboo clumps occurring in whole of 0.1 ha sample plots were recorded by species. This was meant for computing total growing stock existing in all such sample plots, and finally in whole of the survey area which was estimated on the basis of these sample plots. This form helps in distributing the grwing stock in terms of stems and volume by various parameters like species, diameter classes, forest types etc.

4. SAMPLE TREE FORM:

Detailed information regarding the species, diameter at breast height (over bark), height of tree, clear bole, bark thickness, dominance and defects etc. of all the trees occurring in north-west quadrant of each of the sample plots, were recorded in this form. On the basis of these parameters (i.e., height, diameter and clear bole), volume of plots was calculated

5. BAMBOO ENUMERATION-CUM-CLUMP ANALYSIS FORM:

In this form, the data of individual culms occurring in the selected clumps bearing S.Nos. 1,9,17,25,33.....etc. (i.e., the first and every eighth clump appearing in Plot Enumeration Form) was recorded. Thus, the information about age, soundness, size and condition etc. of the culms of the above clumps was obtained and analysed in various columns of this form. This information gave the position of total bamboo stock by clump sizes occurring under various conditions.

6. BAMBOO WEIGHT FORM.:

This form was designed for collecting data to determine the green weight of bamboos of different species and sizes and further for establishing relationship between green weight and dry weight of bamboo culms. The data was recorded in respect of two selected culms from each dia. class, i.e., 2 to 5 cm, 5 to 8 cm, and 8 cm and the green weight of three 50 cm long sub-samples, each taken from the bottom, the middle and the top portions of the culms were recorded. These three sub-samples are dried in air and finally in the oven in order to remove their entire moisture contents and to get their air dry weight. This facilitates to establish relation between the green weight and the dry weight of culms by species and sizes and to know the total growing stock of bamboos in terms of weight.

3.5 FIELD WORK:

The field work of union territory of Dadra and Nagar Haveli was completed in two stages. Only one field party carried out the survey. It consisted of one Dy.Ranger and two Fieldmen. Initially inventory of 29 sample plots was undertaken in the month of October, 1985 with camps at Silvasa and Khanvel. After completion of inventory, Wood Consumption Studies were also undertaken to assess the quantity of wood being consumed in the territory for various purposes. Second visit was in the month of Janury - February, 1988 during which 33 additional plots were tackled. Thus total sample plots tackled in the territory were 62.

3.6 FIELD CHECKING;

The checking of the surveyed plots was done by the Joint Director himself. Mistakes found, if any, were rectified in consultation with the crew leader present during his visit to the forests.

3.7 MAPS AND PLOTS:

The Survey of India toposheets which were used during the inventory and the no. of plots tackled in each of them are mentioned below indicating the scale of the toposheet and the year of survey of the toposheet:

S.No.	Toposheet No.	Scale of toposheet	Year of survey of toposheet	No. of plots inventoried
1.	46 D/16	1:50,000	1963-65	9
2.	46 H/3	1:50,000	1963-64 and 1966-67	13
3.	46 H/4	1:50,000	1963-66	40
				62

3.8 CONSISTENCY CHECKING OF FIELD FORMS;

On completion of field work, the field forms containing the inventory information of 62 plots were manually checked in the zonal office as per the field manual and coding instructions meant for the purpose. Inconsistency noticed in these forms was removed after discussing the specific point with the crew leader who had undertaken the survey. All these field forms were finally forwarded to the Data Processing Unit at headquarter, Dehradun, for computer analysis and processing the data for deriving various kinds of informations.

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CHAPTER -IV

DATA PROCESSING

4.Ø SAMPLING DESIGN.

Grids were marked at 2 1/2' x 2 1/2' interval in the forest areas of Dadra and Nagar Haveli (union territory). Initially two plots were laid in each grid. These plots were square in shape each having an area of Ø.1 ha. The first plot was laid out at random and the second was linked to the first in the opposite quadrant at an equal distance from the grid centre. Since the number of samples available from two plots in a grid were not adequate two additional pairs of plots were laid in the same grids in the similar manner so as to get total 62 sample plots in the entire territory.

4.1 DATA:

The basic data of inventory survey was collected in the Plot Description Form, Plot Enumeration Form, Sample Tree Form, Bamboo Enumeration Form. The volume data from felled trees was not collected since a moratorium on felling of trees was in force in the territory. The field forms were precoded so that the field data could easily be transferred on to the punch cards.

No. of cards punched for the filled-in field forms were as under:

	Card design		No. of cards.
1.	Plot description	..	62
2.	Plot enumeration	..	1Ø3
3.	Sample tree	..	151
4.	Bamboo enumeration	..	16
5.	Bamboo weight data	..	16
	Total	..	348

4.2 DATA PROCESSING

The data processing involved the following operations:-

i) MANUAL PROCESSING;

The field forms received in the Machine Data Management Unit of Forest Survey of India, Dehradun were checked with the list supplied by the central zone. Entries of the field forms were made in the register regarding the number of field forms relating to each map-sheet, grids and plots. The total number of cards required to be punched

under each card design were also estimated and recorded in the register for future references. Job numbers, card design and left hand zeros wherever missing were filled up in the field forms to avoid mistake during punching.

Each entry in the field forms was checked for consistency in the data. The main checks applied were the range check for the maximum and minimum value of the codes and logical check for inter-relation between the entries for two or more fields.

Listing taken out of the data loaded on the magnetic tape/disk were checked to ensure complete loading and proper sequence of data.

Sampling statistics were calculated and checked with the computer output to see if the calculations on computer were correct. These involved volume of enumerated tree from local volume equation, plot volume and standard error etc.

Intermediate and final computer output were checked for consistency and relevance of results. The area tables were also prepared manually.

ii) PROCESSING ON UNIT RECORD MACHINE;

The data of field forms were punched on cards with the help of punching machine. The punched data cards were verified using card verifier to detect punching mistakes. The verified cards were sorted out for proper input to the computer.

iii) PROCESSING ON ELECTRONIC COMPUTER;

The punched, verified and sorted data on cards were loaded on magnetic tapes/disks and listings of the loaded data were taken out to check the desired sequence.

The volume of each enumerated tree was estimated with the help of local volume equation of the species.

The contribution of the volume of each enumerated tree towards per hectare volume was derived and stored in a tree/plot volume file for further processing.

The growing stock tables by species and diameter class under each crop composition were prepared from tree/ plot volume file. Standard error of the estimated growing stock in each crop composition was calculated.

The data of this survey was processed on System - 332 of National Forest Computer Centre of Indira Gandhi National Forest Academy, Dehradun.

This computer had the following configurations:

1.	Memory	256 K bytes
2.	Card reader	1
3.	Tape drives	2
4.	Disk drives	2
5.	Line printer	1
6.	Terminals	4

4.3 AREA.

The entire area of 19935.42 ha Reserved forests was surveyed for the estimations. On the basis of total number of sample plots falling in these areas, weightage of each sample plot was calculated. This factor was used to derive area by different land use classes. The total area was classified by land use covers given in table no. 5.1. The area falling in land use dense tree forest, moderately dense, open forest, young plantations of forestry species and young crop of natural and artificial regeneration was considered as tree vegetated cover and was classified by crop composition classes on the basis of the number of sample plots in crop compositions viz; Teak and Miscellaneous. The details of which are given in table No. 5.2

The total area under each crop composition was classified by topography, slope , soil depth,top height, size class,canopy layer,and estimated plantable area in the Govt. forest land. All area details by these parameters have been explained in Chapter V of this report.

4.4 VOLUME ESTIMATION;

4.4.1 VOLUME EQUATIONS;

The data was not collected from freshly felled trees. The sample tree data was inadequate to develop local volume equations. Therefore, local volume equations developed for various species for adjoining Surat Circle in Gujarat State were used for estimating the enumerated tree volume.

The following local volume equations were used:

1. Acacia catechu (114)

$$V = -0.048108 + 5.873169\ D^2$$

2. Adina cordifolia (127)

$$\sqrt{V} = 0.215690 + 4.329878\ D - 1.504977\sqrt{D}$$

3. Anogeissus latifolia (122)

$$\sqrt{V} = 0.357373 + 2.430449\ D + 0.784626\sqrt{D}$$

4. Lagerstroemia parviflora (115)

$\sqrt{V} = 0.027366 + 3.668008\ D - 0.718475\sqrt{D}$

5. Dalbergia latifolia (134)

$\sqrt{V} = -0.144504 + 2.943115\ D$

6. Diospyros melanoxylon (95)

$\sqrt{V} = -0.184139 + 2.892723\ D$

7. Garuga pinnata (150)

$\sqrt{V} = 0.053434 + 3.530350\ D - 0.810548\sqrt{D}$

8 Lannea coromandelica (174)

$\sqrt{V} = 0.404153 + 5.555051\ D - 2.545525\sqrt{D}$

9. Mitragyna parvifolia (156)

$V/D^2 = 10.086934 - 1.744274/D + 0.099768/D^2$

$V = 0.099768 - 1.744274\ D + 10.086934\ D^2$

10. Ougenia oojeinensis

$\sqrt{V} = 0.469152 + 1.403410\ D + 1.425555\sqrt{D}$

11. Pterocarpus marsupium (102)

$\sqrt{V} = 0.175068 + 4.598243\ D - 1.500562\sqrt{D}$

12. Tectona grandis (925)

$\sqrt{V} = -0.405890 + 1.981580\ D + 0.987375\sqrt{D}$

13. Terminalia belerica (107)

$V = 0.074706 - 1.430082\ D + 10.181971\ D^2$

14. Terminalia crenulata (215)

$\sqrt{V} = -0.203947 + 3.159215\ D$

15. Wrightia tinctoria (162)

$\sqrt{V} = 0.050294 + 3.115497\ D - 0.687813\sqrt{D}$

16. Rest of species (629)

$\sqrt{V} = -0.153973 + 2.724109\ D$

(Note: Figures in brackets against the name of the species denote the number of trees on which the equation is based).

4.4.2 ENUMERATED TREE VOLUME;

The volume of each enumerated tree was estimated from the breast height over bark diameter of the tree and the local volume equation used for the species. The estimated tree volumes were converted to per hectare and stored in tree/plot volume file with speices code, tree diameter, parameters of Plot Description Form, per hectare stems and volume in the sample plot. The file helped in the tabulation of results by species and diameter for different crop compositions.

4.4.3 PLOT VOLUMES:

The estimated volume of each enumerated tree in a plot when added up over the whole plot provided the plot volume. It was converted to per hectare basis and stored in the tree/plot volume file. The per hectare plot volumes were used to estimate volume under different classes of desired parameters. The plot volumes were also used to estimate the average volume per hectare (cu.m.) and the sampling error of growing stock in each crop composition.

4.5 STAND TABLES:

The estimates of tree/plot volume file were utilised to classify the trees by species, diameter and crop composition etc. Estimates of the number of stems per hectare and total stems by species and diameter classes were obtained for each crop composition. These are given in the computer out put originally.

The number of stems per hectare and total stems over all crop compositions were also derived and are given in the table nos. 6.1 A & B, 6.2 A & B and combined growing stock in terms of stems is given in table no. 6.5 A & 6.5 B.

4.6 STØOCK TABLES.

Estimates of volume per hectare and total volume by species and diameter classes were obtained for each crop composition from the tree/plot volume file. These are also given in table nos. 6.3 A & B, 6.4 A & B and combined growing stock in terms of volume is given in table no. 6.6 A & 6.6 B.

4.7 SAMPLING ERROR:

The sampling was considered as systematic cluster sample having two sample plots in each cluster. In order to estimate sampling error the sample plots were considered to constitute simple random sample of unequal clusters because

in many cases only one plot was enumerated from a grid. As such the ratio method of estimation is used and the sampling error is estimated as follows:

Estimate of variance of R

$$\hat{V}_{\hat{R}} = \frac{N-n}{N-n}\,\frac{1}{\bar{x}^{-2}}\sum_{i=1}^{n}\frac{(Yi - \hat{R}\,xi)^2}{n-1}$$

$$= \frac{1}{n(n-1)\bar{x}^{-2}}\sum_{i=1}^{n}(yi - \hat{R}\,xi)^2$$

(Ignoring the finite population correction factor)

$$= \frac{1}{n(n-1)\bar{x}^{-2}}\left(\sum_{i=1}^{n} y^2 - 2\hat{R}\sum_{i=1}^{n} xy + \hat{R}^2\sum_{i=1}^{n} xi^2\right)$$

Where n = total number of clusters in the sample

Yi = the total of per hectare volume in the ith grid.

$$\bar{x}^{-1} = \frac{\sum_{i=1}^{n} xi}{n}$$ = Average number of plot per grid

$$R = \frac{\sum_{i=1}^{n} Yi}{\sum_{i=1}^{n} n}$$ = Estimate of average volume per hectare overall clusters.

Estimate standard error (S.E.) of R

$$S.E. = \sqrt{\hat{V}_{\hat{R}}}$$

$$S.E\,\% = \frac{S.E.}{\hat{R}} \times 100$$

The standard errors have been estimated for the growing stock in each crop composition and are given in table no.6.7. In this case the standard error is slightly more because the number of sample plots in each crop composition was slightly less.

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CHAPTER - V

INVENTORY RESULTS - AREA

5.Ø AREA

The forest resources information of Dadra and Nagar Haveli has been compiled on the basis of randomly selected 62 plots falling all over the forest areas of the territory. The forest area figures supplied by the Forest Department of union territory (as per their Working Plan) are adopted. Out of a total geographical area of 48882 ha the territory has a forest expanse of 19935.42 ha on which the results of this survey are based. For the purposes of this inventory survey the territory was taken as a single unit and as such growing stock as well as area results pertain to the territory as a whole.

This forest area of 19935.42 ha was divided by the total no. of sample, i.e., 62 falling in the entire forest areas giving the weightage of each sample plot as 321.539Ø3 ha. Further break-up of area under different land uses covers, crop compositions, topography classes, slope classes, soil depth classes, top-height classes, size classes, canopy layers etc. was worked out giving due weightage to the sample plots falling under various locality factors as observed during the course of field work. These are discussed below in details:

5.1 FOREST AREA BY LAND COVERS:

Table no. 5.1 produced below gives a pattern in which forest land of the territory is being used. It shows that 8.Ø7% of the forest area is under dense forest with canopy density more than 7Ø%, 33.87 % is under moderately dense forest with canopy density ranging between 3Ø-7Ø% and almost an equal proportion (32.26%) is under open forest with a canopy density 5-3Ø%. 3.23% of forest area is under young plantations having diameter between 2-1Ø cms at breast height, 16.13% of forest land was under young crop of natural or artificial regeneration with diameter below 2 cms. Such crop cannot be considered to be an established one. Area under scrub, agricultural land with and without trees and water bodies each constituted 1.61%. All the randomly selected plots which were spread over the entire forest area of the territory were visited by the field party.

Table No. 5.1

BREAK UP OF AREA BY LAND USE CLASSES

Land class	No. of plots	Area in ha.	Percentage
Dense tree forest	5	1607.69	8.07
Moderately dense tree forest	21	6752.32	33.87
Open tree forest	20	6430.78	32.26
Scrub forest	1	321.54	1.61
Young plantations	2	643.08	3.23
Agri.land without trees in surround	1	321.54	1.61
Agri.land with trees in surround	1	321.54	1.61
Water bodies	1	321.54	1.61
Young crop of artificial or natural reg.	10	3215.39	16.13
Total ..	62	19935.42	100.00

5.2 AREA BY CROP COMPOSITIONS:

For classifying the area under different categories viz; topography classes, slope classes, soil-depth classes, top-height classes, size classes, canopy layers the sample plots bearing only vegetated area such as dense, moderately dense, open tree forest, young plantations and young crop of artificial or natural regeneration have been taken into consideration which collectively form an aggregate of 58 plots distributed over a forest area of 18649.26 ha. Remaining 4 plots having an area of 1286.16 ha falling in scrub forest, agricultural land with and without trees, and water bodies have been ignored. The forests of Dadra & Nagar Haveli have been classified into two main strata namely; Teak and Miscellaneous. Table no. 5.2 below gives areas and percentage of tree forests under these two forest types. Table indicates that 56.90% of vegetated area is under Teak forest type and 43.10% is under Miscellaneous forest type. In Miscellaneous forest type no species was found in majority.

Table No. 5.2

BREAK UP OF TREE VEGETATED AREA BY CROP COMPOSITIONS

Crop compositon	No. of plots	Area in ha.	Percentage
Teak	33	10610.79	56.90
Miscellaneous	25	8038.47	43.10
Total	58	18649.26	100.00

5.3 AREA BY CROP COMPOSITIONS AND TOPOGRAPHY CLASSES:

Table no. 5.3 below shows the distribution of vegetated area under different forest types by topography classes. Out of the four topographic classes mentioned in the table, forests are confined to gently rolling and hilly areas only. No sample plot was located in flat lands and very hilly areas. The table also reveals that the majority of the forest in the territory is in hilly area.

Table No. 5.3

BREAK UP OF TREE VEGETATED AREA BY TOPOGRAPHY CLASSES

Crop compositon	Flat	Gently rolling	Hilly	Very hilly	Total
Teak	-	964.62	9646.17	-	10610.79
Misc.	-	1929.23	6109.24	-	8038.47
Total	-	2893.85	15755.41	-	18649.26
% age	-	15.52	84.48	-	100

5.4 AREA BY CROP COMPOSITIONS AND SLOPE CLASSES:

Table no. 5.4 below gives distribution of vegetated area under different slope classes ranging from less than 10% to over 100%. This table reveals that most of the forest area is confined to slopes below 60%.

Table No. 5.4

BREAK-UP OF THE TREE VEGETATED AREA BY SLOPE CLASSES

Crop composition	Less than 10%	10-60%	60-100%	100 & above	Total
Teak	643.08	9967.71	-	-	10610.79
Misc.	1929.23	6109.24	-	-	8038.47
Total	2572.31	16076.95	-	-	18649.26
% age	13.79	86.21	-	-	100

5.5 AREA BY CROP COMPOSITIONS AND SOIL-DEPTH CLASSES:

The data was collected under various soil-depth classes viz; very shallow (15 cm), shallow (15-30 cm), medium (30-90 cm) and deep (over 90 cm). Over 79% of the vegetation is supported by medium deep soils and the remaining on shallow soils. In other words most of the vegetation is supported by shallow and medium deep soils.

Table No. 5.5

BREAK UP OF TREE VEGETATED AREA BY SOIL DEPTH CLASSES

Crop composition	No soil	Very shallow	Shallow	Medium	Deep	Total
Teak	-	-	2250.77	8360.02	-	10610.79
Misc.	-	-	1607.69	6430.78	-	8038.47
Total	-	-	3858.46	14790.80	-	18649.26
%age.	-	-	20.69	79.31	-	100

5.6 AREA BY CROP COMPOSITIONS AND TOP HEIGHT CLASSES:

Table no. 5.6 below gives distribution of vegetated area of the territory by top-height classes. This table reveals that 13.79% of the vegetation is at very young stage having top-height ranging between 1-5 m, 12.07% of the vegetation has top-height between 6-10 m, 13.79% has height between 11-15 m. Top height of most of the vegetation (45%) is between 16-20 m whereas only 15.52% of the vegetation has top-height upto 25 m. No tree crop has attained top-height beyond 25 m.

Table No. 5.6

BREAK UP OF TREE VEGETATED AREA BY TOP-HEIGHT CLASSES;

Crop composition	1-5 m.	6-10 m.	11-15 m.	16-20 m.	21-25 m.	26-30 m.	Total
Teak	1607.69	964.62	1929.23	4823.09	1286.16	-	10610.79
Misc.	964.62	1286.16	643.08	3536.92	1607.69	-	8038.47
Total	2572.31	2250.78	2572.31	8360.01	2893.85	-	18649.26
%age	13.79	12.07	13.79	44.83	15.52	-	100

5.7 AREA BY CROP COMPOSITIONS AND SIZE CLASSES:

Table no. 5.7 gives distribution of vegetation by crop composition and size classes namely; regeneration crop (below 10 cm dia), pole crop (10-20 cm dia), small timber (20-30 cm dia), big timber (over 30 cm dia) and mixed size crop which has no marked dominance of any particular size class. There is virtually no crop of big sized timber in the territory. The over all position is that nearly 57% of the crop is young having diameter below 30 cms.

Table No. 5.7

BREAK UP OF TREE VEGETATED AREA BY SIZE CLASSES:

Crop composition	Regeneration	Pole crop	Small timber	Big timber	Mixed size	Total
Teak	2250.78	321.54	3536.92	-	4501.55	10610.79
Misc.	964.62	1607.69	1929.23	-	3536.93	8038.47
Total	3215.40	1929.23	5466.15	-	8038.48	18649.26
%age	17.24	10.34	29.31	-	43.11	100

5.8 AREA BY CROP COMPOSITIONS AND CANOPY LAYERS:

Table no. 5.8 gives distribution of vegetated area by crop composition and forest canopy varying from no storey to multi-storeyed forest. This table indicates that 17.24% of the crop has no storey as it is at a very young stage where canopy formation has not yet taken place. Almost 13.79% of the crop has single canopy and about 68.97% of it has two storeyed forest, out of which Teak constitutes 66% and Miscellaneous constitutes 34% of the crop.

Table No. 5.8

BREAK UP OF TREE VEGETATED AREA BY CANOPY LAYERS

Crop composition	No storey	Single storey	Double storey	Three or more storey	Total
Teak	2250.77	-	8360.02	-	10610.79
Misc.	964.62	2572.31	4501.54	-	8038.47
Total	3215.39	2572.31	12861.56	-	18649.26
%age	17.24	13.79	68.97	-	100

5.9 SOIL EROSION:

Data pertaining to soil erosion was collected from 2 ha area around the plot. On the basis of ocular estimation, it has been found that about 85% forest land is affected by moderate soil erosion whereas 15% of the area is affected by mild erosion. Because of good vegetal cover over the forest areas heavy erosion was not noticed anywhere during the course of this survey.

5.10 REGENERATION STATUS:

An assessment of regeneration of commercially important species was made during the inventory work of the territory. It was done by counting the number of seedlings of commercial species in 16 sq.m. area around the centre of the plot. The species considered for this survey were:- Acacia catechu, Adina cordifolia, Albizzia species, Dalbergia latifolia, Dalbergia sisoo, Diospyros melanoxylon, Eucalyptus species, Garuga pinnata, Gmelina arborea, Lagerstroemia parviflora, Lannea coromandelica, Mitragyna parvifolia, Ougenia dalbergioides, Pterocarpus marsupium, Syzigium cumini, Schleichera oleasa, Terminalia crenulata, Terminalia belerica, Terminalia chebula, Terminalia arjuna, and Tectona grandis.

The survey revealed that most of the forest area (about 80%) was devoid of any regenration and it was inadequate in the remaining 19% area. One percent of the forest area was covered with adequate regeneration.

5.11 FIRE INCIDENCE:

Data regarding incidence of occurrence of fire in the forest was collected from the vicinity of the plot centres. On the basis of this survey most of the forest areas of this territory (about 97%) were subjected to occasional fires. No areas were affected by heavy and frequent fires. The fires are mostly set by local dwellers during the course of collection of MFP.

5.12 GRAZING INCIDENCE:

The inventory results indicate that almost 86% of the forest area is affected by medium grazing and only 10% of the area was affected by heavy grazing. Quite a small proportion of the area was found to be without any grazing incidence. Such areas are located away from habitation i.e. on hills which do not provide an easy access to cattle.

5.13 BAMBOO OCCURRENCE:

The forest areas of the territory are poor in bamboo growth. No areas with pure bamboo brakes or even dense bamboo could be found in the territory. Moderately dense bamboo (with 50-100 clumps per ha) was noticed in 12% of the forest area. Scattered or sparse bamboos were found here and there in association with the tree crop. The bamboo in regeneration stage was also found in some sample plots (15% of the forest area) - these were the areas where clump formation had not yet taken place. Thus, bamboo occurrence in the territorial forests is not of much significance and, therefore, not dealt separately.

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CHAPTER-VI

INVENTORY RESULTS: GROWING STOCK

6.0 GENERAL:

The results of growing stock of trees are discussed in this chapter. The forests of the territory, as discussed earlier, were divided into two strata namely; Teak and Miscellaneous spread over an area of 10610.79 ha and 8038.47 ha respectively. Bamboo stratum is not separately identifiable due to its sparse and scattered occurrence. The distribution of the growing stock in the form of total no. of stems and stems per hectare and volume and volume per hectare for both these strata has been given in the tables at the end of this chapter. However, findings from tables are discussed in the following paragraphs:

6.1 TOTAL NO. OF STEMS AND STEMS PER HECTARE STRATUM: TEAK:

Table nos.6.1 A and 6.1B deal with the distribution of total no. of stems and stems per hectare in Teak stratum covering an area of 10610.79 ha. These tables reveal that Tectona grandis includes total no. of 334397 stems or 31.515 stems per hectare and constitutes about 18.57% of the tree crop in the stratum. It is followed by Terminalia crenulata, Garuga pinnata, Mitragyna parvifolia and Adina cordifolia and so on in the order of their contribution per hectare. It is given below in their descending order:(Note: The percentage of Teak is not adequate to consider it as a separate type, but considering its economic importance and stocking in comparison with other species it is treated as a separate stratum.)

Order	Species	Total no. of stems	stems per hectare.	Percentage.
I	Tectona grandis	334397	31.515	18.57
II	Terminalia crenulata	231506	21.818	12.85
III	Garuga pinnata	138248	13.029	7.68
IV	Mitragyna parvifolia	73946	6.969	4.11
V	Adina cordifolia	61085	5.757	3.39
	Rest of the species	961362	90.603	53.40
	Total	1800544	169.691	100.00

This table further shows that teak is stocked well upto 60-70 cm diameter class. Terminalia crenulata too shows the same trend.

6.2 TOTAL NO. OF STEMS AND STEMS PER HECTARE: STRATUM: MISCELLANEOUS:

Table nos. 6.2 A and 6.2 B give distribution of total no. of stems and stems per hectare in Miscellaneous stratum which is spread over an area of 8038.47 hectares. These tables reveal that out of aggregate 1347241 stems in this stratum highest contribution is made by Acacia catechu which occurs naturally as well as in plantations raised by the State Forest Department. It's contribution is 241154 stems (30 stems per hectare), followed by Terminalia crenulata, Garuga pinnata, Tectona grandis and Wrightia tinctoria and finally by Dalbergia latifolia. The trend is similar in case of stems per hectare. This is shown in the following table:

Order	Species	Total no. of stems	Stems per hectare	Percentage
I	Acacia catechu	241154	30.000	17.90
II	Terminalia crenulata	170415	21.200	12.65
III	Garuga pinnata	135045	16.800	10.02
IV	Tectona grandis/ Wrightia tinctoria	93246	11.600	6.92
V	Dalbergia latifolia	57877	7.200	4.29
	Rest of the species	649504	80.800	48.22
	Total	1347241	167.600	100.00

6.3 TOTAL VOLUME AND VOLUME PER HECTARE: STRATUM: TEAK:

Table nos. 6.3 A and 6.3 B give distribution of total volume and volume per hectare in Teak forest type. Teak obviously tops in the volumetric contribution (112782 cu.m. and 10.629 cu.m/ha) followed by Terminalia crenulata, Anogeissus latifolia, Garuga pinnata, Bridelia retusa and so on. Their representation is given in descending order in the following table:

Order	Species	Total volume	Volume/ha	Percentage
I	Tectona grandis	112782	10.629	18
II	Terminalia crenulata	88260	8.318	14
III	Anogeissus latifolia	60131	5.667	10
IV	Garuga pinnata	30240	2.550	5
V	Bridelia retusa	23789	2.242	4
	Rest of the species	308338	35.494	49
	Total	623540	58.765	100%

Total volume and volume per hectare in this stratum is 623540 cu.m. and 58.765 cu.m. per hectare.

A comparison between table no. 6.1 and 6.3 pertaining to Teak stratum shows that teak tops the list both in terms of stems and volume.

6.4 TOTAL VOLUME AND VOLUME PER HECTARE; STRATUM: MISCELLANEOUS:

Table nos. 6.4 A and 6.4 B deal with the distribution of total volume and volume per hectare in Miscellaneous stratum (Mixed forest type). Out of total volume of 364793 cu.m. contribution of Anogeissus latifolia is maximum i.e, 56920 cu.m. (7.081 cu.m./ha) followed by Terminalia crenulata with 52119 cu.m. (6.485 cu.m./ha), Garuga pinnata, Acacia catechu, Tectona grandis and so on. Total per hectare volume in this stratum is 45.381 cu.m. Maximum volume contribution is rendered by trees between 20-25 cm diameter class followed by those of 25-30 cm diameter class and 30-35 cm. diameter class. Following table depicts the descending order of the volumetric representation of various species in this stratum:

Order	Species	Total volume	Volume/ha.	Percentage
I	Anogeissus latifolia	56920	7.081	15.60
II	Terminalia crenulata	52129	6.485	14.29
III	Garuga pinnata	35666	4.437	9.78
IV.	Acacia catechu	34245	4.260	9.39
V	Tectona grandis	20434	2.542	5.60
	Rest of the species	165399	20.576	45.34
	Total	364793	45.381	100

6.5 COMBINED GROWING STOCK IN TERMS OF STEMS:

Table nos. 6.5 A and 6.5 B deal with total no. of stems and stems per hectare combined together for the entire the vegetated area of the territory, i.e., 18649.26 ha. A combined picture is somewhat different from that by stratum-wise. Here, Tectona grandis and Terminalia crenulata contribute maximum stock, as in Teak forest type with 427643 and 401921 stems (22.930 and 21.552 stems per hectare). They are followed by Acacia catechu, Garuga pinnata, Wrightia tinctoria and Mitragyna parvifolia and so on. These species are given in the following table in their descending order:

Order	Species	Total stems	Stems/ha	Percentage
I	Tectona grandis	427643	22.930	13.59
II	Terminalia crenulata	401921	21.552	12.77
III	Acacia catechu	295809	15.862	9.40
IV	Garuga pinnata	273293	14.654	8.68
V	Wrightia tinctoria	189709	10.172	6.03
VI	Mitragyna parvifolia	99669	5.344	3.17
	Rest of the species	1459741	78.270	46.36
	Total	3147785	168.784	100%

Total no. of stems estimated in the territory is 3147785 and stems per hectare is estimated as 168.784.

6.6 COMBINED GROWING STOCK IN TERMS OF VOLUME:

Table nos. 6.6A and 6.6. B give distribution of total volume and volume per hectare for whole of the forest area of the union territory combined together for both the strata. Total volume estimated in the territory is to the tune of 988333 cu.m. (52.995 cu.m. per ha.). On the whole maximum contribution is made by Terminalia crenulata with 140389 cu.m.(7.528 cu.m. per ha) followed by Tectona grandis with 133216 cu.m. (7.143 cu.m. per ha), Anogeissus latifolia, Garuga pinnata, Acacia catechu, Mitragyna parvifolia, Lannea coromandelica and so on. As seen on the whole, maximum contribution is made by the tree crop between 20-25 cm diameter class followed by that between 25-30 cm diameter class and 30-35 cm diameter class and so on. Minimum contribution is of 70-80 cm. dia class which shows that big sized trees are not many in the territory. Following table gives volumetric contributions of various species in their descending order in the whole forest area:

Order	Species	Total volume	Vol/ha	Percentage
I	Terminalia crenulata	140389	7.528	14.20
II	Tectona grandis	133216	7.143	13.48
III	Anogeissus latifolia	117051	6.276	11.84
IV	Garuga pinnata	65906	3.534	6.69
V	Acacia catechu	51329	2.752	5.19
VI	Adina cordifolia	37197	1.994	3.76
VII	Mitragyna parvifolia	30927	1.658	3.13
	Rest of the species	412318	22.110	41.71
	Total	988333	52.995	100%

6.7 STANDARD ERROR:

Table no. 6.7 poduced below gives standard error percentage in respect of area, volume per hectare and total volume for both the strata and the entire territory.

For area, standard error was estimated to be 11% for Teak stratum, 15.3% for Miscellaneous stratum and 9.3% for the entire forest area of the territory.

For volume per hectare, standard error was estimated to be 23.6% for Teak forest type, 25.2% for Miscellaneous (Mixed) forest type and 19.9% for the enire forest area of the territory.

Similarly for total volume, standard error was estimated to be 26% for Teak stratum, 29.5% for Miscellaneous stratum and 22% for the entire forest area of the territory.

Standard error of Miscellaneous stratum was higher than that of Teak for all the three prarameters, probably because of lesser number of plots.

Since these survey results are based on 58 sample plots only the data processed on the basis of this inventory survey should be used with due caution. It may be treated as indicative only.

Table No. 6.7

GROWING STOCK WITH ESTIMATE OF S.E. BY CROP COMPOSITION

Crop composition	Area (km^2)	SE%	Volume per ha.	SE%	Total volume (in ØØØ cu.m)	SE%
Teak	1Ø6.1Ø79 (33)	11.Ø	58.765	23.6	623.54Ø	26.Ø
Misce.	8Ø.3847 (25)	15.3	45.381	25.2	364.793	29.5
Total	186.4926 (58)	9.3	52.995	19.9	988.333	22.Ø

2. Figures in brackets denote the number of plots.

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Table No. 6.1 A
Dadra and Nagar Haveli.

Stratum: Teak
Stems : 000

Area 10610.79
No. of plots: 33

Species Description	Diameter classes (in cm)											
	10-15	15-20	20-25	25-30	30-35	35-40	40-50	50-60	60-70	70-80	80+	Total
Acacia catechu	19.290	9.645	6.430	6.430	9.645	3.215	-	-	-	-	-	54.655
Adina cordifolia	19.290	12.860	9.645	3.215	12.860	-	-	3.215	-	-	-	61.085
Anogeissus latifolia	12.860	19.290	12.860	-	-	-	-	-	-	-	-	45.010
Bombax ceiba	9.645	-	3.215	-	-	-	-	-	-	-	-	12.860
Bridelia retusa	6.430	6.430	6.430	22.505	9.645	3.215	3.215	-	-	-	-	57.870
Dalbergia latifolia	3.215	3.215	6.430	3.215	-	3.215	-	-	-	-	-	19.290
Diospyros melanoxylon	12.860	-	-	-	-	-	-	-	-	-	-	12.860
Garuga pinnata	35.366	32.151	41.796	22.505	6.430	-	-	-	-	-	-	138.248
Lagerstroemia parviflora	-	3.215	-	-	-	-	-	-	-	-	-	3.215
Lannea coromandelica	12.860	9.645	12.860	12.860	6.430	-	3.215	-	-	-	-	57.870
Mitragyna parvifolia	19.290	25.721	9.645	9.645	3.215	3.215	3.215	-	-	-	-	73.946
Pterocarpus marsupium	6.430	-	-	3.215	6.430	-	3.215	-	-	-	-	19.290
Tectona grandis	106.108	54.667	77.172	38.580	38.580	9.645	3.215	3.215	3.215	-	-	334.397
Terminalia belerica	3.215	3.215	9.645	-	-	-	-	3.215	3.215	-	-	22.505
Terminalia crenulata	35.366	54.667	80.387	35.366	9.645	6.430	6.430	-	3.215	-	-	231.506
Wrightia tinctoria	67.527	12.860	9.645	3.215	3.215	-	-	-	-	-	-	96.462
Miscellaneous species	270.098	90.033	99.678	41.796	22.505	6.430	9.645	3.215	6.430	3.215	6.430	559.475
Total	639.850	337.614	385.838	202.547	128.600	35.365	32.150	12.860	16.075	3.215	6.430	1800.544

Table No. 6.1 B
Dadra and Nagar Haveli.

Stratum: Teak
Stems per ha.

Area : 10610.79
No. of plots : 33

Species Description	Diameter classes (in cm)											
	10-15	15-20	20-25	25-30	30-35	35-40	40-50	50-60	60-70	70-80	80+	Total
Accacia catechu	1.818	0.909	0.606	0.606	0.909	0.303	-	-	-	-	-	5.151
Adina cordifolia	1.818	1.212	0.909	0.303	1.212	-	-	0.303	-	-	-	5.757
Anogeissus latifolia	1.212	1.818	1.212	-	-	-	-	-	-	-	-	4.242
Bombax ceiba	0.909	-	0.303	-	-	-	-	-	-	-	-	1.212
Bridelia retusa	0.606	0.606	0.606	2.121	0.909	0.303	0.303	-	-	-	-	5.454
Dalbergia latifolia	0.303	0.303	0.606	0.303	-	0.303	-	-	-	-	-	1.818
Diospyros melanoxylon	1.212	-	-	-	-	-	-	-	-	-	-	1.212
Garuga pinnata	3.333	3.030	3.939	2.121	0.606	-	-	-	-	-	-	13.029
Lagerstroemia parviflora	-	0.303	-	-	-	-	-	-	-	-	-	0.303
Lannea coromandelica	1.212	0.909	1.212	1.212	0.606	-	0.303	-	-	-	-	5.454
Mitragyna parvifolia	1.818	2.424	0.909	0.909	0.303	0.303	0.303	-	-	-	-	6.969
Pterocarpus marsupium	0.606	-	-	0.303	0.606	-	0.303	-	-	-	-	1.818
Tectona grandis	10.000	5.152	7.27	3.636	3.636	0.909	0.303	0.303	0.303	-	-	31.515
Terminalia crenulata	3.333	5.152	7.57	3.333	0.909	0.606	0.606	-	0.303	-	-	21.818
Terminalia belerica	0.303	0.303	0.90	-	-	-	-	0.303	0.303	-	-	2.121
Wrightia tinctoria	6.364	1.212	0.90	0.303	0.303	-	-	-	-	-	-	9.091
Miscellaneous species	25.455	8.485	9.39	3.939	2.121	0.606	0.909	0.303	0.606	0.303	0.606	52.727
Total	60.302	31.818	36.363	19.089	12.120	3.333	3.030	1.212	1.515	0.303	0.606	169.691

Table No. 6.2 B
Dadra and Nagar Haveli.

Stratum: Miscellaneous
Stems : 000

Area : 8038.47
No. of plots: 25

Species Description	Diameter classes (in cm)											
	10-15	15-20	20-25	25-30	30-35	35-40	40-50	50-60	60-70	70-80	80+	Total
Acacia catechu	170.416	35.369	12.862	9.646	6.431	3.215	3.215	-	-	-	-	241.154
Adina cordifolia	6.431	3.215	-	12.862	3.215	3.215	3.215	-	-	-	-	32.153
Anogeissus latifolia	16.077	-	19.292	3.215	-	-	-	-	-	-	-	38.584
Bombax ceiba	-	3.215	3.215	-	3.215	-	-	3.215	-	-	-	12.860
Bridelia retusa	6.431	6.431	3.215	3.215	-	-	-	-	-	-	-	19.292
Dalbergia latifolia	16.077	16.077	9.646	12.862	-	-	3.215	-	-	-	-	57.877
Diospyros melanoxylon	9.646	6.431	3.215	-	-	-	-	-	-	-	-	19.292
Garuga pinnata	25.723	19.292	51.446	28.938	6.431	3.215	-	-	-	-	-	135.045
Lagerstroemia parviflora	12.862	3.215	3.215	-	-	-	-	-	-	-	-	19.292
Lannea coromandelica	3.215	3.215	6.431	-	3.215	6.431	-	-	-	-	-	22.507
Nitraguna parvifolia	3.215	3.215	6.431	6.431	6.431	-	-	-	-	-	-	25.723
Pterocarpus marsupium	-	-	6.431	3.215	6.431	-	-	-	-	-	-	16.077
Tectona grandis	25.723	22.508	28.938	16.077	-	-	-	-	-	-	-	93.246
Terminalia balerica	6.431	-	-	-	-	-	-	-	-	-	-	6.431
Terminalia crenulata	70.739	35.369	35.369	9.646	6.431	-	9.646	3.215	-	-	-	170.415
Wrightia tinctoria	70.739	16.077	6.431	-	-	-	-	-	-	-	-	93.247
Miscellaneous species	141.477	77.169	38.585	35.369	32.154	6.431	9.646	3.215	-	-	-	344.046
Total	585.202	250.798	234.722	141.476	73.954	22.507	28.937	9.645	-	-	-	1347.241

Table No. 6.2 B
Dadra and Nagar Haveli.

Stratum: Miscellaneous
Stems per ha

Area : 8030.47
No. of plots: 25

Species Description	Diameter classes (in cm)											
	10-15	15-20	20-25	25-30	30-35	35-40	40-50	50-60	60-70	70-80	80+	Total
Acacia catechu	21.200	4.400	1.600	1.200	0.800	0.400	0.400	-	-	-	-	30.000
Adina cordifolia	0.800	0.400	-	1.600	0.400	0.400	0.400	-	-	-	-	4.000
Anogeissus latifolia	2.000	-	2.400	0.400	-	-	-	-	-	-	-	4.800
Bombax ceiba	-	0.400	0.400	-	0.400	-	-	0.400	-	-	-	1.600
Bridelia retusa	0.800	0.800	0.400	0.400	-	-	-	-	-	-	-	2.400
Dalbergia latifolia	2.000	2.000	1.200	1.600	-	-	0.400	-	-	-	-	7.200
Diospyros melanoxylon	1.200	0.800	0.400	-	-	-	-	-	-	-	-	2.400
Garuga pinnata	3.200	2.400	6.400	3.600	0.800	0.400	-	-	-	-	-	16.800
Lagerstroemia parviflora	1.600	0.400	0.400	-	-	-	-	-	-	-	-	2.400
Lannea coromandelica	0.400	0.400	0.800	-	0.400	0.800	-	-	-	-	-	2.800
Mitragyna parvifolia	0.400	0.400	0.800	0.800	0.800	-	-	-	-	-	-	3.200
Pterocarpus marsupium	-	-	0.800	0.400	0.800	-	-	-	-	-	-	2.000
Tectona grandis	3.200	2.800	3.600	2.000	-	-	-	-	-	-	-	11.600
Terminalia crenulata	8.800	4.400	4.400	1.200	0.800	-	1.200	0.400	-	-	-	21.200
Terminalia belerica	0.800	-	-	-	-	-	-	-	-	-	-	0.800
Wrightia tinctoria	8.800	2.000	0.800	-	-	-	-	-	-	-	-	11.600
Miscellaneous species	17.600	9.600	4.800	4.400	4.000	0.800	1.200	0.400	-	-	-	42.800
Total	72.800	31.200	29.200	17.600	9.200	2.800	3.600	1.200	-	-	-	167.600

Table No. 6.3 A
Dadra and Nagar Haveli.

Stratum: Teak
Volume: 000

Area : 10610.79
No. of plots: 33

Species Description	Diameter classes (in cm)											
	10-15	15-20	20-25	25-30	30-35	35-40	40-50	50-60	60-70	70-80	80+	Total
Acacia catechu	1.295	1.666	1.963	2.547	6.748	2.865	-	-	-	-	-	17.084
Adina cordifolia	1.273	1.889	2.143	1.401	8.319	-	-	6.441	-	-	-	21.466
Anogeissus latifolia	11.460	26.728	21.943	-	-	-	-	-	-	-	-	60.131
Bombax ceiba	0.403	-	0.891	-	-	-	-	-	-	-	-	1.294
Bridelia retusa	0.424	0.987	1.793	8.818	5.624	2.451	3.692	-	-	-	-	23.789
Dalbergia latifolia	0.138	0.477	1.825	1.613	-	3.236	-	-	-	-	-	7.289
Diospyros melanoxylon	0.721	-	-	-	-	-	-	-	-	-	-	0.721
Garuga pinnata	2.005	4.594	10.749	8.807	4.085	-	-	-	-	-	-	30.240
Lagerstroemia parviflora	-	0.541	-	-	-	-	-	-	-	-	-	0.541
Lannea coromandelica	0.711	1.316	3.130	5.231	3.703	-	5.496	-	-	-	-	19.587
Mitragyna parvifolia	0.732	3.873	2.154	3.756	2.334	3.067	5.624	-	-	-	-	21.540
Pterocarpus marsupium	0.371	-	-	1.878	4.266	-	4.923	-	-	-	-	11.436
Tectona grandis	4.743	9.051	23.238	18.728	27.482	10.229	3.661	5.740	9.910	-	-	112.782
Terminalia belerica	0.340	0.403	2.653	-	-	-	-	6.706	13.062	-	-	23.164
Terminalia crenulata	2.122	9.369	23.906	16.277	6.992	6.802	12.171	-	10.621	-	-	88.260
Wrightia tinctoria	2.780	1.623	2.281	0.912	1.390	-	-	-	-	-	-	8.986
Miscellaneous species	11.300	11.099	24.182	16.956	12.903	4.998	10.537	5.348	18.877	11.810	47.218	175.228
Total	40.818	73.616	122.851	86.924	83.846	33.648	46.104	24.235	52.470	11.810	47.218	623.540

Table No. 6.3 B
Dadra and Nagar Haveli.

Stratum: Teak
Volume per hectare(cu.m.)

Area :10610.79
No. of plots: 33

Species Description	Diameter classes (in cm)											
	10-15	15-20	20-25	25-30	30-35	35-40	40-50	50-60	60-70	70-80	80+	Total
Acacia catechu	0.122	0.157	0.185	0.240	0.636	0.270	-	-	-	-	-	1.610
Adina cordifolia	0.120	0.178	0.202	0.132	0.784	-	-	0.607	-	-	-	2.023
Anogeissus latifolia	1.080	2.519	2.068	-	-	-	-	-	-	-	-	5.667
Bombax ceiba	0.038	-	0.084	-	-	-	-	-	-	-	-	0.122
Bridelia retusa	0.040	0.093	0.169	0.831	0.530	0.231	0.348	-	-	-	-	2.242
Dalbergia latifolia	0.013	0.045	0.172	0.152	-	0.305	-	-	-	-	-	0.687
Diospyros melanoxylon	0.068	-	-	-	-	-	-	-	-	-	-	0.068
Garuga pinnata	0.189	0.433	1.013	0.830	0.385	-	-	-	-	-	-	2.550
Lagerstroemia parviflora	-	0.051	-	-	-	-	-	-	-	-	-	0.051
Lannea coromandelica	0.067	0.124	0.295	0.493	0.349	-	0.518	-	-	-	-	1.846
Mitragyna parvifolia	0.069	0.365	0.203	0.354	0.220	0.289	0.530	-	-	-	-	2.030
Pterocarpus marsupium	0.035	-	-	0.177	0.402	-	0.464	-	-	-	-	1.078
Tectona grandis	0.447	0.853	2.190	1.765	2.590	0.964	0.345	0.541	0.934	-	-	10.629
Terminalia crenulata	0.200	0.883	2.253	1.534	0.659	0. 641	1.147	-	1.001	-	-	8.318
Terminalia belerica	0.032	0.038	0.250	-	-	-	-	0.632	1.231	-	-	2.183
Wrightia tinctoria	0.262	0.153	0.215	0.086	0.131	-	-	-	-	-	-	0.847
Miscellaneous species	1.065	1.046	2.279	1.598	1.216	0.471	0.993	0.504	1.779	1.113	4.450	16.514
Total	3.847	6.939	11.578	8.192	7.902	3.171	4.345	2.284	4.945	1.113	4.450	58.765

Table No. 6.4 A
Dadra and Nagar Haveli.

Stratum: Miscellaneous
Volume : 000

Area : 8038.47
No. of plots : 25

Species Description	Diameter classes (in cm)											
	10-15	15-20	20-25	25-30	30-35	35-40	40-50	50-60	60-70	70-80	80+	Total
Acacia catechu	9.493	5.386	3.489	4.301	4.325	2.870	4.381	-	-	-	-	34.245
Adina cordifolia	0.578	0.410	-	5.651	2.444	2.797	4.051	-	-	-	-	15.731
Anogeissus latifolia	15.289	-	33.874	7.757	-	-	-	-	-	-	-	56.920
Bombax ceiba	-	0.305	0.635	-	1.656	-	-	5.579	-	-	-	8.175
Bridelia retusa	0.145	0.611	0.804	1.302	-	-	-	-	-	-	-	2.862
Dalbergia latifolia	0.512	3.095	3.376	6.608	-	-	4.252	-	-	-	-	18.143
Diospyros melanoxylon	0.766	0.941	0.836	-	-	-	-	-	-	-	-	2.243
Garuga pinnata	1.130	2.821	13.392	11.358	3.947	2.918	-	-	-	-	-	35.666
Lagerstroemia parviflora	0.667	0.707	1.214	-	-	-	-	-	-	-	-	2.588
Lannea coromandelica	0.169	0.289	1.576	-	1.768	6.881	-	-	-	-	-	10.683
Mitragyna parvifolia	0.096	0.570	2.114	2.596	4.011	-	-	-	-	-	-	9.387
Pterocarpus marsupium	-	-	2.243	1.439	4.831	-	-	-	-	-	-	8.513
Tectona grandis	0.635	3.489	8.786	7.524	-	-	-	-	-	-	-	20.434
Terminalia belerica	0.450	-	-	-	-	-	-	-	-	-	-	0.450
Terminalia crenulata	2.926	5.442	10.940	5.346	4.526	-	14.091	8.858	-	-	-	52.129
Wrightia tinctoria	2.942	1.744	1.383	-	-	-	-	-	-	-	-	6.069
Miscellaneous species	6.262	9.984	9.598	13.239	17.886	5.161	13.296	5.129	-	-	-	80.555
Total	41.960	35.794	94.260	67.121	45.394	20.627	40.071	19.566	-	-	-	364.793

Table No. 6.4 B
Dadra and Nagar Haveli.

Stratum: Miscellaneous
Volume per hectare (cu.m.)

Area : 8038.47
No. of plots : 25

Species Description	Diameter classes (in cm)											
	10-15	15-20	20-25	25-30	30-35	35-40	40-50	50-60	60-70	70-80	80+	Total
Acacia catechu	1.181	0.670	0.434	0.535	0.538	0.357	0.545	-	-	-	-	4.260
Adina cordifolia	0.047	0.051	-	0.703	0.304	0.348	0.504	-	-	-	-	1.957
Anogeissus latifolia	1.902	-	4.214	0.965	-	-	-	-	-	-	-	7.081
Bombax ceiba	-	0.038	0.079	-	0.206	-	-	0.694	-	-	-	1.017
Bridelia retusa	0.018	0.076	0.100	0.162	-	-	-	-	-	-	-	0.356
Dalbergia latifolia	0.101	0.385	0.420	0.822	-	-	0.529	-	-	-	-	2.257
Diospyros melanoxylon	0.058	0.117	0.104	-	-	-	-	-	-	-	-	0.279
Garuga pinnata	0.153	0.351	1.666	1.413	0.491	0.363	-	-	-	-	-	4.437
Lagerstroemia parviflora	0.083	0.088	0.151	-	-	-	-	-	-	-	-	0.322
Lannea coromandelica	0.021	0.036	0.196	-	0.220	0.856	-	-	-	-	-	1.329
Mitragyna parvifolia	0.012	0.071	0.263	0.323	0.499	-	-	-	-	-	-	1.168
Pterocarpus marsupium	-	-	0.279	0.179	0.601	-	-	-	-	-	-	1.059
Tectona grandis	0.079	0.434	1.093	0.936	-	-	-	-	-	-	-	2.542
Terminalia crenulata	0.364	0.677	1.361	0.665	0.563	-	1.753	1.102	-	-	-	6.485
Terminalia belerica	0.056	-	-	-	-	-	-	-	-	-	-	0.056
Wrightia tinctoria	0.366	0.217	0.172	-	-	-	-	-	-	-	-	0.755
Miscellaneous species	0.779	1.242	1.194	1.647	2.225	0.642	1.654	0.638	-	-	-	10.021
Total	5.220	4.453	11.726	8.350	5.647	2.566	4.985	2.434	-	-	-	45.381

Table No. 6.5 A
Dadra and Nagar Haveli.

Combined growing stock
Stems : 000

Area : 10.64926 (000)ha.
No. of plots : 58

Species Description	Diameter classes (in cm)											
	10-15	15-20	20-25	25-30	30-35	35-40	40-50	50-60	60-70	70-80	80+	Total
Acacia catechu	189.706	45.014	19.292	16.076	16.076	6.430	3.215	-	-	-	-	295.809
Adina cordifolia	25.721	16.075	9.645	16.077	16.075	3.215	3.215	3.215	-	-	-	93.238
Anogeissus latifolia	28.937	19.290	32.152	3.215	-	-	-	-	-	-	-	83.594
Bombax ceiba	9.645	3.215	6.430	-	3.215	-	-	3.215	-	-	-	25.720
Bridelia retusa	12.861	12.861	9.645	25.720	9.645	3.215	3.215	-	-	-	-	77.162
Dalbergia latifolia	19.292	19.292	16.076	16.077	-	3.215	3.215	-	-	-	-	77.167
Diospyros melanoxylon	22.506	6.431	3.215	-	-	-	-	-	-	-	-	32.152
Garuga pinnata	61.089	51.443	93.242	51.443	12.861	3.215	-	-	-	-	-	273.293
Lagerstroemia parviflora	12.862	6.430	3.215	-	-	-	-	-	-	-	-	22.507
Lannea coromandelica	16.075	12.860	19.291	12.860	9.645	6.431	3.215	-	-	-	-	80.377
Mitragyna parvifolia	22.505	28.936	16.076	16.076	9.646	3.215	3.215	-	-	-	-	99.669
Pterocarpus marsupium	6.430	-	6.431	6.430	12.861	-	3.215	-	-	-	-	35.367
Tectona grandis	131.831	77.175	106.110	54.657	38.580	9.645	3.215	3.215	3.215	-	-	427.643
Terminalia crenulata	106.105	90.036	115.756	45.012	16.076	6.430	16.076	3.215	3.215	-	-	401.921
Terminalia belerica	9.646	3.215	9.645	-	-	-	-	3.215	3.215	-	-	28.936
Wrightia tinctoria	138.266	28.937	16.076	3.215	3.215	-	-	-	-	-	-	189.709
Miscellaneous species	411.575	167.202	138.263	77.165	54.659	12.861	19.291	6.430	6.430	3.215	6.430	903.521
Total	1225.052	568.412	620.560	344.023	202.654	57.872	61.087	22.505	16.075	3.215	6.430	3147.785

Table No. 6.5 B
Dadra and Nagar Haveli.

Combined growing stock
Stems per hectare

Area : 18.64926 (000)ha.
No. of plots : 58

Species Description	Diameter classes (in cm)											
	10-15	15-20	20-25	25-30	30-35	35-40	40-50	50-60	60-70	70-80	80+	Total
Acacia catechu	10.172	2.414	1.035	0.862	0.862	0.345	0.172	-	-	-	-	15.862
Adina cordifolia	1.379	0.862	0.517	0.862	0.862	0.172	0.172	0.172	-	-	-	4.998
Anogeissus latifolia	1.552	1.034	1.724	0.172	-	-	-	-	-	-	-	4.482
Bombax ceiba	0.517	0.172	0.345	-	0.172	-	-	0.172	-	-	-	1.378
Bridelia retusa	0.690	0.690	0.517	1.379	0.517	0.172	0.172	-	-	-	-	4.137
Dalbergia latifolia	1.035	1.035	0.862	0.862	-	0.172	0.172	-	-	-	-	4.138
Diospyros melanoxylon	1.207	0.345	0.172	-	-	-	-	-	-	-	-	1.724
Garuga pinnata	3.276	2.758	5.000	2.758	0.690	0.172	-	-	-	-	-	14.654
Lagerstroemia parviflora	0.690	0.345	0.172	-	-	-	-	-	-	-	-	1.207
Lannea coromandelica	0.862	0.690	1.034	0.690	0.517	0.345	0.172	-	-	-	-	4.310
Mitragyna parvifolia	1.207	1.552	0.862	0.862	0.517	0.172	0.172	-	-	-	-	5.344
Pterocarpus marsupium	0.345	-	0.345	0.345	0.690	-	0.172	-	-	-	-	1.897
Tectona grandis	7.069	4.138	5.690	2.931	2.069	0.517	0.172	0.172	0.172	-	-	22.930
Terminalia crenulata	5.690	4.828	6.207	2.414	0.862	0.345	0.862	0.172	0.172	-	-	21.552
Terminalia balerica	0.517	0.172	0.517	-	-	-	-	0.172	0.172	-	-	1.550
Wrightia tinctoria	7.414	1.552	0.862	0.172	0.172	-	-	-	-	-	-	10.172
Miscellaneous species	22.069	8.966	7.414	4.138	2.931	0.690	1.034	0.345	0.345	0.172	0.345	48.449
Total	65.691	31.553	33.276	18.447	10.861	3.102	3,272	1,205	0.861	0.172	0.345	168.784

Table No. 6.6 A
Dadra and Nagar Haveli.

Combined growing stock
Volume:'000

Area : 18.64926 (000)ha.
No. of plots: 58

Species Description	Diameter classes (in cm)											
	10-15	15-20	20-25	25-30	30-35	35-40	40-50	50-60	60-70	70-80	80+	Total
Acacia catechu	10.788	7.052	5.452	6.848	11.073	5.735	4.381	-	-	-	-	51.329
Adina cordifolia	1.651	2.299	2.143	7.052	10.763	2.797	4.051	6.441	-	-	-	37.197
Anogeissus latifolia	26.749	26.728	55.817	7.757	-	-	-	-	-	-	-	117.051
Bombax ceiba	0.403	0.305	1.526	-	1.656	-	-	5.579	-	-	-	9.469
Bridelia retusa	0.569	1.598	2.597	10.120	5.624	2.451	3.692	-	-	-	-	26.651
Dalbergia latifolia	0.950	3.572	5.201	8.221	-	3.236	4.252	-	-	-	-	25.432
Diospyros melanoxylon	1.187	0.941	0.836	-	-	-	-	-	-	-	-	2.964
Garuga pinnata	3.235	7.415	24.141	20.165	8.032	2.918	-	-	-	-	-	65.906
Lagerstroemia parviflora	0.667	1.248	1.214	-	-	-	-	-	-	-	-	3.129
Lannea coromandelica	0.880	1.605	4.706	5.231	5.471	6.881	5.496	-	-	-	-	30.270
Mitragyna parvifolia	0.828	4.443	4.268	6.352	6.345	3.067	5.624	-	-	-	-	30.927
Pterocarpus marsupium	0.371	-	2.243	3.317	9.097	-	4.923	-	-	-	-	19.951
Tectona grandis	5.378	12.540	32.024	26.252	27.482	10.229	3.661	5.740	9.910	-	-	133.216
Terminalia crenulata	5.048	14.811	34.846	21.623	11.518	6.802	26.262	8.858	10.621	-	-	140.389
Terminalia balerica	0.790	0.403	2.653	-	-	-	-	6.706	13.062	-	-	23.614
Wrightia tinctoria	5.722	3.367	3.664	0.912	1.390	-	-	-	-	-	-	15.055
Miscellaneous species	17.562	21.083	33.780	30.195	30.789	10.159	23.833	10.477	18.877	11.810	47.218	255.783
Total	82.778	109.410	217.111	154.045	129.240	54.275	86.175	43.801	52.470	11.810	47.218	988.333

Table No. 6.6 B
Dadra and Nagar Haveli.

Combined growing stock
Volume per hectare (cu.m.)

Area : 18.64926 (000)ha.
No. of plots: 58

Species Description	Diameter classes (in cm)											
	10-15	15-20	20-25	25-30	30-35	35-40	40-50	50-60	60-70	70-80	80+	Total
Acacia catechu	0.578	0.378	0.292	0.367	0.594	0.308	0.235	-	-	-	-	2.752
Adina cordifolia	0.089	0.123	0.115	0.378	0.577	0.150	0.217	0.345	-	-	-	1.994
Anogeissus latifolia	1.434	1.433	2.993	0.416	-	-	-	-	-	-	-	6.276
Bombax ceiba	0.022	0.016	0.082	-	0.089	-	-	0.299	-	-	-	0.508
Bridelia retusa	0.030	0.086	0.139	0.543	0.302	0.131	0.198	-	-	-	-	1.429
Dalbergia latifolia	0.051	0.192	0.279	0.441	-	0.173	0.228	-	-	-	-	1.364
Diospyros melanoxylon	0.064	0.050	0.045	-	-	-	-	-	-	-	-	0.159
Garuga pinnata	0.173	0.398	1.294	1.081	0.431	0.157	-	-	-	-	-	3.534
Lagerstroemia parviflora	0.036	0.067	0.065	-	-	-	-	-	-	-	-	0.168
Lannea coromandelica	0.047	0.086	0.252	0.281	0.293	0.369	0.295	-	-	-	-	1.623
Mitragyna parvifolia	0.044	0.238	0.229	0.341	0.340	0.164	0.302	-	-	-	-	1.658
Pterocarpus marsupium	0.020	-	0.120	0.178	0.488	-	0.264	-	-	-	-	1.070
Tectona grandis	0.288	0.672	1.717	1.408	1.474	0.549	0.196	0.308	0.531	-	-	7.143
Terminalia crenulata	0.271	0.794	1.868	1.159	0.618	0.365	1.408	0.476	0.570	-	-	7.528
Terminalia belerica	0.042	0.022	0.142	-	-	-	-	0.360	0.700	-	-	1.266
Wrightia tinctoria	0.307	0.180	0.196	0.049	0.075	-	-	-	-	-	-	0.807
Miscellaneous species	0.942	1.131	1.811	1.619	1.651	0.545	1.278	0.562	1.012	0.633	2.532	13.716
Total	4.438	5.866	11.639	8.261	6.982	2.911	4.621	2.349	2.813	0.633	2.532	52.995

CHAPTER-VII

WOOD CONSUMPTION STUDIES

7.0 GENERAL:

Wood consumption studies were carried out in Dadra and Nagar Haveli alongwith the forest inventory during the months of October-November, 1986 in order to estimate the annual consumption of wood for various purposes.

7.1 POPULATION OF DADRA AND NAGAR HAVELI:

The population of Dadra and Nagar Haveli according to 1971 and 1981 census is given below:

Population in the year 1971	.. 74,170
Population in the year 1981	.. 1,03,676
Annual rate of increase in population in 10 years per 100	.. 3.978
Total no. of households in the year 1981.	.. 12,428
Average size of the household	.. 5.336
Projected population in the year 1985(based on 3.978% annual increase).	.. 1,20,173
Projected population in the year 1991	.. 1,44,918

The above figures have been used as a basis for calculation of wood consumption during the year 1985 (year of survey) and projection of demand for the year 1991.

7.2 METHODOLOGY:

For conducting these studies, methodology prescribed in the Manual for wood consumption survey prepared by the Forest Survey of India in 1985 was adopted. However, it was not possible to stratify the villages according to their distance from the forests or on the basis of rural and urban areas. Except for Silvassa town all other habitations are rural and they are within 6 km. from the forests. Except for 3 villages of Dadra, Demni & Dhapsa, all other villages possess forests within their boundaries. While selecting the villages for survey proper representation was given to different kinds of villages. Out of 68 forested villages 8 villages were selected. Out of non-forest villages 2 were chosen and Silvassa being the only urban area was also taken up for this survey. In each village 10-16 households were selected for study classifying each into low income, middle

income or upper income groups depending upon the annual income of the household. The limits of income used for classification were as follows:

Annual income	Income group
Upto Rs. 3600/-	Low income
Rs.3600 - Rs.7000/-	Middle income
Above Rs.7000/-	Upper income

Table below gives the list of villages with their population and no. of households selected in each under different income groups.

Sl. No.	Name of village/ town	No. of house-holds (1981 census)	Popula-tion (1981 census)	No. of households surveyed			Total
				Low income	Middle income	Upper income	
1.	Galonda	431	2532	5	5	2	12
2.	Chimda	302	1647	5	5	5	15
3.	Amboli	229	1269	5	5	5	15
4.	Khedpa	177	866	5	5	4	14
5.	Tinoda	63	328	5	5	-	10
6.	Kilvani	104	560	5	5	-	10
7.	Goratpada	38	205	5	5	1	11
8.	Naroli	1071	5952	5	5	6	16
9.	Dhapsa	30	183	4	5	5	14
10.	Demni	131	723	5	5	5	15
11.	Silvassa (town)	1305	6914	10	10	10	30

The data on actual wood consumed for various purposes was collected by measurement of wood actually used by the households. So far as the consumption of firewood is concerned, it is based on the information furnished by the members of the households. The data was recorded in the forms prescribed in the Manual for wood consumption survey.

This data was analysed by regression analysis taking size of the household as independent variable to estimate per capita wood consumption for all the villages/town as a whole and separately for each income groups in these villages. The formula $Y = mx + c$ was used in this estimation where x is the average size of the household in Dadra and Nagar Haveli(as determined from 1981 census figures) and m and c are the constants which were estimated by regression analysis to predict the value of dependent variable which is the per capita consumption of wood for specific uses like building construction, furniture,

agricultural implements etc. The consumption of teak and other species was estimated separately as well as combined together. For statistical analysis of data DCM MOSCAL 14025 desk calculator was used. It gives the values of correlation co-efficients, co-efficient of x, constant etc. directly on entering the data.

7.3 ESTIMATED PER CAPITA ANNUAL WOOD CONSUMPTION BY INCOME GROUPS:

As already pointed out the households were divided into their income groups and data was analysed separately for each income group i.e. low, middle and upper. Based on the regression analysis of this vilage-wise data, per capita consumption of wood in the territory for different income groups is tabulated below:

Item	Species	Unit	Income group		
			Low	Middle	Upper
A) Timber					
Building construction	Teak	Cu.m.	Ø.Ø595	Ø.1Ø34	Ø.1456
	Other wood	"	Ø.6328	Ø.78Ø1	Ø.2152
Furniture	Teak	"	Ø.ØØØ3	Ø.Ø143	Ø.Ø382
	Other wood	"	Ø.ØØØ5	Ø.ØØ42	Neg.
Agricultural implements	Teak	"	Ø.ØØ63	Ø.ØØ78	Ø.Ø284
	Other wood	"	Ø.ØØ81	Ø.Ø126	Ø.ØØ56
Total(timber)	Teak	"	Ø.Ø661	Ø.1255	Ø.2122
	Other wood	"	Ø.6414	Ø.7969	Ø.22Ø8
	Total:		Ø.7Ø75	Ø.9224	Ø.433Ø
B) Firewood		Kg/month	31.85	28.Ø1	16.88

The above table brings out the effect of income on wood consumption for various purposes. The total consumption of teak in upper income group is more while the consumption of other wood is more in middle income and low income groups. In case of building constructions teak is preferred by upper income group while other woods are used by middle and low income groups. The use of teak for furniture is more in upper income group. Likewise the use of teak for agricultural implements is less in low income groups while the consumption of other wood for agricultural implements is lowest in the upper income group.

7.4 ESTIMATED PER CAPITA ANNUAL WOOD CONSUMPTION IRRESPECTIVE OF INCOME:

The table below gives per capita annual wood consumption for various purposes based on sample data. Regression analysis of this data, taking average size of the household as 5.336, gives following estimates of per capita wood consumption for the territory as a whole.

Per capita annual consumption of wood irrespective of income

Use	Teak cu.m.	Other wood cu.m.	Total timber cu.m.
A) Timber			
1. Building construction	Ø.Ø682	Ø.6Ø75	Ø.6757
2. Furniture	Ø.Ø142	Ø.ØØ31	Ø.Ø173
3. Agricultural implements	Ø.ØØ62	Ø.Ø139	Ø.Ø2Ø1
Total timber	Ø.Ø886	Ø.6245	Ø.7131
B) Firewood	-	-	31.2 Kg/ month

These figures show that in case of teak 77% consumption is for building construction, 16% for furniture and 7% for agricultural implements whereas for other timber, 97% is for building construction, 2.5% for agricultural implements and only Ø.5% for furniture.

7.5 ESTIMATION OF PRESENT WOOD CONSUMPTION AND FUTURE PROJECTION:

In para 7.4, per capita wood consumption for different uses in Dadra and Nagar Haveli has been worked out. These figures are used to estimate present consumption of teak and non-teak timber in the territory on the basis of 1981 census figures and their projection for the year 1985, the year of survey, and for the year 1991. If we assume that the present trend of wood consumption continues to be similar in the future, we can work out timber and firewood requirements for any projected future population. However, such assumption cannot be valid for a long period as the trend in wood consumption is changing very fast. The prices

of timber and firewood are increasing every year and use of teak or other valuable timber for house construction and furniture making is becoming increasingly prohibitive. In urban areas use of cooking gas, kerosene and electricity is on the increase and there is reduction in per capita consumption of firewood in such areas. However, for a short period of 5-6 years assumption of present rate of wood consumption may not be invalid. Moreover, it helps to arrive at approximate additional requirements of timber in order to plan proper strategy to meet such requirements.

7.6 PROJECTED REQUIREMENTS OF TIMBER AND FIREWOOD FOR THE YEAR 1991:

On the basis of per capita consumption figures and projected population for the year 1991, the following figures have been worked out:

	In the year 1985 (1)	In the year 1991 (2)	Difference for the years 1991-1985 (2 - 1)	Average per annum requirements
Population	120173	144918	24745	-
Per capita consumption of teak(cu.m)	0.0886	0.0886	-	-
Per capita consumption of other timbers(cu.m.)	0.6245	0.6245	-	-
Per capita consumption of firewood (Kg/p.m.)	31.2	31.2	-	-
Total consumption of teak (cu.m.)	10647	12840	2193	365
Total consumption of other timber(cu.m.)	75048	90501	15453	2575
Total annual consumption of firewood(M.T.)	44993	54257	9264	1544

Above figures show that during the year 1985 to 1991 on an average 365 cu.m. of teak and 2575 cu.m. of other timbers would be required for new houses, furniture and agricultural implements etc. on account of increase in population. In addition to this there would be additional annual requirement of timber for repairing existing houses, furniture and agricultural implements etc. also.

Since the year 1982-83 the Govt. have imposed a moratorium on commercial felling of trees in the forest. Before the moratorium was placed, the recorded production of timber from the forests was to the tune of 3000 cu.m. and firewood to the tune of 10,000 metric tonnes per year. Almost all of this production was disposed of by auction either through the contractors or through the agency of Forest Cooperative Societies and very little was actually available for consumption in the territory. It is thus clear that most of the needs of the people for firewood and a large proportion of timber used for house consumption etc. were met through unrecorded production from the forests. This trend is likely to continue during the period of moratorium also.

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ANNEXURE - I

Glossary of local names with corresponding botanical names of common trees, herbs and shrubs found in Dadra and Nagar Haveli

S.No.	Local Name		Botanical Name
1.	Teak	-	Tectona grandis
2.	Sadad	-	Terminalia crenulata
3.	Haldwan	-	Adina cordifolia
4.	Tiwas	-	Ougeinia dalbergioides or O. oojeinensis
5.	Siras	-	Albizzia lebbek
6.	Pangara	-	Erythrina indica
7.	Bondar	-	Lagerstroemia parviflora
8.	Kakad	-	Garuga pinnata
9.	Mahuda	-	Madhuca latifolia
10.	Asan	-	Bridelia retusa
11.	Khair	-	Acacia catechu
12.	Kanti	-	Acacia ferruginea
13.	Bio	-	Pterocarpus marsupium
14.	Killai	-	Albizzia procera
15.	Kandel	-	Sterculia urens
16.	Dhawada	-	Anogeissus latifolia
17.	Sawar	-	Bombax ceiba
18.	Papda	-	Heloptelea integrifolia
19.	Bahedas	-	Terminalia belerica
20.	Phaman	-	Grewia tiliaefolia
21.	Shisham	-	Dalbergia latifolia
22.	Dandoshi	-	Dalbergia species
23.	Karmal	-	Dillenia pentagyna
24.	Amba	-	Mangifera indica
25.	Petar	-	Trewia nudiflora
26.	Seven	-	Gmelina arborea
27.	Jambul	-	Syzygium cuminii
28.	Modad	-	Lannea coromandelica
29.	Kumbhio	-	Careya arborea
30.	Timru	-	Diospyros melanoxylon
31.	Kharoti	-	Ficus species
32.	Kudi	-	Wrightia tinctoria
33.	Awla	-	Emblica officinalis
34.	Aledi	-	Morinda tinctoria
35.	Kirmira	-	Casearia tomentosa
36.	Ashitro	-	Bauhinia racemosa
37.	Bhava	-	Cassia fistula
38.	Khakher	-	Butea monosperma
39.	Ghatbor	-	Zizyphus xylopyra
40.	Goli	-	Trema orientalis
41.	Umbar	-	Ficus glomerata
42.	Adu	-	Vangueria spinosa
43.	Payar	-	Ficus rumphii
44.	Manvelbans	-	Dendrocalamus strictus
45.	Katas bans	-	Bambusa arundinacea

46.	Murudasing	-	Helicteres isora
47.	Karvand	-	Carissa carandas
48.	Nirgudi	-	Vitex negundo
49.	Ukshi	-	Calycopteris floribunda
50.	Rui	-	Calotropis gigantea
51.	Kuda	-	Holarrhena antidysenterica
52.	Ranbhendi	-	Thespesia macrophylla
53.	Ranambadi	-	Hibiscus tetraphyllus
54.	Chikta	-	Desmodium pulchellum

CLIMBERS

1.	Bokarvel	-	Combretum ovalifolium
2.	Palascel or Vadvel	-	Butea superba
3.	Garvel	-	Tinospora cordifolia
4.	Nandanvel	-	Vitis repanda
5.	Chilhar	-	Acacia intsia
6.	Kangvel	-	Ventilago madraspatana
7.	Toran	-	Zizyphus rugosa
8.	Tanvel	-	Cocculus villosus
9.	Kawich or quili	-	Mucuna pruriens

GRASSES

1.	Polad	-	Spodiopogon rhizophus
2.	Dab	-	Cymbopogon martinii
3.	Valchond	-	Vetiveria zizanoides
4.	Gandhei	-	Chloris incompleta

ANNEXURE-II

BIBLIOGRAPHY

1. Working Plan of Dadra and Nagar Haveli
2. Census Report of Dadra and Nagar Haveli - 1981.

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