Chapter IV

NATURAL RESOURCE BASE
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IV.1 INTRODUCTORY STATEMENT:

A natural resource can be defined as a natural endowment which is value to man. Basically the natural resources can be divided into two categories, i.e., renewable and non-renewable.

(1) Non Renewable resources are those which are exhausted after use.

(2) Renewable Resources are self-regenerative. Resources are also divided into the following two types according to the sources from which they are derived:

(a) Physical Resources, such as water, soil and minerals; and,

(b) Biotic Resources, such as those derived from plants and animals.

Renewable resources are those which may be used repeatedly without getting exhausted, since they regenerate themselves in the natural state or are regenerated through intelligent human intervention. Such resources are available continuously and are also called flow resources.¹

The non-renewable resources are always found in limited quantities, such as minerals. These can be used once as they get exhausted after one-use.

The renewable resources are relatively more important in the region than the non-renewable resources. Among the non-renewable resources mention may be made of various minerals extracted from the region. The mining and quarrying activities are poorly developed which speaks of the low level of resource identification. Nevertheless, the region is rich in renewable resources, both physical and biotic.

The natural resource base of the region can be studied by recognising the following categories:

(i) Forest Resources
(ii) Animal Resources
(iii) Mineral Resources
(iv) Soil Resources
(v) Water Resources

Forest resources are of prime importance in the region since the exploitation of these resources have yielded income since long. Although the region has a tremendous potential of water resources, they have not been properly utilized.
IV.2  FOREST RESOURCES:

The Himalayan Chenab Basin presents a picture of highly rugged and complex topography and is characterised by a limatic diversity from subtropical to sub-polar conditions. These environmental factors have profusely influenced the vegetal cover. The typical Himalayan flora and other vegetal cover are represented in the region ranging between high altitude rhododendrons to sub-tropical scrub vegetation.\(^2\) North-east, east and southeastern parts have characteristically wet temperate forests which give way to sub-tropical dry scrub towards the south-west. Forests mostly occupy the mountain slopes and valleys. The northern slopes are thickly wooded with undergrowth of minor varieties.

IV.2.1 Classification of Forests:

As characteristic of the temperate zones the forests in the region are mostly constituted by the coniferous species. Such forests are occasionally mixed with the broad-leaved species at lower altitudes, rising well above the surface growth and luxuriant undergrowth in higher altitude zones.\(^3\)

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2. J.C. Sharma, Floral Regime of the Pir Punjal, unpublished M.Phil. thesis submitted to the Punjab University, Botany Department, 1978.

The forests can be classified as follows:

(i) Alpine Forests:

The high level forests generally existing above 3,000 metres are characteristically alpine. The major species found are Abies Pindrow, Abies Webiava and Pinus excelsa. Occassionally Junipers occupy areas even above 4,000 metres. Betula utilis is the major broad-leaved associate of these species at higher altitude, whereas rhododendron gives them company below the form in which Betula utilis grows.

Other alpine species can be categorised into two groups.

(i) Alpine meadows, and
(ii) Alpine scrub forests

Alpine meadows extend up to an altitude of 4,500 metres. A number of minor forest species grow in alpine meadows outstanding of which are saussurea lappa (Dhoop) etc. Picrorhiza kurrooa (Kour) is quite sensitive to altitude and grows strictly between 3,000-4,000 metres. Similarly jurinia macrocephala (Dhoop) also grows strictly above 3,000 metres but sometimes crosses the upper limit, depending upon the aspect and climatic conditions. Another species usually found at 3,000-4,000 metres is Sassurea
Lappa (kuth) crosses the lower limits and grows even at an elevation of 2,500 metres. Yet another alpine species known as *Bergenia liquulata* is also important.

Animitry alpine scrub grows over a wide range of altitude between 1,800 metres and 4,000 metres depending upon aspect and climatic conditions. The most common alpine scrubs are *Aconitum chasmantham* with its best flourishing zone lying between 2,100 metres to 4,000 metres.

*Abies webiana* is found in Kishtwar division, whereas *Abies pindro* and *Pinus excelsa* cover large areas in all the divisions of the region. *Betula utilis* is the commonest associate in upper reaches of Bhaderwah, Doda and Kishtwar divisions. The alpine meadow and scrub species are found all over the region with varying degrees of concentration.

(ii) Himalayan Moist Temperate Forests:

These forests are found in the areas lying between the altitudinal zone of 1,800 metres and 3,000 metres with small adjustments with aspect and configuration, *i.e.*, along the northern slopes they even come down to 1,500 metres whereas along the southern slopes (which are a relatively drier) they are not found below 2,000 metres. This zone is characterized adequate rainfall and heavy to moderate snowfall. The terrain and climatic conditions in
this zone are best suited to the growth of *Cedrus deodara* (Deodar). The major forest species associated are *Abies pindrow*, *Picea morinda* and *Pinus excelsa*. All these species need well-drained soil and low temperature conditions and hence they grow comfortably along the slopes. *Cedrus deodara* is very sensitive to water-logging and hence its growth is always poor in low-lying areas with abundant water supply. *Pinus excelsa* germinates quickly and hence its population increases very fast. The ideal elevation for *Pinus excelsa* is above an elevation of 1,900 metres.

*Abies pindrow* is very slow in growth. It grows in areas which are not suited to the growth of other species. It has been noticed that in the ecotone the *Abies pindrow* flourishes in the ravines where the seedlings are not disturbed by the alien forces, e.g. animal and human forces. It flourishes above 2,000 metres and may be found upto 4,000 metres or above.

The main broad-leaved species associated with these forests are *Quercus Incana* and *Quercus dilatatae*. Temperate scrub varieties are artinisa in Kishtwar division between

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Colchicum luteum is common between 1,600 to 2,700 metres. Heracleum condin is abundant between 2,000 to 3,000 metres in all the divisions of the region. Vrota oderata grows between 1,500 to 2,000 metres in Doda, Ramban and Bhaderwah divisions, and Walerina walichii grows between 1,800 to 2,000 metres throughout the region. A very important species known as Mallotus philipensis grows almost everywhere in the region irrespective of climatic and physical conditions.

(iii) Himalayan Dry Temperate Forests:

For this type of forests the altitudinal and climatic conditions are more or less similar to those of the moist temperate forests. Rainfall and aspect are the main factors controlling the growth of forests. Here the rainfall is scanty and the forests inhabit the southern slopes. The conifers have similar characteristics again as found in wet temperate forests but the major different is that the species like rhododendrons, desmodium and oaks are altogether absent. The Parrotia shrub has a very dense undergrowth in the cedrus deodara belt. Asculus and walnut are the major broad-leaved species.

(iv) Sub-tropical Pine Forests:

The zone lying between 800 to 1,400 metres is the
habitat of sub-tropical pine forests. Sub-tropical pine forests are dominated by Pinus roxburghii, which occurs pure over vast stretches. The limits of these forests extend right upto Bhala in Bhaderwah and Hasti in Kishtwar. Wild oak is quite common above 1,000 metres, whereas Mallotus philipensis is quite common even at 900 metres.

(v) Sub-Tropical Dry Evergreen Forests:

These forests occur along the lower altitude zones in the region. Just below the Pinus roxburghii zone Olea cuspidata, Pistacia integerrina, Dodonea ciscosa and Vasica callatropis are the common species.

IV.2.2 Area Analysis of Forests:

The region extends over 11.6 per cent of the total area of the state on this side of the actual line of control. Ladakh alone accounts for 57.96 per cent and the rest of the area is shared by Jammu region and Kashmir valley accounting for 14.62 per cent and 15.82 per cent respectively. So far as the total forest area is concerned it is the lowest in this region accounting for 28.5 per cent of the state's forest area, whereas the proportion of forest area in the valley of Kashmir is highest with 40.2 per cent followed by Jammu region with 32.3 per cent of the state forest area. There has been a substantial decrease in the area under forests during 1965-66 to 1975-76 to the tune of
10.3 per cent due to varied reasons, i.e., unlawful felling for construction purposes, encroachment of forest land and unregulated leasing of forests etc.

As much as 48.9 per cent of the geographical area of the region is under forests. The region consists of four forest divisions, namely, Ramban, Doda, Kishtwar and Bhaderwah. It can be observed from Table IV.2 that about one-half of the area of the region is under forests. Ramban forest division has the highest proportion of area under forests accounting for a little more than 75.65 per cent, whereas the proportion of area under forests to total area of the division is lowest in Kishtwar accounting for 41.1 per cent. The distribution of forest area of the region is far from uniform among the four divisions. Kishtwar division alone accounts for 55.72 per cent of the total forest area of the region with the share of Doda division accounting for 12.6 per cent, Ramban with 14.39 per cent and Bhaderwah 17.27 per cent (Table IV.1).

The distribution of area by individual species has marked variations. In case of Cedrus deodara Bhaderwah and Doda divisions collectively account for 35 per cent of the area of the state under this variety followed by Kishtwar and Ramban with 9 per cent and 4.8 per cent respectively.
TABLE IV.1

Forest Area

<table>
<thead>
<tr>
<th>Sl. No.</th>
<th>Division</th>
<th>Geog. Area</th>
<th>Forest Area</th>
<th>% Forest Area</th>
<th>Concentration Index</th>
</tr>
</thead>
<tbody>
<tr>
<td>1.</td>
<td>Doda</td>
<td>1072.0</td>
<td>726.65</td>
<td>67.76</td>
<td>12.6</td>
</tr>
<tr>
<td>2.</td>
<td>Bhaderwah</td>
<td>1362.86</td>
<td>995.74</td>
<td>70.15</td>
<td>17.27</td>
</tr>
<tr>
<td>3.</td>
<td>Ramban</td>
<td>1096.09</td>
<td>829.34</td>
<td>75.65</td>
<td>14.39</td>
</tr>
<tr>
<td>4.</td>
<td>Kishtwar</td>
<td>7313.78</td>
<td>3212.19</td>
<td>41.10</td>
<td>55.72</td>
</tr>
<tr>
<td></td>
<td><strong>Total</strong></td>
<td><strong>11344.73</strong></td>
<td><strong>5763.92</strong></td>
<td><strong>50.8</strong></td>
<td><strong>100.00</strong></td>
</tr>
</tbody>
</table>

Source: Annual Administration Reports, 1978-79.
(Table IV.2). The two divisions - Bhaderwah and Doda - account for more than 71 per cent of the area of the region under this species (Table IV.2). *Pinus excelsa* has lower proportion of area (33.87 per cent) in this region as compared to the Kashmir valley (56.7 per cent), whereas Jammu region accounts for only 9.43 per cent of the forest area of state under this species. Within the Chenab basin the distribution of area under this species varies between 15.3 per cent in Kisthwar to 37.3 per cent in Doda. In the other two divisions, *viz.* Bhaderwah and Ramban its proportion is uniform accounting for 23.7 per cent of the area under this species (Table IV.2). The area under *Abies pindrow* accounts for 29.85 per cent of the total area of the state under this species. Doda division alone accounts for 12.13 per cent of the state's area under this species. However, in variations are well marked with Doda division alone accounting for 40.6 per cent of the area under this species and the rest of the area is almost uniformly distributed with lowest proportion in Ramban division. In case of the low altitude species *Pinus roxburghii* is most important. Of the total area of the state under this species this region accounts for only 5.69 per cent. Jammu region alone accounts for 94.31 per cent of the state's area under this species. So far as the Chenab basin is
TABLE IV.2

Speciewise Area

<table>
<thead>
<tr>
<th></th>
<th>Percentage to the state Forest Area</th>
<th></th>
<th>Percentage area to the region</th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>C.D.</td>
<td>P.E.</td>
<td>A.P.</td>
<td>P.R.</td>
</tr>
<tr>
<td>1. Kishtwar</td>
<td>0.09</td>
<td>5.16</td>
<td>6.43</td>
<td>-</td>
</tr>
<tr>
<td>2. Bshaderwah</td>
<td>17.49</td>
<td>8.03</td>
<td>6.2</td>
<td>0.01</td>
</tr>
<tr>
<td>3. Doda</td>
<td>16.94</td>
<td>12.64</td>
<td>12.13</td>
<td>0.18</td>
</tr>
<tr>
<td>4. Ramban</td>
<td>4.81</td>
<td>8.04</td>
<td>5.09</td>
<td>5.5</td>
</tr>
<tr>
<td>Total</td>
<td>48.83</td>
<td>33.87</td>
<td>29.85</td>
<td>5.69</td>
</tr>
<tr>
<td>Kashmir Valley</td>
<td>42.7</td>
<td>56.7</td>
<td>49.03</td>
<td>0.00</td>
</tr>
<tr>
<td>Jammu Region</td>
<td>8.53</td>
<td>9.43</td>
<td>21.12</td>
<td>94.31</td>
</tr>
</tbody>
</table>

Source: Forest Digest, Handbook of Forest Statistics, 1978

Note: C.D. = Cedrus Deodara or Deodar
P.E. = Pinus Excellsa or Kail
A.P. = Abies Pindrow or Fir
P.R. = Pinus Roxiburgii or Chir
concerned, Kishtwar division is devoid of this species, while Bhaderwah division accounts for 0.3 per cent of the area, followed by Doda with 3.26 per cent. Ramban division has the high proportion accounting for 96.44 per cent.

The intra regional pattern of distribution of area under various species highlights the fact that area under Cedrus deodara, Pinus excelsa and Abies Pindrow is lowest in Ramban division whereas in case of Pinus roxburghii the case is entirely opposite. This fact can be explained in the light of topographic and climatic conditions. As mentioned in the previous chapter the general altitude increases towards the north and east with consequent decrease in the total intake of leaf. The high altitude and low temperature conditions are well-suited to the growth of Cedrus deodara, Pinus excelsa and Abies pindrow, whereas the case is reverse with Pinus roxburghii. In different divisions different species dominate the total area under major forest species. Doda and Kishtwar divisions are dominated by the area under Abies pindrow whereas in Bhaderwah division Cedrus deodara dominates in area. In case of Ramban division it is the Pinus roxburghii which covers more than 96 per cent of the area (Table IV.2).

Regional patterns in the distribution of area under different species at range-level bring to light the high
HIMALAYAN CHENAB BASIN IN JAMMU AND KASHMIR
RANGEWISE DISTRIBUTION OF AREA UNDER MAJOR FOREST SPECIES
1978-79

PERCENTAGE SHARE OF MAJOR SPECIES IN FOREST AREA

FIR
DEODAR
KAIL

Click to buy NOW!
P
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degree of variations. In case of area under Deodar 56.5 per cent of this area is concentrated in just five ranges e.g. Neeru, Kellar, Udil, Marwah and Siraj; the area under Pinus excellsa is concentrated in Bhalessa, Siraj, Ramban, Desa and Udil accounting for 54.8 per cent of the region's area under this species, Abies pindrow is concentrated in Bhalessa, Desa, Udil, Marwah and Ramban ranges (56.2 per cent) and 89.8 per cent of the Pinus roxburqii area of the region is concentrated in Lander, Ramban and Banihal ranges (Table IV.3). The high degree of variation in the distribution of area can be explained in the light of specific ecological conditions which favour the growth of these species.

Intra-range variations are also very high in the distribution of area under various species - depending upon the local condition of relief, aspect and climate. In the southern part of the region, comprising Killar, Neeru and Chirala ranges the proportion of area under Deodar (Cedrus deodara) is above 50 per cent of the forest area of the ranges (Fig. 4.1). It decreases both towards the east, west and north of this zone of concentration (Fig. 4.1). Area under Abies pindrow dominates in the north-east comprising Marwah, Udil, Dachhan, Kishtwar, Poddar, Nagsin and Bhalessa ranges forming a compact block. Ram-
**TABLE IV.3**

Percentage Area Distribution

<table>
<thead>
<tr>
<th>Range</th>
<th>% area under Deodar</th>
<th>% area under Kail</th>
<th>% area under Fir</th>
<th>% area under Chir</th>
</tr>
</thead>
<tbody>
<tr>
<td>1. Neeru</td>
<td>65.2</td>
<td>12.8</td>
<td>21.98</td>
<td>-</td>
</tr>
<tr>
<td>2. Killar</td>
<td>62.1</td>
<td>14.47</td>
<td>23.5</td>
<td>-</td>
</tr>
<tr>
<td>3. Chirala</td>
<td>50.8</td>
<td>35.3</td>
<td>13.5</td>
<td>0.3</td>
</tr>
<tr>
<td>4. Bhales</td>
<td>15.58</td>
<td>36.3</td>
<td>48.12</td>
<td>-</td>
</tr>
<tr>
<td>5. Udil</td>
<td>30.9</td>
<td>23.6</td>
<td>48.45</td>
<td>-</td>
</tr>
<tr>
<td>6. Thakrai</td>
<td>37.4</td>
<td>22.5</td>
<td>39.9</td>
<td>-</td>
</tr>
<tr>
<td>7. Siraj</td>
<td>23.4</td>
<td>38.38</td>
<td>37.58</td>
<td>0.6</td>
</tr>
<tr>
<td>8. Kontwara</td>
<td>19.01</td>
<td>27.96</td>
<td>52.8</td>
<td>0.2</td>
</tr>
<tr>
<td>9. Marmat</td>
<td>24.1</td>
<td>30.47</td>
<td>44.3</td>
<td>1.1</td>
</tr>
<tr>
<td>10. Batote</td>
<td>15.86</td>
<td>39.5</td>
<td>5.9</td>
<td>38.7</td>
</tr>
<tr>
<td>11. Lander</td>
<td>11.9</td>
<td>26.5</td>
<td>15.8</td>
<td>45.7</td>
</tr>
<tr>
<td>12. Ramban</td>
<td>9.3</td>
<td>38.46</td>
<td>44.57</td>
<td>7.6</td>
</tr>
<tr>
<td>13. Banhal</td>
<td>16.5</td>
<td>23.1</td>
<td>54.28</td>
<td>6.1</td>
</tr>
<tr>
<td>14. Kishwan</td>
<td>24.2</td>
<td>27.5</td>
<td>48.2</td>
<td>-</td>
</tr>
<tr>
<td>15. Nagsin</td>
<td>14.6</td>
<td>32.3</td>
<td>48.25</td>
<td>-</td>
</tr>
<tr>
<td>16. Paddar</td>
<td>24.2</td>
<td>27.5</td>
<td>48.2</td>
<td>-</td>
</tr>
<tr>
<td>17. Dachhan</td>
<td>15.5</td>
<td>34.15</td>
<td>50.3</td>
<td>-</td>
</tr>
<tr>
<td>18. Marwah</td>
<td>20.9</td>
<td>24.8</td>
<td>54.2</td>
<td>-</td>
</tr>
</tbody>
</table>

Source: Annual Administration Reports 1978-79.
INTRA RANGE DOMINANCE OF AREA: MAJOR
FOREST SPECIES 1978–79

1. NEERU RANGE
2. KILLAR
3. CHIRALA
4. BHALESIA
5. UDIL
6. THAKRAI
7. SIRAJ
8. KONTWARA
9. MARMAT
10. BATOTE
11. LANDER
12. RAMBAN
13. BANIHAL
14. KISHTWAR
15. NAGSIN
16. PADDAR
17. DACHHIN
18. MARWAH
ban and Banihal form a compact block in the west, whereas Kontwara is an outlier. Pinus excelsa dominates in two of the ranges, e.g. Batote and Siraj but here there is strong competition with one or the other species. In Batote range Pinus excelsa with 39.5 per cent of the forest area is closely followed by Pinus roxburghii with 38.7 of its forest area. In Siraj range the main competitor is Fir (Abies Pindrow) which is only 0.6 per cent behind the Pinus excelsa. The distribution of this species does not form any particular pattern (Fig. 4.1). Area under Pinus roxburghii is significant in Lander range only where about 46 per cent of the forest area is under the species. In the area analysis ranges namely Siraj and Batote are dominated by Kail, in three ranges viz. Kellar, Chirala and Neeru Deodar dominates, in Lander range Chir is the most important variety and the rest of the ranges are dominated by Fir (Fig. 4.2).

IV.2.3 **Distribution of Population of Major Forest Species:**

The population statistics of various major forest species reveal the immensity of the resource value of the forest wealth of the region. Unfortunately the statistics are not available at range level whereas it is easier to count the trees at lower level (beat level). The population statistics are compiled by the working plan divisions. The population statistics of the major forest species have been based on the Forest Digest, Published by the Forest Department, 1978.
once in a decade. This makes the problem more difficult in the sense that one cannot analyse the temporal behaviour of the growth stock. Present population analysis is based on secondary data at division level for the year 1975-76.

In the case of distribution of population of major forest species the region ranks first in Cedrus deodara, Pinus excelsa and Abies pindrow. In case of Cedrus deodara the region accounts for 50.76 per cent population of the state followed by Kashmir valley with 37.7 per cent and Jammu region with 11.55 per cent (Table IV.4). Similar is the case with Pinus excelsa, the region accounting for 53.8 per cent of states population of this species and the remainder being shared equally by Jammu and the Kashmir valley (Table IV.4). The region leads in the population of Abies Pindrow with 48.96 per cent of the state's population followed by the valley of Kashmir. Intra-regional variations in the distribution of population of major forest species are too high. Taking the case of Cedrus deodara Bhaderwah division alone accounts for 48.98 per cent of the Cedrus population of the region closely followed by Doda division (31.75 per cent) whereas Ramban division accounts for only 4.7 per cent of the region's population of Cedrus deodara. The population of Pinus excelsa also concentrated in Bhaderwah and Doda

TABLE IV.4

Percentage Distribution of Population of Major Forest Species

<table>
<thead>
<tr>
<th>Division</th>
<th>% Population to the Total of State</th>
<th>% Population to the total of the Region</th>
<th>% Population to the total of the Division</th>
</tr>
</thead>
<tbody>
<tr>
<td>Kishtwar</td>
<td>7.4</td>
<td>3.47</td>
<td>9.57</td>
</tr>
<tr>
<td>Bhaderwah</td>
<td>24.87</td>
<td>22.31</td>
<td>25.03</td>
</tr>
<tr>
<td>Doda</td>
<td>16.1</td>
<td>18.39</td>
<td>16.28</td>
</tr>
<tr>
<td>Ramban</td>
<td>2.39</td>
<td>4.79</td>
<td>2.96</td>
</tr>
<tr>
<td>Region Total</td>
<td>50.76</td>
<td>48.96</td>
<td>53.84</td>
</tr>
<tr>
<td>Jammu Region</td>
<td>11.55</td>
<td>6.4</td>
<td>22.57</td>
</tr>
<tr>
<td>Kashmir Valley</td>
<td>37.69</td>
<td>44.64</td>
<td>23.59</td>
</tr>
</tbody>
</table>

division accounting for 45.6 per cent and 37.5 per cent respectively. Ramban and Kishtwar divisions have relatively lesser proportion in Pinus *excellsa* population accounting for 9.8 per cent and 3.1 per cent respectively. The position of *Abies pindrow* population is none too different from that of the other two species. Here again Bhaderwah division leads with 46.5 per cent of the region's *Abies pindrow* population followed by Doda (30.2 per cent), whereas the lowest proportion (5.2 per cent) is associated with Ramban division. *Pinus roxiburgii* according to the official statistics is the monopoly of the Ramban division but in fact it is not true. It has been observed in the field-work that *Pinus roxiburgii* grows as far as Bhala in Bhaderwah division, in Doda division dense groves of *Pinus roxiburgii*, along the right and left bank slopes of the Chenab are quite common.

The region as a whole is dominated by *Abies Pindrow* and *Pinus excellsa* accounting for 37.6 and 34.1 per cent, respectively, of the total population of the major forest species. The proportion of *Pinus roxiburgii* in the region's population is as low as 0.6 per cent (Table IV.4). The forest population of Kishtwar division is dominated by *Abies pindrow*, that of Bhaderwah by *Cedrus deodara* and those of Ramban and Doda by *Pinus excellsa* (Fig. 4.3).
The dominance of all these species (Abies pindrow, Pinus excelsa and Cedrus deodara) is controlled by the altitudinal condition. Kishtwar division where the tree-line extends even above 4,000 metres and the climate is very cold Abies pindrow is the happy dweller. In Bhaderwah the climatic and tropographic conditions such as moderate slope, adequate amount of rainfall and sufficient sunshine are more suitable for Cedrus deodara. As a result of high rainfall the Neeru valley has wet temperate forest species dominating all over.

IV.2.4 Girthwise Distribution Patterns:

The girthwise distribution of population of major forest species is a more meaningful indicator of the resource-value of the forests. A tree is considered fit for felling when its girth at breast height reaches 30 centimetres. The economic value of the stock rests in the proportion of population at various girth levels. In other words if the percentage of population in higher girth categories is higher the volume available will also be higher and vice-versa.

In almost all the divisions the percentage of population in the 30-40 centimetre girth is highest for Cedrus deodara and declines as the girth increases (Table IV.5). In Kishtwar, Bhaderwah and Ramban divisions this
TABLE IV.5
Girthwise % Distribution of Population
(1975-76)

<table>
<thead>
<tr>
<th>Divisions</th>
<th>30-40 cms.</th>
<th>40-50 cms.</th>
<th>50-60 cms.</th>
<th>60-70 cms.</th>
<th>70-80 cms.</th>
<th>80-90 cms.</th>
<th>90-100 cms.</th>
<th>100+ cms.</th>
</tr>
</thead>
<tbody>
<tr>
<td>Zadar</td>
<td>36.7</td>
<td>25.98</td>
<td>16.5</td>
<td>9.4</td>
<td>6.2</td>
<td>2.97</td>
<td>1.2</td>
<td>0.9</td>
</tr>
<tr>
<td>Bhaderwah</td>
<td>43.4</td>
<td>25.4</td>
<td>16.5</td>
<td>7.4</td>
<td>3.4</td>
<td>1.9</td>
<td>0.8</td>
<td>1.2</td>
</tr>
<tr>
<td>Dodda</td>
<td>24.87</td>
<td>22.5</td>
<td>23.2</td>
<td>25.1</td>
<td>2.56</td>
<td>0.9</td>
<td>0.31</td>
<td>0.56</td>
</tr>
<tr>
<td>Ramban</td>
<td>33.56</td>
<td>24.8</td>
<td>16.61</td>
<td>10.12</td>
<td>5.97</td>
<td>3.5</td>
<td>2.14</td>
<td>3.3</td>
</tr>
</tbody>
</table>

**Cedrus Deodara**

<table>
<thead>
<tr>
<th>Divisions</th>
<th>30-40 cms.</th>
<th>40-50 cms.</th>
<th>50-60 cms.</th>
<th>60-70 cms.</th>
<th>70-80 cms.</th>
<th>80-90 cms.</th>
<th>90-100 cms.</th>
<th>100+ cms.</th>
</tr>
</thead>
<tbody>
<tr>
<td>Zadar</td>
<td>40.34</td>
<td>23.8</td>
<td>18.62</td>
<td>10.2</td>
<td>4.35</td>
<td>1.66</td>
<td>0.64</td>
<td>0.4</td>
</tr>
<tr>
<td>Bhaderwah</td>
<td>47.1</td>
<td>16.79</td>
<td>23.34</td>
<td>6.03</td>
<td>4.5</td>
<td>0.94</td>
<td>0.55</td>
<td>0.1</td>
</tr>
<tr>
<td>Dodda</td>
<td>23.4</td>
<td>26.9</td>
<td>22.3</td>
<td>25.0</td>
<td>2.35</td>
<td>0.04</td>
<td>0.01</td>
<td>0.04</td>
</tr>
<tr>
<td>Ramban</td>
<td>29.61</td>
<td>25.03</td>
<td>20.73</td>
<td>12.29</td>
<td>6.34</td>
<td>3.15</td>
<td>1.48</td>
<td>1.31</td>
</tr>
</tbody>
</table>

**Pinus Excellsa**

<table>
<thead>
<tr>
<th>Divisions</th>
<th>30-40 cms.</th>
<th>40-50 cms.</th>
<th>50-60 cms.</th>
<th>60-70 cms.</th>
<th>70-80 cms.</th>
<th>80-90 cms.</th>
<th>90-100 cms.</th>
<th>100+ cms.</th>
</tr>
</thead>
<tbody>
<tr>
<td>Zadar</td>
<td>23.5</td>
<td>25.6</td>
<td>14.2</td>
<td>13.9</td>
<td>10.8</td>
<td>6.3</td>
<td>2.8</td>
<td>2.9</td>
</tr>
<tr>
<td>Bhaderwah</td>
<td>48.8</td>
<td>14.5</td>
<td>11.38</td>
<td>9.9</td>
<td>7.98</td>
<td>4.76</td>
<td>4.66</td>
<td>0.0</td>
</tr>
<tr>
<td>Dodda</td>
<td>18.8</td>
<td>19.0</td>
<td>15.99</td>
<td>15.54</td>
<td>10.33</td>
<td>6.56</td>
<td>5.36</td>
<td>6.42</td>
</tr>
<tr>
<td>Ramban</td>
<td>19.6</td>
<td>15.5</td>
<td>14.14</td>
<td>11.99</td>
<td>10.43</td>
<td>6.4</td>
<td>7.48</td>
<td>12.7</td>
</tr>
</tbody>
</table>

Girthwise Population of Species

**Pinus Excelsa**

- B. BHADERWAH
- D. DODA
- K. KISHTWAR
- R. RAMBAN

**Ciderus Deodara**

Fig. 4.4
decline in percentage population with increase in girth is steep up to 60-70 centimetre girth and becomes gradual as the girth increases. In Doda division the case is rather peculiar. There is a gradual decline from first to second stage of girth and a gradual increase up to 60-70 centimetre girth, followed by an abrupt fall and finally a gradual decline with an increase in girth (Fig. 4.4).

The population of *Pinus excelsa* is also having higher proportion in lower girths and decreases as the girth increases with minimum stock above 100 centimetre girth in all the divisions as compared to the other two species, *i.e.*, *Cedrus deodara* and *Abies pindrow*. In Kish-twar and Ramban divisions there is a continuous and gradual decline, in the percentage of population of *Pinus excelsa*, with increase in girth. In Bhaderwah division there is a sharp decline from first to second stage of girth followed by a sharp increase up to 50-60 centimetres girth which decreases sharply at 60-70 centimetres girth level and after that it declines gradually. In Doda division there is a slight increase from first to second stage of girth followed by a slight decrease at 50-60 centimetres girth, it is again followed by a slight increase. From 60-70 centimetre girth stage to 70-80 centimetres girth stage there is sharp decline in percentage distribution, thereafter the fall is gradual (Fig. 4.4).
The pattern of distribution of *Abies pindrow* in different girths is totally different from the other two species. In case of this species the decline of population is more gradual except in Bhaderwah division where it falls from 48.8 per cent to 14.5 per cent in the second stage but after that the decline is almost uniform in all the divisions. According to the official data the trees with a girth above 100 centimetres are absent in Bhaderwah division. In all other divisions the decline with increase in girth is uniformly low. The outstanding feature in this case is that there is a slight increase in the percentage in the last stage of girth, with exception to Bhaderwah division (Table IV.5).

With reference to table IV.6 and Fig. 4.4 one can infer that the species having lowest economic value has higher percentages in higher stages of girth as we find in case of *Abies pindrow* estimated contract price of which according to 1978 estimates is Rs. 94.00 per cubic metre; *Pinus excelsa*, which is a little more important than *Abies pindrow*, has very low percentage of trees in higher girth categories; the most precious species with the estimated contract price of Rs. 185.97 per cubic metre is *Cedrus deodara* which has moderate percentage of trees in higher girth categories. 7

7. The rates of the growing timber have been estimated by the forest working plans.
GIRTHWISE VOLUME OF GROWING STOCK
OF
MAJOR FOREST SPECIES

FIG. 45
There is a definite relationship between girth of a tree and the volume of timber produced from it. From a deodar tree which has a girth between 30-40 centimetres at breast height 0.75 cubic metre timber can be extracted, whereas a tree of the same species with 90-100 centimetre girth at breast height yields 6.85 cubic metres of timber (Table IV.6). *Abies pindrow* yields relatively higher quantity of volume, e.g. in 30-40 centimetre girth at breast height it yields 0.83 cubic metres of timber and in 90-100 girth at breast height it produces 9.4 cubic metres of timber. The yield of timber per tree under all the categories of girth at breast height is higher in case of *Abies pindrow* whereas in the rest of the species the differences are less pronouncing. *Cedrus deodara* and *Pinus excellsa* both yield similar quantities of timber in 30-40 centimetre girth at breast height (Fig. 4.5). It is only after 70-80 centimetre girth at breast height that volume produced by *Cedrus deodara* increases making the gap of 1.2 cubic metre in the last stage of girth at breast height between the two species (Fig. 4.5). *Pinus roxburgii* has remained in close conformity with *Cedrus deodara*.

The volume of stock of timber existing at the end of 1975-76 in various categories of girth at breast height.
corresponds with the distribution of population of species. Abies pindrow has maximum percentage of volume in higher girth at breast height categories whereas Pinus excelsa has the lowest proportion (Table IV.6). The existing stock of timber in all the divisions is dominated by Abies pindrow.

IV.2.5 Density of Population of Major Forest Species:

Any discussion about the distribution of population remains incomplete without a discussion of the density per hectare. In the region as a whole Pinus excelsa and Abies pindrow have more or less similar ratio of trees to area standing at 181 trees per hectare. Cedrus deodara has a relatively lower tree-area ratio, accounting for 145 trees per hectare (Table IV.7). At the division level the density of Cedrus deodara is the highest in Bhaderwah division accounting for 186 trees per hectare; it is moderate in Kishtwar and Doda divisions accounting for 109 and 128 trees respectively and lowest in Ramban division with only 66 trees per hectare (Fig. 4.6). The density of Pinus excelsa is highest again in Bhaderwah division with 302 trees per hectare followed by Doda division with 161 trees, whereas in Kishtwar and Ramban divisions the density is low with 75 and 66 trees per hectare respectively (Fig. 4.6B). Abies pindrow is thickly concentrated in Bhaderwah division with 283 trees per hectare followed by Kishtwar with 103,
TABLE IV.7

Density of Population of Major Forest Species
(No. of trees/hectare)

<table>
<thead>
<tr>
<th>Division</th>
<th>Deodar</th>
<th>Kail</th>
<th>Fir</th>
<th>Chir</th>
</tr>
</thead>
<tbody>
<tr>
<td>Doda</td>
<td>128.5</td>
<td>161.9</td>
<td>93.8</td>
<td>-</td>
</tr>
<tr>
<td>Bhaderwah</td>
<td>186.7</td>
<td>302.1</td>
<td>283.9</td>
<td>-</td>
</tr>
<tr>
<td>Ramban</td>
<td>66.9</td>
<td>66.2</td>
<td>40.6</td>
<td>19</td>
</tr>
<tr>
<td>Kishtwar</td>
<td>109.8</td>
<td>103.8</td>
<td>75.0</td>
<td>-</td>
</tr>
</tbody>
</table>
whereas in Ramban division the density of *Abies pindrow* is low as 40 trees per hectare.

IV.3 ANIMAL RESOURCES:

Livestock is another major element in the natural resource base of the Chenab basin. The pasture lands are available everywhere in the region with rich and succulent grass is appearing in the summers; climatic conditions are suitable for sheep culture. The livestock rearing has traditionally remained the way of life of the people which still helps in the development of livestock.\(^8\) The livestock in the region consists milch animals, such as cows, buffalos, yaks and goats; of draught animals such as horses, mules and donkeys, and bullocks and yaks.

IV.3.1 General Pattern:

During the year 1978-79 there were 134,781 milch animals in the region. Their population was dominated by an overwhelming majority of cows accounting for 75.97 per cent of the total milch animals followed by buffalos and yaks with 22.81 and 1.22 per cent respectively. The cows are not economically very productive in case of milk as average milk production per unit per day accounts for 1.5

---

<table>
<thead>
<tr>
<th>Animal Type</th>
<th>1960-61</th>
<th>1972-73</th>
<th>Change 60-72</th>
<th>1978-79</th>
<th>Change % 1972-78</th>
</tr>
</thead>
<tbody>
<tr>
<td>Cows+Bulls+Calves</td>
<td>2,25,259</td>
<td>2,22,313</td>
<td>-1.3</td>
<td>2,55,267</td>
<td>+14.8</td>
</tr>
<tr>
<td>Buffaloes</td>
<td>32,523</td>
<td>29,474</td>
<td>-9.3</td>
<td>31,720</td>
<td>+7.62</td>
</tr>
<tr>
<td>Yaks</td>
<td>6,321</td>
<td>5,103</td>
<td>-19.3</td>
<td>4,004</td>
<td>-21.5</td>
</tr>
<tr>
<td>Sheep</td>
<td>1,72,050</td>
<td>1,32,994</td>
<td>-22.7</td>
<td>1,41,751</td>
<td>+6.58</td>
</tr>
<tr>
<td>Goat</td>
<td>75,288</td>
<td>51,851</td>
<td>-31.1</td>
<td>51,245</td>
<td>-1.2</td>
</tr>
<tr>
<td>Horses+Ponies</td>
<td>3,489</td>
<td>3,542</td>
<td>+1.5</td>
<td>3,501</td>
<td>-1.33</td>
</tr>
<tr>
<td>Mules</td>
<td>342</td>
<td>261</td>
<td>-23.7</td>
<td>481</td>
<td>+84.29</td>
</tr>
<tr>
<td>Donkies</td>
<td>622</td>
<td>535</td>
<td>-13.98</td>
<td>389</td>
<td>-27.3</td>
</tr>
<tr>
<td><strong>Total</strong></td>
<td>5,09,573</td>
<td>4,46,073</td>
<td>12.46</td>
<td>4,88,588</td>
<td>9.53</td>
</tr>
</tbody>
</table>
kilogram only. In case of buffalos the milk production ranges between 15 to 20 kg per head per day during summer season. Although milk from goats is also collected but it is not preferred and does not have any commercial value. It is entirely meant for domestic consumption.

The second category of animals is comprised by those used in transportation such as horses, mules and donkey. There is an altitudinal bearing upon the distribution of the three. The horses and mules are found everywhere in the region, whereas as one moves towards the higher altitude areas the donkey gradually vanishes from the scene and above 5,000 feet it is a rare species. In some parts of the region such as northeastern paddar the Bhots use yak as a beast of burden. The total population of animals involved in transportation, according to 1976 statistics, stands at 4,601 in the region which is dominated by the preponderance of horses and ponies which account for 81.1 per cent of the total transportation animals. Mules and donkeys account for 10.45 and 8.45 per cent respectively of the total population of transportation animals in the region (Table IV.8).
The third category includes those animals which help the farmer in the field either in ploughing the field or thrashing of corn. They include bullocks, yaks and in some cases male buffalos. Bullocks and yaks are exclusively used for this purpose. A cross breed of yak locally known as 'chanwar' is more dependable in the agricultural activities and are most economical too. They are (chanwar) more strong than bulls or buffalos and after ploughing the field in June-July they are dragged into the jungle hence saving the fodder collection for them in winter. When winter recedes people set out in their search and are again brought to plough. The total population of animals used in agriculture stands at 90,690 at the end of the year 1978-79. Bullocks dominate the population of animals used in agriculture with 96.66 per cent of the region's total, whereas yaks and buffalos account for 2.24 and 1.1 per cent respectively. Here again the use of buffalos is limited in temprate zone only, that of yaks in areas above 1000 metres of altitude, whereas the use of bullocks is universal.

IV.3.2 Temporal Variations:

The temporal variations in the livestock do not reveal any healthy trends. The total livestock
population declined by a little more than 12 per cent during 1960-61 to 1972-73. The percentage change during this period varies for different species of animals. Population of goats experienced maximum decline accounting for -31.1 per cent; the population of sheep declined by 39,156 heads which accounts for -22.7 per cent; mules and donkies declines by 23.7 and 13.98 per cent respectively. The decline in the number of goats and sheep may be associated to lack of interest among the herdsmen and lack of facilities, medical and economic, for the promotion of livestock activities. During the same period the population of cattle also declined by -1.3 per cent in case of cows, bulls and calves and by -9.3 per cent in the case of buffalos whereas the yaks declined by 19.3 per cent (Table IV.8).

During 1972-73 to 1978-79 the population of cattle, sheep and mules increased but for other categories the decline in the population continued unchecked. In case of cows, bulls and calves the population increased by 14.8 per cent, whereas the buffalos increased by 7.62 per cent. Sheep population experienced a growth of 6.58 per cent and the mules increased by 84.29 per cent.
The increase in the sheep population has taken place due to intensive sheep development programmes taken up during the seventies. The condition by and large has been checked by increasing the medical and economic facilities. In case of goat the rate of decline has come down to -1.2 per cent as against -31.1 per cent during 1961-72 period and almost similar is the case with horses and ponies. The donkies and yaks are declining at a continuously high rate which reveals that their use is fast declining. Yak is declining because the use of cross breed from yak and bull is increasing in agriculture, whereas the donkies are not considered economical.

IV.3.3 Animal Products:

The major raw material and products available from the livestock consist of milk, wool, hides and skins, bones and other by products etc. They may eventually prove to be of great value to the processing industry which may be located within the region and generate employment prospects. This potential has hither to remained untapped.

(a) Milk: Due to unrestricted and inferior breeding and insufficient fodder the average yield of milk from
cows is very low and does not exceed 1.5 kg. per day per cattle. The total availability of milk from cattle is estimated at 41,000 Kgs. of milk per day. During the summer months the availability of milk improves due to the migration of Gujjars to pastures in the region but the supply of this source is not dependable. In the inaccessible areas the Gujjars use their milk in making the butter, ghee and other by products, to sell them at better rates when they retreat to plains during winter. The fat contents of cow and buffalo milk in the area is 6 and 7 per cent respectively. The total daily supply of milk from Gujjars per day is estimated at 30,000 Kgs. Similarly the availability of milk from other milch animals account for 9,000 Kgs. a day. Taking together the total milk supply per day during summer months works out to about 80,000 kgs. According to the human population in the region this works out to 230 grams of milk per head per day during summer. This however, is reduced to one fourth during winter months.

(b) Hides: As noted earlier, there has been a continuous decline in the livestock population since 1956 onwards. The death rate among the livestock popu-
lation has been very high. This is obviously due to the inaccessibility to the nearest veterinary unit from the interior areas. The total buffalo and cow hides in the region as per 1976 data are about 27,698 hides. Owing to utter backwardness and absence of flayers in some remote areas of the region the dead animals are buried along with their skins. This loss is estimated to be 2,500 hides annually leaving 25,000 hides available for export. 9

According to the estimates the weight of a cow hide varies from 12 to 15 kgs. and that of a buffalo between 20-25 kgs. It is therefore, estimated that about 2,900 quintals of raw leather is available annually for leather tanning industry.

(c) Skins: There are about 200 registered slaughter houses in the region. This brings the total availability of skins to the extent of 73,000 per annum. More than 70 per cent of these are of goat and rest are from sheep.

9. There has been no better source of information about the availability of hides in the area. The above statistics have been supplied by the department of industries which according to them are extremely conservative.
(d) Wool: According to the estimates of the revenue department there are 1,41,751 sheep available in the region. The sheep development department claims to have 74,051 cross breed sheep. The local type of sheep yields 900 grams of wool per head. Whereas the cross breed sheep yields about 2 kgs. of wool. The total availability of wool from both local and cross breeds accounts for 1,93,156 kgs. annually.

(e) Goat Hair: The total quantity of goat hair available from the region annually is of the order of about 10,000 quintals. About 300 quintals of it is fleeced by Bakarwals themselves and used for their own personal requirements for making ropes and other saddlery equipment. About 200 quintals of goat hair is exported every year. Nevertheless, this product does not carry much economic value because of its limited use.

IV.3.4 Economic Value of the Animal Resources:

Milk products contribute a sizeable amount to the economy of the region. About 1,000 quintals of ghee is exported from the region annually yielding an income of about 25 lakh rupees. An average income
from buffaloe hides per quintal comes to about 200 to 225 rupees, whereas from cow hides it ranges between 250-280 rupees per quintal. In all about 1,300 quintals of hides are exported from the region annually amounting to Rs. 32,500. Wool constitutes the bulk of the annual income from livestock. During 1973-74 the production of wool worth Rupees 20,94,000 was assessed by the industries department. This amount increased to 35,80,000 during 1978-79.

To conclude the livestock is gaining importance in the recent years especially the sheep culture is getting lot of incentives from the government. Department of sheep husbandry is expanding fast and making experiments to improve the quality of the stuff.

IV.4 MINERAL RESOURCES:

The region is rich in minerals but the mining activity is limited due to the unfavourable terrain and climatic conditions. Quite a large variety of minerals and rocks, which can be used for industrial purposes, are found in the region. The Geological Survey of India and the Directorate of Geology and Mining of the state have conducted surveys from time to time to establish the presence of various minerals
and rock materials in the region. The minerals found in the region can be grouped into four categories.10

(I) Non Metallic Minerals: These include gypsum, lime stone, dolomite, marble, glass sands, graphite, chorundum, tourmaline, kyanite, garnet, quartiz, felspor and beryle.

(II) Base Metals: They include ores of lead (Galena), nickle and copper.

(III) Precious Stones: Among the precious stones saphire is the pride of the region.

(IV) Building Materials: A variety of construction materials area found in the region such as slate marbles, traps, quartzite, cravel and sand stone, gneisses and ordinary clay.

IV.4.1 Distribution Patterns:

(i) Gypsum:

Of the non metallic minerals gypsum is mined on a large scale in Assar, Batote and Ramban areas. According to the estimates of Directorate of Geology and

Mining about 54 million tonnes of this mineral are found in the region. These deposits are mainly located in three narrow tracts:

(i) The Assar Tract lies at a distance of 30 kilometres from Batote between Batote and Doda. Most of the mining sites are located above the road the most famous site is that of Jathi which is located just near the road.

(ii) Kanga Mine is located at a distance of 40 kilometres from Batote on Ramban Dhamkund Road.

(iii) Parlanka Mines - These mines are also located on the Ramban Dhamkund road at a distance of 60 kilometres from Batote.

Ramban tract is the richest in this mineral with the total reserves amounting to 1,77,80,678 tons followed by Assar area with 98,31,908 tons, whereas Batote has 10,43,483 tons. In Ramban area it is found in a tract which is 40 kilometres in length having four important sites namely Bahutkanad, Dhothanwala Khad (Dhothan Jagir), Kanga and Paralnka Thalva. It has been noticed that the gypsum deposits increase as one

11. ibid, pp. 4-6.
moves towards the south western sector of the region.
In Assar too its deposits are found in a 30-kilometre long tract running along the Batote-Doda road. From the point of view of mining activity, accessibility and transportation, the deposits of Assar tract have got an advantage over the other areas in the region because of its open mining and transportation to the road side by the gravity as almost all the mining sites are located above the level of the road. In contrast the Kanga and Paralanka sites are located below the road side and pose lot of transportation problems.

(ii) Dolomite:

Dolomite as such does not occur in the region but dolomitic marble does occur in Thathri sector. Several bands of dolomitic marble, with a thickness varying 5 to 40 metres and the strike length of a few hundred metres, have been located near Thathri. Graphite a mineral of immense value having multifarious uses have been found in the Atholi-Sunjam belt of Paddar mines. The graphite has not yet been mined on a commercial scale due to the unfavourable location of mines which remain under snow for most part of the year. The total quartzites and glass sands also occur in the region though they have not yet been extracted.
Quartzites, found on the Dooldhar ridge facing Kishtwar plateau towards the northeast are of pure white colour. Glass sand has been reported to be found near Banihal town. Tourmaline deposits occur in Paddar in the form of crystals of different sizes. The mineral is extracted, but not on a large scale.

(iii) Base Metals:

Galena is the chief source of lead which is an essential non ferous metal in modern industry. Large reserves of this base metal are found in many parts of the region. The most important site of mining galena is chichha about 25 kilometres north east of Kishtwar town. From this locality this metal has been extracted on a very small scale. In this area the galena beds are 4 to 7 metres in thickness associated with pyrites. Most of these joints are cavity filling type occurring in gaps and joints. The total estimated reserves in the region are about 3,700 tonnes with an average tenor of 4 to 7 per cent lead.

Nickle in the form of nickle ferous pyrites is found at several places with in the crystalline metamorphic rocks of the region. It is found in two localities near Ramsu along the national highway. The first
locality extends from Magarkote to Nachelana for a strike length of more than 5 kilometres and second locality is near Sherbibi about 6 kilometres to the north of the first locality. The traces of nickle along with iron pyrities have also been found in Khelani near Doda most probably existing in strike continuation of the roaks of Ramsu. Nevertheless, the mineral has not yet been mined in the region except for experimental extraction from Ramsu and they were found to be uneconomical. Copper ores occur near Pari Jagir in Ramban tehsil of the region. A 61 to 76 metres wide carbonaceous band of phylites rich in pyrites (Nickel ferrous) have been found from Assar to Khelani running 12 kilometres in length.\(^{12}\) The site east of Ruggi nala is noted for its pyrites.

(iv) Precious Stones:

Amongst the precious stones saphire is mined at Sunjan in Paddar. It is a clear transparent blue variety of chorundum. Paddar is famous for its saphire mining. This famous saphire mine is located at Sunjam which is situated at an elevation of about 4418 metres in Bhutna valley, a right bank tributary of Chenab.

\(^{12}\) ibid, pp. 12-14.
This precious stone was first discovered during the year 1831. Since then the mining has been going on intermittently. The mine is linked by a bridal path with Kishtwar. The mining season is limited to July, August and September months as it remains under snow for rest of the period of the year. Saphire occurs both as primary mineral in some pegmatite veins and secondly accumulations in placers. Its crystals are dispersed in the rock and sometimes make about 60 per cent of the whole vein. It usually occurs as small prisms which are mostly 5 mm. or below in size.

Though the mining of this precious mineral has been going on in this area for more than one hundred and fifty years, yet the mines have not been developed on the lines of modern mechanised mining.

(v) Building Materials:

Building materials occur in various forms in the region such as slates, limestone, marbles, quartzite and building stone. Of all these limestone has been mined on a commercial scale. It forms the basic raw material in the manufacture of cement commonly known as portland cement. In the form of
lime it is utilized in many industries. The limestone in the region occurs in three sectors, with varying qualities, i.e., in Kishtwar, Batote and Banihal sectors.

The Kishtwar limestone is most suitable for the manufacture of cement and blast furnaces. In Kishtwar two important belts of varying thickness are under the mining. A 25 to 50 metres thick band of limestone occurs for about 6 kilometres in length near Sarboil, 30 kilometres east north east of Kishtwar. Another belt of 15 metres thick band with a length of about 2 kilometres occurs in Robarea. Thick bands of limestone also occur in Kalari, Gali, Chensar, Amarsingh Pura, Bunencha area about 50 kilometres south east of Kishtwar.

The marble of Thathri is greyish to white in colour and is medium to coarse grained.\textsuperscript{13} It occurs in thick slabs and contains considerable amount of mica. The marble however does not take a good polish possibly due to the coarseness of the grains and presence of micaceous flakes which often imparts a

\textsuperscript{13} Government of Jammu and Kashmir, Department of Industries, Minerals of Doda Districts, 1975, Memeographed.
dirty look to the stone. The marble of Thathri is being locally used for construction of buildings and a very small quantity is exported from the region. The marble also occurs in Ramsu area located in the old metamorphic rocks lying close to the national highway. This marble is fine grained generally pure white in colour and homogeneous in nature. It is suitable for the production of marble chips for the increasing demand from Srinagar and Jammu. For the construction of houses and other buildings the stone is intensively used but its economic value for the analysis can not be ascertained because of paucity of data.

It has been noticed that though the region is rich in mineral wealth yet they have not been utilized adequately to make full use of its resources except for sapphire, limestone, marble and gypsum which are mined adequately.

IV.5 WATER RESOURCES:

The Chenab and its tributaries are the reservoir of water which is mainly derived from the snow melts with the onset of summer. There is, therefore, a distinctive seasonality in water supply.
The immensity of the water flow is subsumed in the large number of first order stream segments in all the sub-basins of the region. The source of perennial water flow is controlled by the amount of snowfall in winter season and the intensity of rainfall. The average annual flow of water in Chenab is 29,000 million cubic metres at Marala which is the highest among the five rivers of the Indus system, viz. Sutlej, Beas, Ravi, Chenab and Jhelum (Table IV.9). The importance of water resources of the region can be observed from the flow of water as compared to the other rivers of the Indus system (Fig. 4.7a). The average annual flow of water from Chenab accounts for 17.95 per cent of the average.

<table>
<thead>
<tr>
<th>River</th>
<th>Site</th>
<th>Volume of average flow (Million cubic metres)</th>
<th>Percentage</th>
</tr>
</thead>
<tbody>
<tr>
<td>1. Indus including Swat &amp; Kabul</td>
<td>Kala-bagh</td>
<td>1,10,450</td>
<td>53.15</td>
</tr>
<tr>
<td>2. Jhelum</td>
<td>Mangla</td>
<td>27,890</td>
<td>13.42</td>
</tr>
<tr>
<td>3. Chenab</td>
<td>Marala</td>
<td>29,000</td>
<td>13.95</td>
</tr>
<tr>
<td>4. Ravi</td>
<td>Madhopur</td>
<td>8,000</td>
<td>3.85</td>
</tr>
<tr>
<td>5. Beas</td>
<td>Mandi plain</td>
<td>15,800</td>
<td>7.6</td>
</tr>
<tr>
<td>6. Sutlej</td>
<td>Rupar</td>
<td>16,660</td>
<td>8.01</td>
</tr>
<tr>
<td>Total</td>
<td></td>
<td>2,07,800</td>
<td>100.00</td>
</tr>
</tbody>
</table>


annual flow of the Indus system, followed closely by Jhelum with 13.42 per cent (Table IV.9).

As compared to other rivers of Punjab the discharge area ratio of the Chenab calculated by Kayastha, is the highest, with reference to the smallest basin, i.e., Ravi basin. There are three discharge and gauging station on the Chenab river in the district. In the upper course there is a station at Atholi in Paddar area; another station is located at Premnagar and the last station is at Dhamkund in Ramban tehsil. Dhamkund is the last discharge and gauging station in the region. The average annual water discharge of Chenab at Dhamkund station is 25,401 million cubic metres based on 1941-51 data. There is a discharge and gauging station at Sartingal which measures the flow of Neeru river; the flow of Kalnai river is measured at Thatri, and the water flow of Maru-Warwan has a discharge and gauging station at Sunjam near Sonder.

Maru-Warwan is the largest tributary of Chenab with a largest basin area accounting for 4,972 square

kilometres. This river has got the maximum average annual water flow which accounts for 4,960,000,000 cubic metres. Kalnai river has a catchment area of 1471 square kilometres with an average annual water discharge of 2,800 million cubic metres (Table IV.1a). Neeru river has a catchment area of 476.5 square kilometres and the average annual water flow is 2,500 million cubic metres (Fig. 4.7b). There seems to be a definite relationship between the catchment area and the flow of water but this relationship is not much important. Although the discharge in Maru-Warwan is higher than that of Kalnai, the proportion is not the same as it is in the case of area. In area the Maru-Warwan basin is three times that of Kalnai basin whereas the average annual water discharge is only 1.4 times to that of Kalnai. Similarly the Warwan area is more than ten times that of Neeru basin, whereas the water flow is only 1.5 times that of Neeru. This means that the relationship between catchment area and water discharge is not very strong.

There are significant seasonal variations in the flow of water. The average monthly discharge is minimum during the winter season and highest in rainy season (Fig. 4.8). The minimum average monthly dis-
### TABLE IV.1D

**Average Monthly Discharge of Chenab at Dhamkund G & D Site for the Year 1941-51**

<table>
<thead>
<tr>
<th>Million cubic metres</th>
<th>Month</th>
</tr>
</thead>
<tbody>
<tr>
<td>1901</td>
<td>January</td>
</tr>
<tr>
<td>2016</td>
<td>February</td>
</tr>
<tr>
<td>2114</td>
<td>March</td>
</tr>
<tr>
<td>2242</td>
<td>April</td>
</tr>
<tr>
<td>2415</td>
<td>May</td>
</tr>
<tr>
<td>2716</td>
<td>June</td>
</tr>
<tr>
<td>2981</td>
<td>July</td>
</tr>
<tr>
<td>3136</td>
<td>August</td>
</tr>
<tr>
<td>2937</td>
<td>September</td>
</tr>
<tr>
<td>2514</td>
<td>October</td>
</tr>
<tr>
<td>2015</td>
<td>November</td>
</tr>
<tr>
<td>1928</td>
<td>December</td>
</tr>
<tr>
<td>25401</td>
<td>Annual Total</td>
</tr>
</tbody>
</table>

**Discharge Sites**

1. Dhamkund Chenab
2. Prem Nagar Chenab
3. Arthal (Atholi) Chenab
4. Sartingal-on Neeru
5. Suguin-Maru-Warwan

(1) **Average Annual Flow of Neeru at Sartingal**

= 2500 Million Cubic Metres

(2) **Average Annual Flow of Kalnai at Thatri**

= 2800 Million Cubic Metres

(3) **Average Annual Flow of Marau-Warwan at Suguin (Soundar)**

= 3960 Million Cubic Metres.

**Source:** National Water & Power Commission, New Delhi
charge has been recorded during the month of January accounting for 19.6 million cubic metres. From August to September the average discharge decreases slightly but after September the decline in the discharge is quite sharp upto November. From November to January the decrease is again gradual.

The discharge starts increasing after February (Table IV.1a).

To sum up the water resources of the region have a very high potential for the development of irrigation and hydropower. At present the waters of Neeru are being utilized for the generation of hydro-electricity. On the same pattern waters of Bichlari, Kalnai, Bhutna and Maru-Warwan can be utilized for local needs, provided it is realized that such a rud exists. However, it is a matter in which political decision-making is for more important. The hydro-power potential of the region is thus in striking contrast to the rigorous cold environment which make living very difficult without electrification. 17

17. Recently a 250 crore rupees Dul Husti project has been undertaken in the central sector to utilize the waters of Chenab river for the generation of power. First phase of the project has been estimated to be completed in 5 year to generate 300 megawatt hydro-power.
The development of irrigation, on the other hand, is severely constrained by topographic factors. Irrigation water should be available at the level at which the land exists. This would imply enormous investment in lift irrigation or damming the river channels at various points for diverting the water supply to the agricultural fields. Reference may, however, be made to the Indus Water Treaty with Pakistan which places an embargo on the utilization of the Chenab waters.

IV.5 CONCLUDING STATEMENT:

The above summary of the natural resource base of the region throws ample light on the potential which exists for development. The lack of correspondence between the natural resources and the level of development is, however, understandable only within the context of political economy of development.

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