

## FORESTS AND FORESTRY IN NORTHERN AREAS

(Part—I)

by

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## BASIC FACTS

Northern areas, located in the extreme north of Pakistan, cover 70,235.62 Km<sup>2</sup> or 7,023,562 hectares. The tract is bounded by Afghanistan, Peoples Republic of China and Indian held territory of Kashmir on its north; Chitral on its west; Kohistan areas of Swat and Hazara in the southwest and south. Kaghan and Azad Kashmir share the southern borders whereas south eastern, eastern and north eastern borders are contiguous with Indian held territory of Jammu and Kashmir.

There are three administrative districts: Gilgit, Diamar and Baltistan. A Resident Commissioner is the head of administrative machinery.

The main watershed runs southwards, draining into the river Indus. The river traverses whole of the district of Skardu after covering about 800 km. stretch before entering into the boundaries of Pakistan. As it meanders down, small streams and nullahs contribute their share to the total stream flow. About 10 km. down stream of Gilgit town, it is joined by Gilgit river, which itself is formed by the union of Gilgit and Hunza rivers.

**Physical features**

The tract is extremely mountainous being near the junction of the Hindu Kush and Korakoram ranges, having a few of the highest peaks in the world, varying from 3,000 to 6,000 metres above sea level, the highest being K-2: 8,475 metres and Nanga Parbat: 7,998 metres. The mountains have a tendency of opening into flat alpine pastures in the extreme north. Throughout the upper northern region of Hunza and Nagar states, the

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valleys are deeply sunk between mountain ranges which are nowhere less than 4500 metres high.

Physiography is variable and orientation irregular. Slopes are steep to precipitous except in the interior of the valleys where stream banks are terraced and cultivated. Most of the area above 4,800 metres elevation remains under snow. Glaciers and snow slides are frequent in the high reaches.

### **Geology, Rock and Soil**

Geological mapping of the Northern Areas has not yet been undertaken and as such it is not possible to describe the rock types. Some basic information has, however, been collected by various Geologists from time to time.

The following rock types may be represented:

Early mesozoic and late palaeozoic rocks.

Green stone complex of lava, tuff, agglomerate, and metasedimentary and sedimentary rocks.

Devonian and silurian rocks.

Mostly quartzites, schists and dolomites, igneous, metamorphic and mafic intrusive rocks.

Granite, gneiss, schists and metasedimentary rocks of possibly precambrian age and intrusions of graniodorite granite, synite and diorite of probably early tertiary age.

Soil formed as a result of disintegration of the existing rocks is loamy and fairly deep on gentle to moderate slopes. On steeper areas and ridges with scanty tree growth, it is shallow with outcrops of the parent rocks and parent weathered material. Generally the soil is fertile, porous and also has humus, though in small quantity where tree growth exists. It is however, highly susceptible to erosion, a phenomenon which is taking place incessantly without drawing much attention.

### **Climate**

The climate ranges from dry sub-tropical through temperate to alpine, depending upon elevation above mean sea level. Temperature and rainfall data for Gilgit and Skardu are given in Table I.

TABLE I

**Temperature (centigrade) and Rainfall (centimetres) of Principal Stations in Northern Areas**

Month/ Station	Gilgit			Skardu		
	Mean Maximum	Mean Minimum	Mean Rainfall	Mean Maximum	Mean Minimum	Mean Rainfall
January	8.0	0.0	0.7	0.9	8.6	2.3
February	11.0	3.0	0.7	3.4	7.1	1.8
March	17.0	7.0	2.0	10.2	0.2	2.5
April	22.0	12.0	2.5	17.1	5.8	0.25
May	28.0	28.0	2.0	22.6	9.6	2.00
June	33.0	19.00	0.9	27.3	13.3	0.6
July	35.0	22.0	1.0	30.9	16.0	0.0
August	34.0	22.0	1.4	31.0	16.0	0.0
September	28.0	7.0	1.0	26.0	12.0	1.0
October	23.0	1.0	0.6	19.0	5.0	0.4
November	17.0	5.0	0.1	12.0	2.0	0.2
December	10.0	1.0	0.3	5.0	6.0	1.0
Annual	22.0	11.0	13.0	17.0	5.0	16.0

Relative humidity is low all the year round. The summary data for the period 1961—70 is given below.

TABLE II

**Relative Humidity in Gilgit**

June		December	
(Average relative humidity %)			
7.00	a.m.	25	65
5.00	p.m.	13	13



### Means of communication

Gilgit and Skardu towns have small airstrips which provide landing grounds for the aeroplanes providing communication facilities between Islamabad and Northern Areas.

Korakoram Highway connects Pakistan with China through Northern Areas. It has been constructed along the rivers Indus and Hunza and is meant to carry heavy traffic all the year round. In addition to that, Kaghan valley road connects Hazara district with Chilas through Babusar Pass. Astore sub-division of Diamar District and Azad Kashmir are linked through Burzil Pass. Chitral is connected with Gilgit through Gupis valley.

Means of communication within Northern Areas are difficult and underdeveloped. River transport is not possible in the tract. Road network has been constructed to join most of the areas but a lot remains to be done. Roads do not touch far flung areas and are too narrow. Except on the Korakoram Highway, jeep is the only means of transport for men and materials. Efforts are, however, being made to further develop the road system.

### People and their Customs

According to 1972 Census, population of Northern Areas was 4,15,000 showing 34.7% increase over the population estimated in 1961. At the rate, the population in 1974 would be about 5,59,00 with a density of almost 8 persons per square kilometer.

Throughout Northern Areas, there are many mixed races (speaking different languages) classed together as Dard. These Dards are chiefly Askkans and Shins. The Shins are the dominant race whose language "Shina" is widely spoken. In general appearance and dress all the mountain bred people extending through out Northern Areas are very similar. They are of good, straight built and of a fair complexion. Gujars are the third faction of importance who earn their living by grazing livestock. They have a migratory mode of life i.e., they ascend high reaches in summer to graze their cattle in Alpine and Sub-alpine pastures and descend in winter when the summer ranges are covered with snow and nothing is left for the livestock to eat.

Economy is basically agrarian and with the exception of a few, the population is basically agriculturist. They have some relationship with the land, either as its owners or as the tenants. Land holdings are small as due to the rocky country, much of the area is not available for cultivation. Culturable Land, however, has been formed along the Indus and other rivers but as facilities for channelising river water through lift system are non-existent, it has not been possible to bring it under plough.

Maize and wheat are the main crops cultivated. Some pulses are also grown along with a small quantity of rice. Grain produced locally is absolutely insufficient for the local population. All foodstuffs have, therefore, to be transported from other provinces of Pakistan which Government of Pakistan provides on subsidized rates. Fruit trees are



an important source of food which provide nutritional reserve as well as additional income for the populace.

Forests, wherever they are located are either privately owned or burdened with rights.

People depend on forests for their genuine demands: timber for house construction; firewood for their daily use; fencing material, grasses and grazing grounds for their livestock. This demand, however, has exerted a deteriorating effect on the forests in the form of fellings and making them bare of vegetation by indirectly eliminating regeneration. Private forests are even more harmed by their owners as they use them according to their own whims in the absence of an effective control of the forest department. They not only fulfill their own needs but also sell them and get a sizable remuneration by the sale of timber trees. They also earn income in the form of a 50% share of the royalty recovered by the forest department from timber contractors.

Private forests are mainly located in Chilas and Darel-Tangir sub-divisions of Diamar district.

Yaghistan, as Darel and Tangir areas were previously called, is still governed by Tribal law. The people and their customs are comparable to those of Indus Kohistan of Hazara and Swat districts. Fights on trivial matters are every day routine. Some shooting device is thought to be a necessary ornament of man and each inhabitant thinks it to be his duty to take revenge on his enemies in case of murder or some other moral breach. They no doubt are basically agriculturist but a lethargy has set into them and they depend on their women folk for the management of their lands. They have to plough only and all the rest is to be done by the fair sex.

Under the circumstances, it is very difficult to enforce the rule of law in these areas, hence, the problem of settlement of rights and ownership of forest land.

Gilgit and Baltistan are the districts where Ismaili and Shiah sects dominate. Valleys in both the districts are famous for fruit growing. Hunza, Nagar, Punyal, Gupis and Skardu Sub-divisions are the areas, known for the beauty of land scape, land use pattern and for the fruits. Common fruits are apple, apricot, peach, mulberry, almond and walnut. Grapes growing also is an important aspect of horticulture. Wine is made out of them and it is known by the name of Punyal water. The famous "Hunza water" is also the extract of grapes and is transported from Punyal and Yasin Valleys.

Local population has been previously ruled by the Mir's of the states or the Rajas of political districts. Most of them had poor means of living and so had to earn their living outside of Northern Areas. Male population, thus, earns by serving out of these areas and females look after their holdings. They till the land and do whatever they can to feed the family.



Mir's of Hunza and Nagar states previously used to levy some land revenue on cultivated lands but recently the practice has been abolished by an order of the Government of Pakistan and now no tax is being recovered from these states. Food grains are sent to these areas to make up the deficiency of cereals grown here.

These areas are mostly devoid of forests and whatever little is present, Government have no effective control over it.

Astore and Gilgit sub-divisions have comparable living conditions. They are the most thickly populated areas throughout the tract. Agrarian society is much balanced. Astore has the most valuable grazing grounds located in this vicinity; hence, much of the population depends upon livestock grazing. Graziers from the Punjab and Azad Kashmir also visit the productive ranges of the sub-division in summer. They have definite routes being followed every year through centuries.

Government Forests are mainly located in these areas. They are restricted to comparatively higher altitudes and away from the inhabitation though there is no place beyond the reach of man and his livestock. Rights of the people are not settled but they exercise full powers to extract any form of forest produce for their personal requirements.

### **Erosion**

Erosion is widespread throughout Northern Areas, in all vegetation zones and all forms of land use, including the forest. As is well known, erosion initially is a natural, geological process which can be greatly accelerated by the actions of man. Very small proportion of the land mass is covered with vegetation which may be sparse at most of the places and quite insufficient in terms of erosion control measures. Mostly there are glacial lands, screes and bare rocks.

"Sun-baked in summer and frost bitten in winter, the mountain sides are but immense ramps of loose rock debris, only awaiting the yearly melting of the upper snow fields, or the advent of a casual rainstorm to be swept downward in an avalanche of mud and stones into the gorges. Here it becomes piled and massed together to be forced to the main valleys under the pressure of accumulation to be spread in alluvial fans or flown down by the river in the form of silt and sediment".

The amount of erosion taking place is evident from the large number of torrents whose beds are choked with debris. Cleared mountain lands, formerly forested, are virtually peeling off everywhere, whether used for cropping or covered by secondary range vegetation. Landslides and other mass movements of soil are largely geological but in many cases must be attributed to man creating additional instability by cutting mountain roads and tracks with inadequate roadside erosion precautions; by clearing forest and overusing the cleared lands for livestock grazing; and by cutting water channels for irrigation of croplands. By far the most important causative factor of erosion is the gross



overuse of the often hazardous land by the ever increasing mountain population and the numbers of livestock either living in, or seasonally migrating into the uplands.

### Land use

Land may be classified as Productive and Unproductive on the basis of its use. Further classification can be as follows:

#### 1. Productive Land

- (i) Forest land.
- (ii) Cultivated land
- (iii) Range land

#### 2. Un-productive land

- (i) Glaciated area
- (ii) Scree
- (iii) Bare rocks (in-accessible)
- (iv) Lakes

The term productive land includes all areas, which at present contribute to the economy of the region whereas the remaining areas not being utilized at present have been termed as un-productive.

#### 1. Productive land

##### (i) *Forest land*

Forests cover about 4.5% of the area only and have been discussed in detail in the following pages.

##### (ii) *Cultivated land*

(a) Agriculture: Throughout the region, practically all land upto 2700 metres above mean sea level, suitable for cropping or marginally so, has been subjected to cultivation. In the mountains, this is not restricted to the valley bottoms but has been pushed up the flanks of hillsides even where these are steep to very steep. Barani (rain-fed) cropping is the rule except in the valley bottoms which are torrent-irrigated. Summer (Kharif) and winter (Rabi) cropping is practised except toward the upper limit of cultivation where the climate is too severe to permit the cultivation of a crop in the winter. In summer, maize is the dominant crop and in the higher tracts above 1500 metres it is indeed almost the only crop besides potato which is perhaps the most valuable crop of the tract. Double cropping on irrigated and manured land is rice followed by wheat. Kharif pulses are grown

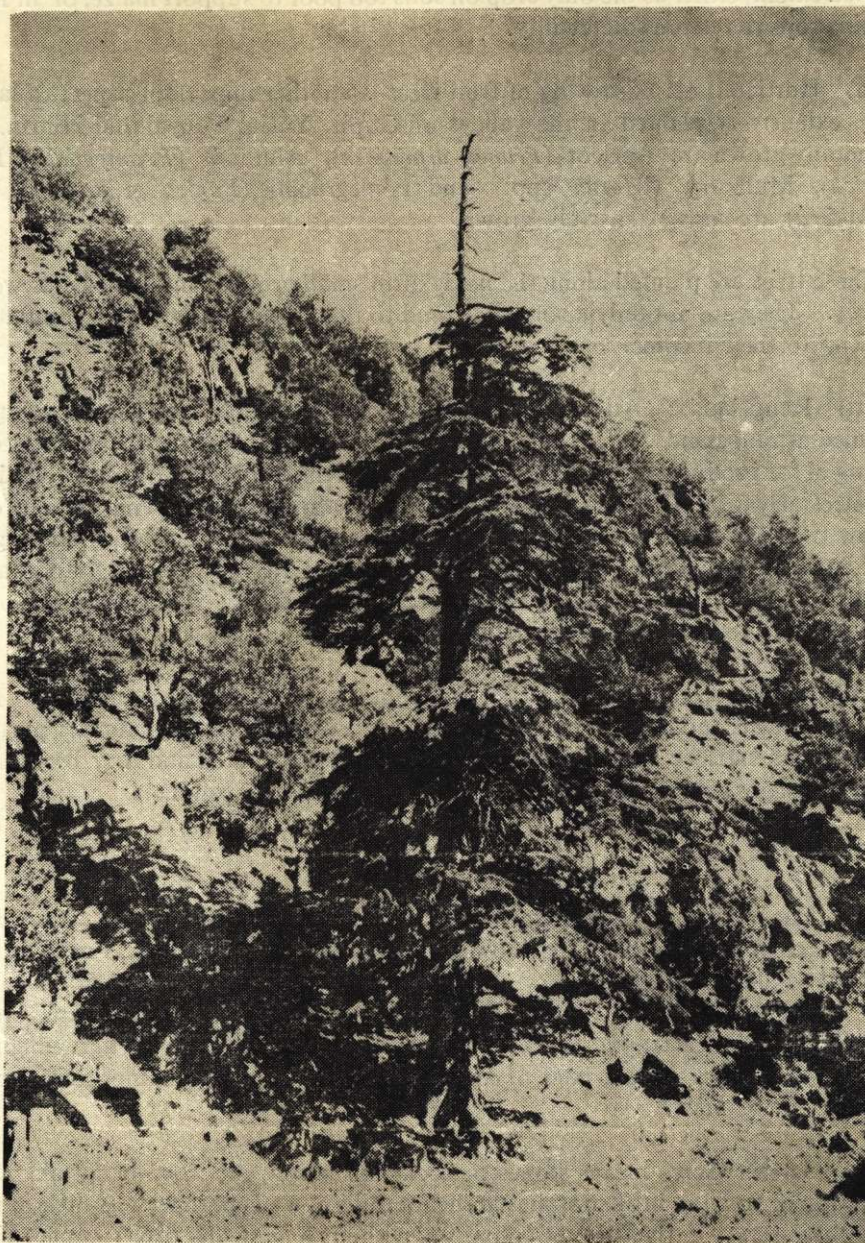




*Fig: 1. Rich Agricultural soil under process of erosion-Banks of Gilgit River.*

(Photo authors)





**Fig: 2.** Dry Temperate Oak forest. In the foreground is the solitary over mature and dying Deodar tree.

(Photo authors)



to a limited extent, either as the only crop on soils too poor to support maize, or in rotation with grain crops to restore soil fertility.

(b) Horticulture: Growing of fruit trees is another important aspect of land use. They are extensively planted in the valleys of Gupis, Yasin, Punyal and Hunza. Fruit trees generally grown are Apricot (*Prunus armianica*), Almonds (*P. amygdalis*), Peaches (*P. persica*), Mulberry (*Morus* spp.) and Pomegranate (*Punica granatum*). Grapes (*Vitis vinifera*) are also extensively grown.

These trees are planted along the fields or in small groups in the fields as well as in courtyards. They are not only a source of food to the otherwise underfed population but also add up to their income.

(iii) Rangelands: All areas other than cultivated and un-productive land have been termed as rangelands. These comprise 80% of the total land area and are used either for grazing or for production of grass for stall feeding of the livestock. Grazing grounds above 3,000 metres elevation are termed as alpine and sub-alpine pastures and remain covered with snow till late April. Grasses appear after the snow melts. These grazing grounds are used by herds of cattle brought from lower down. Grass produced in lands adjacent to the villages in sub-alpine areas is preserved till September when it is cut and converted into hay for stall feeding of livestock during winter.

The area has a great potential for development of range based industry. Even at present the local economy is supported to a large extent by raising animals particularly goats, sheep and cattle. The needs of the local people are limited and they barely manage to live with meagre sums earned by sale of animals and animal products.

## 2. Un-productive Land

(i) Glaciated area: The areas are situated in high mountain ranges where snow is a regular feature during winter. The snow is heavy and wide-spread and most of it stays in the form of glaciers during summer through autumn when fresh snowfall takes place. Glaciers are generally found above 4,200 metres elevation. High peaks are uniformly occurring throughout the length and breadth of the area. There are 34 peaks ranging from 5,500 to 8,475 metres. Being bare of any form of life they are unimportant from land utilization point of view.

(ii) Scree: Scree means stones or rock formation, the word being also used for accumulation of small or broken stones at the foothills of a steep slope. A little vegetation occupies these scree in the form of colonizers without having any direct impact upon the economy.

(iii) Bare Rocks: All areas other than glaciated areas above 4,500 metres elevation may be categorized under bare rocks as:



- (a) The areas are covered with snow all the time and very little vegetation exists which is totally unimportant from utilization point of view.
- (b) The weathering process is at its lowest ebb due to higher altitudes and extremely cold climate, hence, soil formation does not take place and the area remains bare in the form of continuous mass of bed rock.
- (c) The areas are generally remote and difficult. Most of these have not even been visited by man so far. These may be termed as inaccessible and hence, unproductive from land utilization point of view.

(iv) **Lakes:** Small lakes exist in the area but they do not make the sizable units to be represented for land-use descriptions. Some of these lakes abound in fish, especially trout. These can be developed as a potential source of animal proteins by using them as reservoir for the fish and breeding ground for water birds.

### FOREST TYPES

A Forest type has been defined by Champion (1969) as a unit of vegetation which possesses (broad) characteristics in physiognomy and structure sufficiently pronounced, to permit of its differentiation from other such units, irrespective of physiographic, edaphic or biotic factors. These forest types have a bearing on the practice of scientific forestry and practical utility is indeed the main reason for distinguishing them, necessarily greater importance is placed on the main tree layers or on the most emergent vegetation.

The major groups of types are subdivided into types on a geographic basis since a recognisable type group varies somewhat with locality owing to differences in floristics and minor variations in climate and site occurring within the range associated with each group-type as a whole.

No effort has so far been made to classify the forests of Northern Areas on type basis. A mention has, however, been made by Champion, Seth and Khattak in their compilation "Forest Types of Pakistan" of two forest areas which do not project the required picture.

An attempt has been made to describe the forest types met within the tract. Classification has been based on Champion's work and the methodology and nomenclature have been followed.

The Forests occur between 750 to 3,900 metres elevations above mean sea level. Climatically the area falls in a transition zone between subtropical and the temperate. Areas located on lower elevations experience sub-tropical climate whereas due to rising altitudes and latitudes toward North, characteristics of temperate region are gradually



assumed. Based on the distribution of rainfall and moisture conditions, the forests can be differentiated into the following categories:

(Montane) Sub-tropical Forests: Group:— Dry subtropical Broad-leaved.

(Montane) Temperate Forests:— Group:— Himalayan dry temperate Sub-Alpine Forests.

Alpine scrub

### (MONTANE) SUB-TROPICAL FOREST

Group:— Dry subtropical Broad-leaved Forests.

#### Description

Low forests of branchy trees, varying in density. Nowhere forest forms a canopy. Scattered trees are mixed with sparsely growing shrubs. The trees and shrubs are mostly thorny except olive. Trees are of smaller size and clearly show the effect of unfavourable climatic conditions. Ground vegetation is little. There are no phanerogamic epiphytes or climbers. Most of the species including the trees are exceptionally hardy as they have persisted in a bushy form under the heaviest lopping and grazing pressures.

#### Distribution

The foothills and lower slopes in Diamar civil district merging upward with Dry temperate forests.

#### Locality Factors

Long dry season due to the absence of monsoon is the diagnostic feature. Rainfall varies between 12—25 cm. in the year, mostly received in winter and early spring. Humidity is also low. Temperatures run high in the months of June/July and mercury falls down to frost level in December/January and February.

Forests occur on the lower hill slopes generally ranging from 900 to 1,500 metres above mean sea level. Soils are universally shallow and dry and may overlie a great variety of quartzites to crystalline rocks.

#### Sub-Division

The following types have been differentiated.

- (1) C<sub>1</sub>. Dry sub-tropical broad leaved forest
- (2) C<sub>2</sub>. Northern dry mixed scrub



- (3) DS<sub>1</sub>. *Dodonaea* scrub
- (4) DS<sub>2</sub>. *Monothea* scrub
- (5) DS<sub>3</sub>. *Pistacia* scrub
- (6) E<sub>1</sub>. Sub-tropical stream bed scrub.

*Acacia modesta* is conspicuous by its absence. *Olea cuspidata* and *Pistacia mutica* are the most important trees. *Dodonaea*, *Rhazya*, *Reptonia* and *Carissa* along with *Daphne* and *Punica* form the undergrowth.

(1) C<sub>1</sub> Dry sub-tropical Broad-leaved Forests

Description	=	
Distribution	=	As described for the group.
Locality factors	=	

### Floristics

Shatial to Jaglot in Tangir Valley along Tangir River. Elevation 1,200 metres.

- (i) *Pistacia mutica*, *P. khinjak*
- (ii) *Olea cuspidata* (sparse), *Acer pentaponicum*
- (iii) *Dodonaea viscosa*, *Reptonia buxifolia*, *Daphne oleoides*, *Artemisia maritima*
- (iv) *Leptadenia* sp., *Cousinia* sp.
- (iva) *Pennisetum* sp., *Aristida* sp.

### 2. C<sub>2</sub>. Northern Dry Mixed Scrub

Shrub communities have taken the place of trees in the Indus valley due to great misuse of the forest.

### Floristics

Harban on Indus valley road. Elevation 1,150 metres, Western aspect.

- (i) *Olea cuspidata*
- (ii) *Do-donaea viscosa*, *Carissa spinarum*
- (iii) a. *Saccharum spontaneum*, *Aristida* sp.



### 3. DS<sub>1</sub>. *Dodonaea* scrub

The ultimate degradation stage, reached after destroying the palatable and useful species and leaving the hardy, freely reproducing inedible *Dodonaea viscosa*.

#### Floristics

Shatial to Tangir Valley—along the River. Elevation 900 to 1,200 metres above mean sea level.

- (i) *Reptonia buxifolia*
- (ii) *Dodonaea viscosa*, *Periploca aphylla*
- (iii) *Capparis* sp., *Heliotropium eichwaldii*
- (iv) *Aristida* sp. and *Pennisetum* sp.

### 4. DS<sub>2</sub>. *Reptonia* scrub

Thorny evergreen shrub, can take the form of a small tree, if well protected, have borne the heavy pressure of grazing.

*Olea cuspidata*, the associate, has disappeared.

#### Floristics

Ginai. 10 miles from Chilas towards Gilgit on Indus Valley Road. Elevation 900 to 1,200 metres above mean sea level.

- (i) *Reptonia buxifolia*
- (ii) *Artemisia maritima*, *Chenopodium album*
- (iii) *Leptadenia* sp., *Cousinia* sp.
- (iv) *Sacharum spontaneum*, *Aristida* sp., *Stipa* sp.

### 5. DS<sub>3</sub>. *Pistacia* scrub

*Pistacia mutica* dominates whereas *Pistacia khinjuk* is represented sparsely. *Reptonia* is also associated. Type mixes with *Q. ilex* and Juniper forests in the higher altitudes.

#### Floristics

Darel—Nullah Elevation 1,500 metres above mean sea level.

- (i) *Pistacia mutica*, *P. khinjuk*, *Reptonia buxifolia*
- (ii) *Daphne oleoides*
- (iii) *Artemisia maritima*, *Leptadenia* sp., *Chenopodium album*
- (iv) *Saccharum spontaneum*, *Pennisetum lunatum*, *Aristida* sp.



## 6. E<sub>1</sub> Sub-tropical stream bed scrub

In the beds of seasonal nullahs and perennial streams and also along the river beds at lower latitudes there occurs *Tamarix dioca* mixed with *Saccharum spontaneum*. This corresponds to *Nerium indicum* in the transition areas and *Myricaria* at the higher altitudes.

### Floristics

Astore River 30 miles up Bunji towards Astore

(i) *Tamarix dioca*

Seasonal nullah falling in Tangir river 10 miles up stream from Herban.

(ii) *Nerium indicum*

## (MONTANE) TEMPERATE FORESTS

Group :—Himalyan dry Temperate

### Nomenclature

Forests included in this group are termed by the prevailing dominant tree species e.g., chilgoza, dry deodar, dry spruce forests etc.

### General Description

Climate shows its severity upon the forest, evident from widely spaced, free standing, low branching and comparatively low trees. Shrub layer is much more pronounced, even then most of the soil is bare. The vegetation as a whole is xerophytic. Aromatic shrubs like *Artemisia* dominate whereas thorny bushes (*Rosa*, *Prunus*, *Daphne*) contribute their share to the ground cover. Roots often develop extensively. Grasses are small and tufted whereas herbs develop bulbous roots. Climbers are few and no epiphytes exist.

### Distribution

The forests in this type are important commercially as they are the potential source of timber and exist throughout Gilgit and Baltistan districts and areas above 1,500 metres mean sea level in Diamar district.

### Locality factors

Altitudinal range is from 1,500 to 3,300 metres extending upto 3,600 metres on southern aspects. Northern aspects due to better moisture conditions (at some places) show a similarity with moist temperate forests.



Meteorological records are available from one place (Skardu) only and that too not from within the forested area. Temperature remains below freezing point for 3 months and mean minimum for 1-6 months is below zero.

The area is beyond the reach of monsoons but western disturbances bring considerable snow and rainfall in winter and spring. The annual total is essentially below 95 cm. The records available do not show the exact amount of precipitation received. The period over which the westerly precipitation is spread varies from place to place, most usually from March to May. No data are available for the intensity of snowfall. The snowline is the highest in July and August and the forest is not clear of snow on cool aspects till the end of June.

The group is confined to mountainous areas with steep rocky slopes though it may occur on gentle slopes, where soil formation has been fair. Parent material varies greatly but has little effect on the forest cover. Rock avalanches and snow slides occur as a routine on the higher altitudes.

### Biotic factors

There are no hazardous fires due to open nature of the crop. Regeneration is adversely affected due to grazing pressure on the forests.

Felling of trees continues unchecked by the local population due to unsettled nature of rights. A gradual Deterioration process has thus set in. Erosion being a natural outcome of the process has started and poses a great threat to watersheds and more so to the Dams being built down streams.

### General Floristics

Coniferous species viz. *Cedrus deodara*, *Pinus wallichiana*, *Picea morinda*, *Abies pindrow*, *Pinus gerardiana* and *Juniperus macropoda* occupy these forests. Transition zone between sub-tropical and temperate types is dominated by *Quercus ilex*. Xeromorphic species, as a rule, abound. Associated tree genera are *Fraxinus* and *Amygdalis*. Shrub layer consists of *Daphne*, *Lonicera*, *Cotoneaster*, *Astragalus* and *Ephedra*. Grasses found are: *Oryzopsis*, *Bromus*, *Agrostis*, *Poa*, *Bathriochloa* and the like.

### Sub-Division

The group has been classified into the following types and sub-types.

- (1) C<sub>1</sub> Dry Oak forest (*Quercus ilex*)
- C<sub>2</sub> Dry temperate coniferous forest.
- (2) C<sub>3</sub> a. Dry zone deodar forest
- (3) C<sub>4</sub> b. Chilgoza forest



- (4) C<sub>3</sub> c. Dry zone blue pine forest
- (5) C<sub>3</sub> d. Dry zone spruce forest
- (6) C<sub>3</sub> e. Dry zone fir forest
- (7) C<sub>3</sub> f. Dry Juniper forest
- (8) C<sub>3</sub> g. Dry zone mixed conifer forest
- (9) C<sub>3</sub> Arid temperate scrub
- (10) E<sub>1</sub> a. Hippophae-Myricaria scrub
- (11) E<sub>1</sub> b. Myricaria riverbed scrub
- (12) E<sub>1</sub> c. Hippophae pure
- (13) E<sub>2</sub> Populus—Salix forest
- (14) E<sub>1</sub> d. Myricaria-Salix scrub
- (15) IS1-s. Dry zone pioneer blue pine
- (16) DS1 Oak scrub (*Quercus ilex*)
- (17) DS2- Dry temperate scrub.

### 1. C<sub>1</sub> Dry Oak Forest (*Quercus ilex*)

Evergreen oak forest mostly occurring as pure open crop. Maximum height rarely exceeds 10 metres. Crown is spreading. On the lower altitudes it mixes up with *Olea* and *Pistacia* and Chilgoza (*Pinus gerardiana*) and *Cedrus* above depending upon the aspect and moisture conditions. Ruthless felling of the trees for firewood and fodder has adversely affected the forests which are now in a shamble. Hill slopes are sparsely covered with trees mixed with xeromorphic types like *Daphne oleoides*. Only one climber was seen. No undergrowth exists under the dense shade of the forest, whenever it is present.

#### Distribution

The type is found only in Diamar district, except Rupal and Burzil valleys of Astore sub-division.

#### Locality Factors

The forests occupy mountain slopes ranging between 1,200 to 2,000 metres on southern exposures and to 1,800 metres on northern aspects. Temperature varies between 6°C and 28°C mean monthly minimum and maximum respectively. The extremes may, however, reach -12°C and 32°C. Rainfall varies between 15 cm. to 50 cm.

#### Ecological Status

Due to the absence of natural coniferous forests, the range of the species has expanded. The scrub responds to protection favourably. Forests whenever preserved, form beautiful thick stands.



# Floristics

(a) *Gumari, Darel*, Diamar district, Elevation, 1,800 metres.

- (i) *Quercus ilex*.
- (ii) *Reptonia buxifolia*, *Indigofera* sp. *Sorbaria* sp. (at open places).
- (iii) *Daphne oleoides*, *Cotoneaster* sp., *Astragalus* sp., *Rosa* sp., *Artemisia maritima*, *Rumex hastatus*, *Rumex* sp., *Chenopodium album*, *Polygonum* sp.
- (iv) *Oxalis* sp., *Trifolium* sp., *Tribulus* sp., *Themeda*, *Lespedeza* sp.
- (iva) *Eragrostis* sp., *Aristida* sp., *Stipa* sp., *Pennisetum* sp., *Oryzopsis* sp.
- (v) *Clematis* sp., *Vitis* sp.

(b) *Tangir*: Elevation 2,100 m. above mean sea level. Eastern slopes.

- (i) *Q. ilex* pure.
  - (ii) (a) *Stipa* sp.
- (c) *Along Tangir River*

- (i) *Quercus ilex*, *Olea cuspidata*, *Juniperus macropoda*.
- (ii) *Pistacia mutica*, *P. khinjuk*, *Acer* sp.
- (iii) *Dodonaea viscosa*, *Reptonia buxifolia*, *Daphne oleoides*, *Artemisia maritima*, *Ephedra gerardiana*.
- (iv) *Cousinia* sp.
- (iva) *Pennisetum* sp., *Aristida* sp.,

(d) *Gunai* 15 Km, from Chilas towards Gilgit.

- (i) *Pistacia mutica*, *Q. ilex*.
- (ii) *Reptonia buxifolia*.
- (iii) *Artemisia maritima*, *Cousinia*, sp., *Leptadenia* sp.
- (iv) *Aristida* sp., *Saccharum spontaneum*, *Stipa* sp., *Pennisetum* sp.



## Dry Temperate Coniferous Forests

### 2. Dry deodar Forests (*Cedrus deodara*).

High forest forming an open canopy of moderate height about 20 metres, almost exclusively of deodar. Chilgoza is mixed on the lower altitudes and fir-spruce on the higher. Blue pine and Juniper are found associated all along. Overmature trees predominate. Regeneration is profuse on the open northern aspects and little on drier sites. *Quercus ilex* forms the second storey on the lower altitudes whereas *Salix* is present on the damper sites. Shrubbery is quite thick. *Pennisetum*, *Bromus* and *Oryzopsis* are the common grasses found. Vegetation never forms a complete cover on the ground and a good deal of bare ground is always present.

#### Distribution

Type occurs only in Chilas and Darel-Tangir sub-divisions of Diamar District. Non existence in rest of the Northern Areas is a peculiar feature.

#### Locality Factors

Type is restricted to the cooler and moister sites from 1,800 to 2,700 metres and even to 3000 metres on the drier sites. Absolutely no meteorological records are available for the areas under the type.

#### Ecological Status

Champion (1965) has termed these forests to be the climax vegetation type though degraded by grazing and fellings.

#### Floristics

(a) *Thurly Forest*—Chilas. at 2,700 metres above mean sea level.

- (i) *Cedrus deodara*, *Pinus gerardiana*
- (ii) *Q. ilex*
- (iii) *Rosa* sp., *Daphne oleoides*, *Sorbaria tomentosa*, *Salix* sp., *Artemisia maritima*
- (iv) *Pennisetum* sp., *Aristida* sp.

(b) *Kutwai Forest*, Tangir, Diamar District 2,500 metres above mean sea level.

- (i) *Cedrus deodara*, *Pinus wallichiana*
- (ii) *Quercus ilex*. (On lower altitudes)
- (iii) *Indigofera* sp., *Sorbaria tomentosa*, *Cotoneaster* sp., *Rosa* sp., *Daphne oleoides*, *Berberis pseudumbellata*



- (iv) *Fragaria* sp., *Viola biflora*, *Chenopodium album*
  - (iva) *Pennisetum* sp., *Bromus* sp., *Agrostis* sp., *Calamagrostis* sp.,
- (c) **Daro Gah Forest**—Tangir, Diamar District at 2,300 metres
- (i) *Cedrus deodara*, *Pinus wallichiana*
  - (ii) *Abies pindrow* (Towards higher altitudes)
  - (iii) *Salix* sp., *Juniperus macropoda*
  - (iii) *Sorbaria tomentosa*, *Indigofera pulchella*, *Spiraea* sp., *Rosa* sp., *Polygonum* sp., *Cotoneaster* sp., *Lonicera* sp., *Astragalus* sp.
  - (iv) *Chenopodium album*, *Taraxicum* sp., *Arenaria* sp., *Fragaria* sp., *Viola biflora*, *Juniperus communis*, *J. recurva*, *Adiantum* sp.
  - (iva) *Bothriochloa* sp., *Lolium* sp., *Aristida* sp., (Different species). *Pennisetum* sp.

### 3. C<sub>2</sub>b **Chilgoza Forest** (*Pinus gerardiana*)

#### Description

An open to very open forest of low branching trees attaining a height upto 15 metres, having a tendency to grow into considerable girth. The forest grows pure but dry Deodar and Juniper overlap. *Quercus ilex*, *Fraxinus xanthoxyloides* and *Amygdalis* mix at the lower altitudes. Shrub cover is also open but at some places helps the dominant tree species in closing the canopy. *Bromus* and *Lolium* form the sparse ground flora.

#### Distribution

The type is distributed throughout Darel and Tangir sub-divisions and also represented in Astore Valley.

#### Locality Factors

The type occupies the drier and hotter aspects and ridges. Climatological records correspond with the records of dry oak and dry deodar forests.

#### Floristics

- (a) **Thurly Forest**; Chilas. Elevation 1,700 metres.

- (i) *Pinus gerardiana*, *Juniperus macropoda*
- (ii) *Quercus ilex*, *Pistacia* sp.
- (iii) *Artemisia maritima*, *Daphne oleoides*
- (iv) *Cousinia* sp., *Chenopodium album*
- (iva) *Bromus* sp., *Lolium* sp.





Fig: 3. Dry zone Blue pine forest (*Pinus wallichiana*).

(Photo authors)





*Fig: 4.* Dry zone Spruce forests, Naltar. There is no natural regeneration and the beautiful forest will disappear with the passage of time.

(Photo : authors)



(b) *Astore Forests*: Elevation 2,100 metres.

- (i) *Pinus gerardiana*, *Juniperus macropoda*, *Prunus* sp.
- (ii) *Fraxinus xanthoxyloides*, *Amygdalis* sp.
- (iii) *Cotoneaster* sp., *Lonicera* sp. *Sophora* sp. *Daphne oleoides*, *Monothea buxifolia*, *Caragana* sp., *Ephedra* sp., *Cousinia* sp., *Artemisia maritima*, *Artemisia* sp.
- (iv) *Chenopodium album*
- (iva) *Bromus* sp., *Lolium* sp., and *Stipa* sp.

(c) Upper Mushkin Forest, Astore Valley.

At 2,400 metres steep N. W. aspect on Schist (Described by Champion, Seth and Khattak—1965).

- (i) *Pinus gerardiana*, all ages and sizes upto 2.5 metre girth and 10 metres high forming 0.1—0.3 cover.
- (ii) *Juniperus macropoda* forming less than 10% cover.
- (iii) *Fraxinus xanthoxyloides*, *Lonicera quinque locularia*.
  - (a) *Cotoneaster bacillaris* (f) *Colutea nepalensis*.
  - (0) *Prunus jacquemontii* (0) *Hippophae rhamnoides* (el), *Artemisia maritima*.
- (iv) (a) *Astragalus* sp. (0) *Androsace* sp.,
  - (a) *Sedum* sp., (0) etc.
- (iva) Grass almost none

#### 4. C<sub>2</sub>c Dry Zone Blue pine Forest (*Pinus wallichiana*).

##### Description

Pure forest type occurs occasionally. Usually it is mixed with deodar, fir and spruce depending on the moisture, aspect and elevation. The shrubbery differs from the moist zone blue pine forest type only. Height growth is below normal. Forest usually forms a closed canopy and attains considerable girth.

##### Distribution

Pure forests were seen at Naltar and Babusar. Mixed with fir and spruce exist in Gilgit and Astore sub-division. Blue pine, however, is found all over Northern Areas.

##### Locality Factors

Altitudinal range of the species is between 2,500 to 3,300 metres. Locality factors are mostly the same as for the group. However, blue pine relishes more moisture as compared to Chilgoza and Deodar.



**Floristics**

(a) *Naltar*. 2,700 to 3,000 metres. At 2,850 metres above mean sea level.

- (i) *Pinus wallichiana* occurs pure as well as mixed with *Picea smithiana*.
- (ii) *Salix* sp., and *Betula utilis*
- (iii) *Rosa webbiana*, *Lonicera* sp.
- (iv) *Carex* sp., *Cynodon dactylon*, *Bothriochloa* sp., *Agrostis* sp., *Agropyron* sp., *Oryzopsis* sp.

(b) *Babusar*—At 3,300 metres. Elevation.

- (i) Blue pine occurs pure without any associates. *Juniperus macropoda* and *Abies pindrow*, however, on lower and higher aspects respectively.
- (ii) Ground cover is mainly alpine forbs and grasses.

### 5. C<sub>2</sub>d Dry Zone Spruce Forest (*Picea smithiana*)

More or less closed high forest of *Picea smithiana* with a few *Pinus wallichiana* and sometimes with a few *Betula utilis* chiefly along the margins.

**Distribution**

Cooler aspects in Gilgit Sub-division. Spruce, however, occurs throughout Northern areas at higher altitudes.

**Locality Factors**

Type occurs between 2,700 to 3,300 metres above mean sea level. No meteorological records are available for the forested area. Spruce, however, likes cooler aspects and occurs where snow stays till late June and compensates the assumingly low rainfall.

**Floristics**

(a) *Naltar Valley* at 2,850 to 3,300 metres on steep N. aspect.

- (i) *Picea smithiana* almost pure forming a nearly complete canopy, the tree being upto 4.5 m. girth. *Pinus wallichiana*.
  - (ii) *Betula utilis*
  - (iii) *Rosa webbiana*, *Ribes grossularis*, *Juniperus communis*
  - (iv) *Viola briflora*, *Lotus* sp., *Astragalus* sp.
  - (iva) *Cynodon dactylon*, *Poa* sp., *Bromus* sp., *Dactylis glomerata*
- No pure spruce forests could be seen elsewhere in Northern Areas



6. C<sub>2</sub>e Dry Zone Fir Forest (*Abies pindrow*)**Description**

High forest forming an open canopy, rarely occurring in a pure form, deodar being the most accepted associate in Darel-Tangir and blue pine in rest of the areas. Due to open nature of the crop, humus is not deposited in the forest floor as is the case in moist temperate forests. Grazing has completely reduced the under growth. Ground cover consists of Alpine and Sub-alpine species.

**Distribution**

Type occurs in Babusar and Minimarg forests of Diamar district. However, the top most tree line consists of the species in most of forests.

**Locality Factors**

Altitudinal zonation is between 2,850 to 3,300 metres. The only assumption in the absence of meteorological records can be that the type occupies comparatively cooler sites where precipitation is more in the form of snow than rainfall.

**Floristics**

(a) *Babusar* Northern aspects, 3,300 metres elevation.

- (i) *Abies pindrow* occurring almost pure with sparse *Pinus wallichiana* and *Juniperus macropoda*.
- (ii) *Astragalus* sp., *Polygonum* sp., *J. communis*
- (iii) *Lotus* sp., *Plantago*
- (iv) *Poa* sp., *Bromus* sp., *Lolium* sp.

(b) *Zaipur-Rupal Valley*, Astore at 3,300 metres elevation on Northern aspect.

- (i) *Abies pindrow*, *Pinus wallichiana*.
- (ii) *Juniperus*, *macropoda*, *Salix* sp., *Betula utilis*
- (iii) *Astragalus* sp., *Rosa* sp., *Sophora* sp., *Lonicera* sp., *Ephedra nebrodensis*, *J. communis*, *Polygonum* sp., *Taraxicum* sp.
- (iv) *Lotus* sp., *Saxifraga* sp.
- (iva) *Calamagrostis* spp., *Poa* sp.



## 7. C<sub>2</sub>f. Dry Zone Juniper Forest

### Description

*Juniperus macropoda* shares drier and hotter slopes with *Quercus ilex* and *Pinus gerardina* in Diamar district towards lower and higher altitudes respectively. It often ascends to alpine scrub zone. The growth, however, is poor and scattered all over the tract within its habitat. Much of the forest floor is bare.

### Distribution

Extends between 1,800 to 3,300 metres elevation throughout Northern Areas.

### Locality Factors

The same as for the group. The species likes drier and hotter places and often grows on rocky slopes.

### Floristics

(a) Kussotā—Rupal Valley—Southern aspect. Elevation 3,450 metres.

- (i) *Juniperus macropoda*
- (ii) *Artemisia maritima*, *Rosa* sp., *Cousinia* sp.
- (iii) *Medicago* sp.
- (iv) *Bromus* sp., *Agrostis* sp., *Poa* sp.

(b) Naltar—Southern aspect at 2,700 to 3,300 metres.

- (i) *Juniperus macropoda*, *Pinus wallichiana* (Sparse).
- (ii) *Artemisia* sp.
- (iii) *Bromus* sp., *Agrostis* sp.

(c) Rahmanpur—Southern aspect 2,550 metres.

- (i) *Juniperus macropoda*
- (ii) *Fraxinus xanthoxyloides*
- (iii) *Artemisia scoparia*, *Cousinia* sp., *Verbascum thepsis*
- (iv) *Calamagrostis* sp., *Bromus* sp.

## 8. C<sub>2</sub>g Dry Zone Mixed Conifer Forests

Conifers, except a few patches are mostly in the form of mixed forests. The frequency or predominance of one species decides the nomenclature of the type. At some places the mixture representing almost equal occurrence of two species exists. Need thus arises



to classify the sub-type further. A typical case is that of Blue pine which at places forms canopies with fir and spruce in equal proportions. Dry zone blue pine forests may hereafter be classified as:

- (i) Blue pine-spruce forests
- (ii) Blue pine-fir forests

### Distribution

The former sub-type exists in Naltar Valley (Gilgit) as well as Rama forest of Astore Sub-Division whereas the latter has a very wide range and occurs in Rupal valley, Rama forests, Gudai and Minimarg forests of Astore.

### Locality Factors

As mentioned for the types: dry zone blue pine and spruce forests.

### Floristics

#### C<sub>2g</sub> Blue pine-spruce forests

(a) Rama forest: Astore 3,200 metres elevation.

- (i) *Pinus wallichiana*, *Picea smithiana*.
- (ii) *Rosa webbiana*, *Berberis lycium*, *Hippophae* sp.
- (iii) *Cynodon dactylon*.

(b) Naltar—Northern aspect at 3,000 metres.

- (i) *Pinus wallichiana*—*Picea smithiana*.
- (ii) *Betula utilis*, *Salix* sp.
- (iii) *Rosa* sp. *Lonicera* sp.
- (iva) *Cynodon dactylon*, *Calamagrostis* sp.

#### C<sub>2g</sub> ii (b) Blue Pine—Fir forest

(a) Chichi Valley—Rupal—Astore, Northern aspect at 3,000 metre elevation.

- (i) *Pinus wallichiana*, *Abies pindrow*.
- (ii) *Salix* sp.
- (iii) *Rosa* sp., *Lonicera* sp., *Cotoneaster* sp. *Polygonum* sp.
- (iv) *Medicago* sp., *Chenopodium album*
- (iva) *Calamagrostis* sp., *Bormus* sp., *Oryzopsis* sp.



(b) *Rama Astore*: 3,150 metre elevation.

- (i) *Pinus wallichiana*—*Abies pindrow*
- (ii) *Rosa* sp.
- (iii) *Medicago* sp., *Juniperus communis*
- (iv) *Cynodon dactylon*

#### 9. C<sub>3</sub> Arid Temperate Scrub

Due to great pressures on the forest in low rain fall areas, tree crop has completely been destroyed and xerophytic scrub forms the ground cover. This may be termed as a degradation stage of the dry sub-tropical forest with *Olea*, and *Pistacia* spp. or of the dry temperate forests with *Juniper* and *Fraxinus*. This explanation may not be true for some of the areas and xerophytic scrub may have to be termed as the climatic climax.

Climatic conditions are rainfall of less than 15 cm. mainly in winter, very high summer temperatures and a short cool to cold winter, elevation being above 1,500 metres mean sea level. The area is mostly hilly but in large valleys there are flat grounds. Soil is shallow, dry and stony.

Low xerophytic shrubs form the open vegetation cover. Tufted perennial grasses, small herbs, a flush of annual grasses after the rainfall add to the soil cover.

#### Floristics

(a) Indus Valley Road Dry Sub tropical zone (Diamar District) Elevation varying between 1,300 to 1,600 metres.

*Artemisia maritima*, *Cousinia* sp., *Heliotropium* sp., *Salsola foetida*; *Saccharum spontaneum*; *Phragmites* sp., *Aristida* sp., *Pennisetum* sp.

The species hardly make 40% of the ground cover.

(b) *Jalalabad*—Gilgit Dry Temperate zone—Northern Aspect. Elevation varying between 1,500 to 2,100 metres of the vegetation.

*Haloxylon griffithii* (75% D.) *Heliotropium* sp., *Salsola foetida*, *Aristida* sp.; *Stipa* sp., *Heteropogon* sp., *Enneapogon* sp.

#### 10. E<sub>1</sub> Hippophae—Myricaria riverbed scrub

##### Description

Dense thicket of shrubs 1.5 to 3 metre high consisting mainly of *Hippophae* spp. and Tamarix like *Myricaria*. Shrubs like *Berberis* and *Lonicera* share in various proportions.



## Distribution

Along stony gravelly stream beds throughout dry temperate regions. The type overlaps the *Tamarix/populus* type of the tropical formations and *Nerium* type of the sub-tropical zone. It extends up to sub-alpine zone.

## Locality Factors

The type is dependent on a continuous supply of moving water varying during the year from a torrent largely submerging the vegetation to a water table well below the surface.

## Floristics

(a) *Naltar Valley*, Gilgit at 2,100 metres (Described by Champion 1965).

*Myricaria germanica*, *Hippophae rhamnoides*, *Hippophae? salicifolia*, *Myricaria elegans*, *Salix* spp.,

*Berberis* sp.

The type may occur with varying frequencies of *Myricaria* and *Hippophae* and at some places one may be totally absent. Hence, it seems appropriate to further sub-divide it into two sub-types.

(a) *Myricaria* riverbed scrub

(b) *Hippophae* riverbed scrub

## Distribution and Locality Factors

General distribution of the sub-type and locality factors are the same as for the type.

11.  $E_1$  (a) *Myricaria* riverbed scrub

## Floristics

(a) *Tangir Valley*. Along Tangir river. Elevation ranging from 2,100 to 2,400.

*Myricaria* spp. exist with sparse (*Salix* spp. *Cousinia* sp. *Stipa* sp. and *Saccharum spontaneum* are also found at places.

12.  $E_1$  (b) On the next page.



### Floristics

(a) *Shishkat*. Hunza, along Hunza river. Elevation 2,900 metres.

- (i) *Hippophae* spp., *Salix* spp., *Populus ciliata*
- (ii) *Artemisia* spp.
- (iii) *Heliotropium* sp.,
- (iv) *Phragmites* sp., *Stipa* sp., *Saccharum spontaneum*; *Heteropogon* sp., *Tetrapogon* sp.

(b) *Kussote*—Rupal Valley—Astore. Elevation 3,300 metres.

### Floristics

- (i) *Hippophae* spp., *Juniperus macropoda*.
- (ii) *Salix* spp.
- (iii) *Lonicera* sp., *Rosa* sp., *Artemisia maritima*, *Ephedra nebrodensis*.
- (iv) *Stipa* sp.

## 13. E<sub>2</sub>. Populus—Salix Forest

### Description

Low closed forest of moderately high trees of *Salix* spp. and *Populus* spp. *Pinus wallichiana* may also share the canopy.

### Distribution

In Mountain river beds at the higher elevations. Mainly restricted to Gilgit and sub-divisions.

### Locality Factors

Elevations varying from 2,700 to 3,600 metres. Type prefers the beds of moderate gradient with fairly wide and changeable courses.

### Floristics

(a) *Naltar Valley*, Gilgit. Elevation 3,600 metres (Champion, 1965)

- (i) *Salix* spp., *Populus ciliata*, *Betula utilis*, *Pinus wallichiana*, *Pyrus aucuparia*, *Juniperus macropoda*.
- (ii) *Berberies* sp., *Rosa webbiana*, *Ribes grossularia*, *Lonicera* sp.



14. E<sub>3</sub>. *Myricaria*—*Salix riverbed scrub*

(a) Chilam—Astore, Elevation 3,000 metres.

(b) Gudai—Rupal, Astore Elevation, 3,000 metres.

- (i) *Populus ciliata*, *Salix* spp., *Populus alba*, *Pinus wallichiana*, *Juniperus macropoda*
- (ii) *Rosa* spp., *Ribes grossularia*, *Lonicera* sp., *Gotoneaster* sp.
- (iii) *Artemisia maritima*, *Ephedra nebrodensis*.

15. 1S<sub>1</sub>. **Dry zone pioneer Blue pine** (*Pinus wallichiana*)**Description**

In the dry zone of the Himalayas, blue pine is the chief pioneering conifer provided there is a seed source within range. It may be found associated with *Populus* and *Salix* as well as with *Hippophae*. Succession seems to be very slow in this type.

**Distribution**

Throughout Northern Areas, blue pine occupies such areas formed out of the changing course of the river bed in the higher altitudinal range.

**Locality Factors**

As those mentioned for *Myricaria*—*Hippophae* or *Populus*—*Salix* types. Trees are heavily lopped, felled and this leads to low and heavily branched trees normally in the form of a very sparse crop.

**Floristics**(a) *Naltar Valley*—Gilgit. Elevation 3,500 metres.

- (i) *Pinus wallichiana*.
- (ii) *Populus ciliata*, *Salix* spp., *Betula utilis*.
- (iii) *Rosa webbiana*, *Lonicera* sp., *Ribes grossularia*, *Berberis lycium*.

16. DS<sub>1</sub>. **Dry Oak scrub** (*Quercus ilex*)

Due to excessive pressure on *Quercus ilex* forests, low shrub in the form of dense conical or flat-topped bushes are the natural outcome. Shrubs share to cover the ground. The type occurs along the inhabitations on the lower altitudinal limits of dry zone Oak forests.



**Floristics**

Jaglote—Tangir, Diamar, Elevation 2,000 metres.

- (i) *Quercus ilex* (almost pure)
- (ii) *Daphne oleoides*, *Sophora griffithii*, *Astragalus* sp., *Reptonia buxifolia*.
- (iii) *Cousinia* sp.
- (iv) *Aristida* sp., *Pennisetum* sp.

**17. DS<sub>2</sub> Dry temperate scrub**

At many places in Northern Areas forest cover has been destroyed due to clearing of land for cultivation, timber and fire wood and converted into a mere scrub. It has borne the pressure of grazing and cutting for fuelwood and exists as such. Much of the ground remains bare.

**Floristics**

Rahmanpur—Astore, Elevation 2,700 metres.

- (i) *Fraxinus xanthoxyloides*, *Juniperus macropoda*, *Populus alba*.
- (ii) *Rosa macrophylla*, *Cotoneaster* sp., *Artemisia scoparia*, *Taraxicum* sp., *Cousinia* sp., *Verbascum thepsus*.

Champion, 1965, has identified the presence of *Hippophae*, *Ribes grossularis*, *Rosa macrophylla* and *Prunus prostrata* in the sub-type.

**SUB-ALPINE FOREST****General Description**

Top most tree formation of *Pinus wallichiana*, *Abies spectabilis* and *Abies pindrow* with an under storey of broad leaved *Betula utilis* on higher and *Salix* spp. at lower altitudes is termed as sub-alpine forest type. *Viburnum* and *Salix* shrubs co-exist. Conifers are comparatively low, more branchy near the ground whereas broad leaved trees are bushy and prostrate suggesting thereby, the implication of severe climatic conditions and sliding snow masses. Herbaceous growth is seen flusing in the spring.

Conifers rarely exceed 20 metres in height and broad leaved trees go upto 10 metres. Conifers attain a considerable girth.

Avalanches sweep down the depressions eliminating all types of trees and shrub growth; only the ground cover remains.



## Distribution

Throughout Northern Areas with an altitudinal range of 3,300 to 3,750 metres and perhaps upto 3,800 metres on warmer slopes.

## Locality Factors

No meteorological records are available even from comparable areas. Champion, Seth and Khattak (1965) have produced climatological data from comparable areas viz., Dras, 3,000 metres, and Leh, 3,480 metres, in Kashmir and Ladakh respectively.

The figures show monthly mean temperature to be at or below 6°C for 5 or 6 months whereas maximum does not exceed 16°C. M.A.T. is about 10°C.

“50 cm. precipitation at Dras and 8.4 cm. at Leh has been recorded snowfall records being 183 cm. and over whereas (Gorrie's estimate of 549 cm. cannot be ignored.) The gradual melting of the accumulated snow ensures adequate soil moisture for most of the short summer growing season.

## Floristics

*Abies pindrow* and *Abies spectabilis* grow on lower and high altitudes respectively without any sharp demarcation line. *Pinus wallichiana* is the only other coniferous tree. *Betula* and *Salix* are next important trees with dwarf junipers.

*Viburnum*, *Lonicera*, *Ribes* and *Rosa* are the common shrubs. *Poa*, *Bromus*, *Eragrostis* are the grasses usually found.

## Sub-Division

Climatic climax types are recognised, viz., birch-conifer and (pure) birch forests. *Salix* scrub is mixed all along in some cases. *Pinus wallichiana*, being colonizer, grows on bare landslips. *Hippophae*—*Myricaria* scrub mixed with *Salix* dominates the stream beds.

### 1. C<sub>1</sub> W. Himalayan Sub-alpine birch-conifer forest (Champion, Seth and Khattak, 1965)

(a) *Upper Naltar Valley*—Gilgit, at 3,600 metres in gneiss on easy ground.

- (i) *Abies spectabilis*, *Pinus wallichiana*, *Betula utilis*
- (ii) *Sorbus aucuparia*, *Salix* sp.
- (iii) *Lonicera* sp.
- (iv) *Rheum* sp., *Plantago* sp., *Taraxicum* sp.
- (iva) *Poa* sp., *Carex* sp.



(b) *Upper Mushkin*, Astore Valley, at 3,600 metres on N. aspect on gneiss (Champion, Seth and Khattak 1965).

- (i) *Abies spectabilis*, *Betula utilis*, *Pinus wallichiana*.
- (ii) *Salix* sp., *Sorbus aucuparia*.
- (iii) *Salix* sp., *Viburnum nervosum*, *Lonicera* sp.,  
*Juniperus recurva*, *Rhododendron hypenanthum*.

(c) *Rupal Top*, Astore at 3,600 metres on Northern aspect.

- (i) *Abies* sp., *Pinus wallichiana*, *Betula utilis*
- (ii) *Salix* sp., *Juniperus macropoda*.
- (iii) *Salix* sp., *Lonicera* sp., *Polygonum* sp., *Sophora* sp., *Rosa* sp., *Juniperus communis*,  
*Saxifraga* sp., *Astragalus* sp., *Ephedra nebrodensis*.
- (iv) *Taraxicum* sp., *Plantago* sp.
- (iva) *Poa* sp.

## 2. C<sub>2</sub> Sub-alpine Birch Forest

### Description

*Abies* and *Pinus wallichiana* fail to stand the severity of climate. Factors of importance being strong, cold and often dry winds coupled with short growing season and deep snow. Birch then remains the only tree growing to a fair height (5 metres) and size.

### Distribution

Type occurs all over Northern Areas where suitable conditions are present.

### Locality Factors

Altitude varies from 3,600 to 4,050 metres above mean sea level. Heavy snowfall and snow slides are obvious reasons for prostrate stems.

The forest is heavily grazed in summer. Felling pressure for fuel and construction of iglo type of hutments is taking heavy toll of the forest. Grazing also hampers the regeneration of forests.

### Floristics

(a) *Naltar Valley*—Gilgit, at 3,600 metres elevation (Champion, 1965).

- (i) *Betula utilis*, *Salix Oxycarpa* (IF)
- (ii) *Sorbus aucuparia*, *Juniperus macropoda*
- (iii) *Lonicera* sp., *Juniperus communis* (From a valley bottom)



(b) *Upper Mushkin*—Astore at 3,600 to 3,900 metres on N. aspect on gneiss (Champion, 1965).

- (i) *Betula utilis*
- (ii) *Sorbus aucuparia*
- (iii) *Juniperus? communis*, *Lonicera* sp. (If), *Rhododendron hypenanthum* (0), *Salix* spp. (f)
- (iv) *Saxifraga? stracheyi*.

(c) *Rupal Top*—Astore, 3,900 metre on N. aspect.

- (i) *Betula utilis*, *Salix* sp.
- (ii) *Salix* sp., *Juniperus macropoda*.
- (iii) *Sophora* sp., *Lonicera* sp., *Astragalus* sp., *Juniperus communis*, *Rosa* sp., *Polygonum* sp. *Ephedra nebrodensis*.
- (iv) *Saxifraga stracheyi*, *Taraxicum* sp.

### 3. E<sub>1</sub> *Hippophae-Myricaria riverbed scrub*

Already described for Naltar Valley, Gilgit. *Hippophae* sp. and *Myricaria* sp. also exist in Rupal Top, Astore.

### 4. E<sub>2</sub> *Myricaria riverbed scrub*

Already described for Rupal Top, Astore.

### 5. IS<sub>1</sub> *Sub-alpine blue pine forest (P. wallichiana)*

Characteristics of the type compare with dry zone blue pine and dry zone pioneer blue pine. It is also indistinguishable from the high level blue pine forests of the moist temperate forests.

Babusar, Rupal-top-Astore and Sardargarhi-Burzil Astore present good examples of the type.

### 6. DS<sub>1</sub> *Deciduous sub-alpine scrub (Champion 1965).*

Trees in the sub-alpine grazing grounds are eliminated due to their use for fuel and building up of huts. Lack of regeneration caused by grazing is also the cause of the absence of tree growth. Associated shrubs survive the grazing pressure in the form of scrub.

### Floristics

*Syringa emodi*, *Lonicera* spp., *Berberis* sp., *Salix* spp. *Rosa* sp., (Champion, 1965).



## 7. DS<sub>2</sub> Sub-alpine Pastures

With the elimination of tree and shrub layer herbaceous pasture is developed on the flat ground especially the damper soils. Associated also is a rich alpine flora with many wide-spread grass genera.

The type can be found all over Northern Areas in the altitudinal range.

### ALPINE SCRUB

#### Description

With the gradual disappearance of snow line, dense scrub formation one to two metres high compared of a number of broad leaved deciduous species starts densely covering the ground with a number of broad leaved deciduous species. Evergreen dwarf junipers and Ephedra are also associated. Snow pressure is pronounced and visible on the stems. Species composition varies with the site. Dwarf *Salix* spp. are also present. Perennial herbaceous flora is also there constructing a number of palatable grasses.

#### Distribution

Mostly developed above the birch zone and sometimes within it in patches on even grounds extensively throughout Northern Areas.

#### Locality Factors

Edaphic and biotic factors influence the formation. Climate is even severe than sub-alpine zone. The type may extend from 3,600 metres to 3,900 metres and may encompass 150 metres more on southern slopes.

#### Floristics

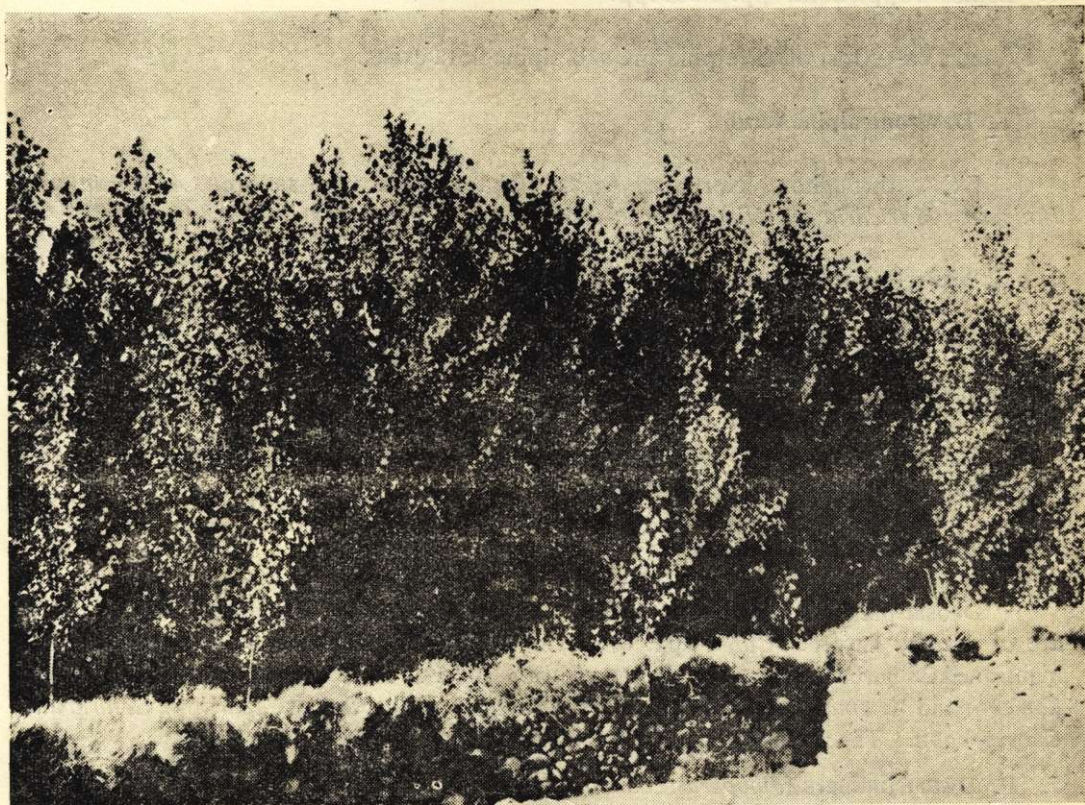
A number of species exist comparable with moist temperate zones with a few endemic ones such as *Salix*, *Lonicera*, *Berberis* and *Cotoneaster* which are characteristic.

#### Sub-Division

The following sub-types can be recognised.

- 1 C<sub>1</sub> Moist deciduous alpine scrub
- 2 C<sub>2</sub> Dry zone alpine scrub
- 3 C<sub>3</sub> Moist alpine pastures
- 4 C<sub>4</sub> Dry alpine plateau pastures
- 5 E<sub>1</sub> Dwarf Juniper scrub





*Fig: 5. Poplar plantation-Dalnaty-There is ample scope for growing poplars along river banks.*

(Photo authors).



### 1. C<sub>1</sub> Moist deciduous alpine scrub

The type overlaps the dry zone alpine scrub but is developed best in the transition zone of Darel-Tangir.

#### Floristics

1. *Lonicera* spp., *Salix* spp., *Rosa* spp.

IV and IVa—Most of the alpine and sub-alpine flora exists.

### 2. C<sub>2</sub> Dry zone alpine scrub

Exists throughout Northern Areas. Characteristic genera are. *Artemisia* and *Juniperus*, *Myricaria* and *Hippophae* extend upto valley bottoms in separate patches.

### 3. C<sub>3</sub> Moist alpine pastures

On the sites unsuitable for shrub growth contiguous with sub-alpine pastures, the type also extends due to grazing pressure on the shrubs. Growing season, as compared to sub-alpine pastures, is shorter and snow melts even late in summer.

*Primula*, *Gentiana*, *Anemone* are conspicuous among the swards of herbaceous growth. *Poa* is one genus represented quite often.

### 4. C<sub>4</sub> Dry alpine plateau pasture

Deosai plains in Astore sub-division carry a steppe type of vegetation. Vast plains are of marshy nature. *Carex* spp. is the most common growth. Stewart (1961) has mentioned 28 herbaceous genera each represented by 5 or more species and also the woody *Lonicera* and *Artemisia*, *Poa sinaica* is fairly abundant. Allied are also *Poa* spp., *Setaria* and *Chrysopogon*. The plains are more than 4,000 metre above mean sea level.

5. E<sub>1</sub> Dwarf junipers (*Juniperus communis* and *J. recurva*) exist in the form of dense compact patches on the the rocky and drier sites extending down into the birch forest. It may also exist amidst alpine pastures. It is usually uprooted by the graziers as it is the sole source of fuel in the area. The type is met with all over Northern Areas, mixed with alpine pastures on hotter slopes.

## IRRIGATED FORESTS

### Block plantation

Hardly any government land is available for raising irrigated plantations. Wherever good land and water are available, people have already used it for raising agricultural crops or orchards. Attempts have, however, been made by the Forest Department



to acquire some land for the purpose and small plantations have been raised. These plantations are mostly in Baltistan District. Gilgit and Diamar too have small sized plantations. The plantations visited were Basha (Diamar District), Jutyal and Dalnaty (Gilgit District). These cover about 80 hectares.

Fast growing tree species are being raised in the plantations. *Robinia pseudo-acacia*, *Ailanthus altissima*, *Eleagnus angustifolia* are the species being grown in Basha and Jutyal plantations whereas pure poplar plantations have been raised at Dalnaty and Gakuch. The clones used are *Populus euramericana* C.V.I., 214 and 'Casal'. *Pinus roxburghii* plantation has also been raised at Jutyal on experimental basis.

The plantations have mostly been raised on alluvial fans where soil is stony. Due to closure and proper protection, the general condition of the crop is very good. Soil has improved due to the addition of leaf mould.

### Roadside plantation

Roadside planting has been attempted over 16 avenue miles around Gilgit as the first step. The species planted are: *Robinia pseudo-acacia*, *Ailanthus altissima* and *Eleagnus angustifolia*. Planting success is almost 80%. Further progress has to be watched carefully. There are likely to be heavy casualties in winter. The job is arduous as the plants have to be watered and protected.

### Trees around the fields

To meet their petty demands of timber and other subsidiary produce, the people have growing *Populus nigra* (Sufaida) along the agricultural fields since centuries. Other species generally planted are *Salix* spp., *Robinia pseudoacacia*, *Ailanthus altissima* and *Eleagnus angustifolia*.

(To be continued)