

# DRY DECIDUOUS FORESTS OF THE POONA DISTRICT, DECCAN, INDIA

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## ABSTRACT

The deciduous vegetation grows in various ghats and hills in the Poona district. The present note describes the type from the Katraj ghats, on the south of Poona at a distance of 6 miles.

The area consists of flat plateau at the top, eastern and western slopes and narrow valleys through which small rivulets flow during monsoons. The mountains are formed of trap rock, the strata of which dip towards east. Thus the eastern slopes are gentle with better developed soil but the western escarpments are steep comparatively dry with shallow soil. Seepage water is seen on eastern slope during monsoon. Alluvial soil deposits in the valley. The average rainfall is about 27".

The following vegetation types are described:

- (I) **Top of the plateau:** They are mainly covered with *Boswellia serrata* which is regenerating profusely where biotic interference is excluded and the soil is dry shallow and gravelly.
- (II) **The western slopes:** These slopes bear a low type of forest. The following trees are common—*Boswellia serrata*, *Lannea coromandelica*, *Diospyros montana* and *Lagerstroemia parviflora*. Shrubs—*Acacia* sp., *Lantana camara*, *Zizyphus xylopyrus*, *Rhus mysorensis*, *Flacourtia*, *Cipadessa baccifera*, *Gymnosporia spinosa* and *Securinega* sp. Herbs—*Tridax procumbens*, *Leucas* sp., *Cocculus* sp., *Polyzygus tuberosus*, *Sida* sp., *Arisaema* sp., *Desmodium* sp., *Acanthospermum hispidum*, *Celosia* sp. etc.

This vegetation is also affected adversely by the biotic interference since lopping, coppicing and grazing are prevalent.

- (III) **Eastern slope (top portion):** It bears a community of *Boswellia serrata*—*Diospyros montana*—*Lannea coromandelica* on dry shallow and rocky soil. The commonest shrubs are *Acacia* sp., *Zizyphus xylopyrus*, *Lantana camara*, *Cryptolepis buchanani*, *Woodfordia fruticosa*, *Cissus pallida* and *Securinega* sp.

The common herbaceous vegetation consists of *Cocculus* sp., *Leucas* sp., *Tridax procumbens*, *Curculigo* sp., *Polyzygus tuberosus*, etc.

- (IV) **Eastern slope (lower portion):** It bears a community of *Tectona grandis*—*Lannea coromandelica*—*Diospyros*—*Boswellia serrata*.

Teak and *Lannea coromandelica* are predominant on the alluvial deposits towards the valley and higher up. *Diospyros* sp. and *Boswellia* become prominent in dry trap soil. *Diospyros* on alluvial soils is heavily infected by *Viscum*. But incidence of the parasite decreases in trees which are growing on dry trap rocks elsewhere in the area. Commonest shrubs in the community are *Acacia* sp., *Clerodendron serratum*, *Zizyphus xylopyrus*, *Cissus pallida* and *Lantana camara*. Commonest herbs are *Leucas* sp., *Tridax procumbens*, *Hemidesmus indicus*, *Curcuma montana*, *Cocculus* sp., *Polyzygus tuberosus*, *Trichodesma* sp., *Crotalaria* sp., *Indigofera* sp., *Celosia* sp., *Aerva javanica*, etc.

Various stages of succession are seen in the area and regeneration of teak, *Boswellia*, *Lagerstroemia*, *Lannea* is common on different types of soils.

## Introduction

Much of the dry deciduous type of vegetation in the Poona District occurs in the hills of the Sahyadris that run parallel, enclosing in between vast stretches of plain country. These hills are called Ghats which rise from the plains abruptly.

Ghats are generally plateau structures, flat at the top with precipitous slopes on all sides. Geologically, they are formed of the Deccan trap. The strata of basalt and amygdaloid are variously weathered to form different types of hills and topography. The soils on the slopes are generally shallow in which blocks of different sizes of rocks are embedded. At the tops, the soils are again shallow but they are mainly gravelly, formed by the

decomposition of the basalt or the amygdaloid. The top soils are dry, while soils in pockets and depressions are generally moist and deep.

The plain country between two ghats has generally deep black coloured soils which are, on the whole, not particularly moist. The drainage in these ghats is on all sides and during rains run off water flows in torrents in many directions.

The present study was conducted in the Katraj and Sinhagad ghats, the vegetation of which is more or less similar. It is mainly formed of trees which become leafless during autumn and are in full leaves during the monsoon period. The vegetation resembles dry deciduous type defined by Champion (1938) with *Anogeissus latifolia* and *Tectona grandis*, the principal species. Other common species are *Lannea grandis*, *Terminalia tomentosa* and *Diospyros* spp.

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The Katraj ghats are 9 miles on the south-east of Poona, on the Poona-Bangalore road and the Sinhagad ghats are 15 miles on the south-west side of Poona, being approached by Poona-Khadakwasla road.

### KATRAJ GHATS

These ghats form a horse-shoe shaped range of hills, the concavity of which faces towards Poona (photo 1). The strata of the rock are slightly inclined towards east, as a result of which water seeps on the eastern slopes which are somewhat moister than the western slopes and carry a better type of vegetation. The eastern slopes are also gentler than the western slopes on account of the dip.

#### General climate of the area

There is no meteorological station at Katraj ghats but rainfall and temperature data from Poona are given in

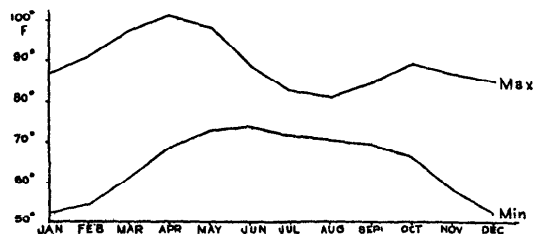


Fig. 1. Average monthly maximum, minimum temperature for Poona.



Fig. 2. Average monthly rainfall for Poona.

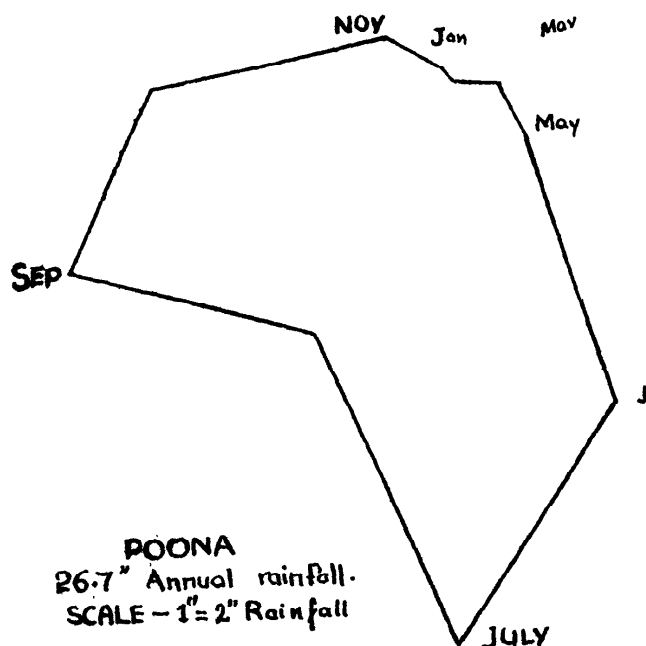


Fig. 3. Rainfall pattern for Poona.

figures 1, 2 and 3. The average annual rainfall is 54 cms. and the rains are chiefly by the south-western monsoons during the months of June, July, August, September and October. There is very little rainfall during the rest of the year.

#### Geology and soil features of the ghats

The ghats are formed of trap in which the strata of basalt and amygdaloid seem to alternate with each other irregularly. There are also seams of red clay. The hills in the Katraj ghats are generally flat-topped or rounded depending upon the way in which the strata of basalt and amygdaloid are found.

The terrace formation on the hills is also the result of washing away of the amygdaloid stratum. In some amygdaloid hills, boulders of basalt are seen exposed after washing away of the upper amygdaloid layer.

The colour of the soil and its character also depends on its origin—soil formed of basalt is usually black and comparatively more retentive moisture. The amygdaloid soils are greyish, gravelly and are usually porous and seem to be probably somewhat poorer in mineral contents.

On black soils, *Tectona grandis*, *Anogeissus latifolia*, *Diospyros* sp. etc. are prominent and on grey gravelly soils *Boswellia serrata*, *Euphorbia ligularia*, *Acacia* etc. grow well. In some areas mixture of both types of soils occur and the vegetation on these is also mixed. On precipitous rock beds, the plants grow in bedding planes, where seepage of water is seen clearly.

#### Biotic features

Most of the Katraj ghats are reserved forests which are not very particularly protected against grazing. Lopping for fodder and also for fuel seems to have been done in the area. Here and there are signs of fire as well. The western slopes which are marked I and IV in Fig. 4 are comparatively poorly wooded and are open to unrestricted grazing. Herds of cattle have been seen grazing in this area throughout the year. As the

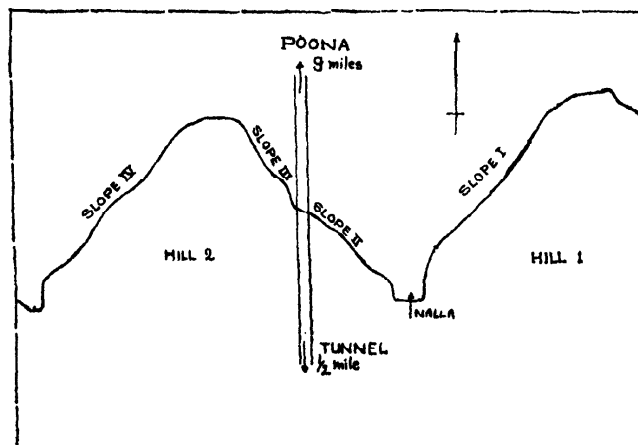


Fig. 4. Diagram showing the direction of hills at the Katrajghats.

result of this, tree vegetation in these slopes are generally scanty and main type of vegetation is generally of a sort of scrub.

The eastern slopes marked II and III are much protected against grazing but periodical cutting of grass is seen. Signs of lopping are also seen in this area. On the Western slope (IV), there is an evidence of abandoned cultivation and trees in rows are growing at some places at lower elevations.

#### Cultivation

The main crop in the area is paddy and it is being cultivated in fields which are flood plain areas in the valley. In paddy fields along the border, *Eleusine coracana* grass, and on the raised portions of land, *Guizotia abyssinica* is grown. In the drier areas Jowar is the main crop. In the paddy growing area the second crop after the harvest of paddy is Jowar.

#### Villages and people of Katraj Ghats

The villages are situated on the elevated areas at the foot of the hills and near the road. The villages are

small and the population in each village is below thousand persons.

The people living in these villages belong to the Maratha sect and are in touch with modern civilisation of Poona. Main occupation of the people is cultivation and production of milk. Each village has a large herd of cattle and depend on Katraj ghats for grass. Some persons also work at Poona. Villagers do not seem to understand the importance and preservation of forest vegetation nor do they practice rotational grazing. For fuel they cut the shrubs indiscriminately and when they require better quality of wood, illegally enter the reserved forest and lop trees of economic importance.

#### Vegetation

The vegetation of the hills was studied by running two transects starting from the first western slope into the valley up the eastern slopes, the top of the ridge and down the II<sup>nd</sup> western slope.

The vegetation data are summarised in Tables I and II.

TABLE I

Percentage occurrence of given species of plants in the four different slopes at Katraj Ghats, Poona.

LOCALITY:—	Western slope of Hill I.	Eastern slope of Hill II (Lower portion)	Eastern slope of Hill II (Upper portion)	Western slope of Hill II.
ROCK AND GEOLOGY:—	Basalt and amygdaloid.	Amygdaloid partly covered over by alluvium.	Amygdaloid	Basalt and amygdaloid.
SOIL:—	Grey, gravelly, somewhat dry. Boulders present. At the top soil is of chocklate colour.	Greyish black, generally fine grained, moist and deep. Soil in pockets very moist. A few boulders present.	Greyish and moist. At top gravelly and less moist. Many boulders present.	Grey, gravelly and comparatively dry. There are patches of red soil. Boulders many.
ASPECT:—	I. Western slope Very steep and precipitous.	II. Eastern slope (Lower half). Gentle.	III. Eastern slope (Upper half). Steeper.	IV. Western slope, very steep and precipitous.
BIOTA:—	Free grazing of cattle all round the year. Numerous foot paths present. Lopping of <i>Acacia</i> sp., <i>Grewia</i> sp., <i>Carissa congesta</i> and <i>Boswellia serrata</i> common.	Very little or no grazing. Few old footpaths. Reserved forest. Lopping of <i>Acacia</i> sp., <i>Carissa congesta</i> , <i>Lantana camara</i> , occasional.	Grazing casual. Many footpaths. Lopping of <i>Boswellia serrata</i> , <i>Lantana camara</i> , <i>Grewia</i> sp., <i>Carissa congesta</i> frequent.	Grazing all round the year. Numerous footpaths. One old road passing through the middle of the slope. Lopping of <i>Acacia</i> sp., <i>Lantana camara</i> , <i>Carissa congesta</i> , <i>Grewia</i> sp. & <i>Emblia officinalis</i> frequent. Abandoned cultivation towards lower part of the slope.
<hr/>				
Number of quadrats studied :	50	35	32	45
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PLANTS:—	Percentage number of quadrats in which the given species were found :			
Upper layer:				
<i>Acacia leucophloea</i> Willd.	2	6	—	—
<i>Acacia</i> sp.	23	23	—	11
<i>Albizia lebbek</i> Benth.	2	—	5	—
<i>Anogeissus latifolia</i> Wall.	14	13	8	3
<i>Bauhinia racemosa</i> Vahl.	3	8	2	2
<i>Boswellia serrata</i> Roxb.	14	29	70	18
<i>Cassia</i> sp.	2	3	—	—
<i>Cordia</i> sp.	2	6	—	—

Number of quadrats studied :	50	35	32	45
<i>Diospyros</i> sp.	23	8	—	7
<i>Dalbergia latifolia</i> Roxb.	2	3	3	2
<i>Erythrina indica</i> Lam.	3	36	15	7
<i>Gmelina arborea</i> L.	2	3	3	4
<i>Lannea grandis</i> Engl.	22	42	13	27
<i>Lagerstroemia lanceolata</i> Wall.	2	7	5	3
<i>Morinda tinctoria</i> Roxb.	2	—	3	—
<i>Emblica officinalis</i> L.	2	10	—	—
<i>Salmalia malabarica</i> DC.	—	8	3	2
<i>Tectona grandis</i> L.	3	16	10	2
<i>Terminalia tomentosa</i> Bedd.	3	8	—	2
<i>Zizyphus jujuba</i> Lam.	—	8	3	—
<i>Z. xylopyrus</i> Willd.	15	36	10	7
Shrub layer:				
<i>Acacia pennata</i> Willd.	5	3	12	5
<i>Acacia</i> sp.	72	64	5	7
<i>Argyrea cuneata</i> Ker.	15	8	10	11
<i>Bauhinia racemosa</i> Vahl.	—	—	8	—
<i>Carissa congesta</i> Wt.	3	7	5	16
<i>Cipadessa fruticosa</i> Blume.	19	5	8	30
<i>Clerodendron serratum</i> Spr.	3	34	—	4
<i>Celastrus paniculata</i> Willd.	5	3	5	15
<i>Cryptolepis buehanani</i> Roem.	6	3	30	15
<i>Erythrina Indica</i> Lam.	2	21	25	11
<i>Flacourtia ramontchi</i> L'Her.	18	10	20	6
<i>Fluggea</i> sp.	57	13	34	29
<i>Gardenia turgida</i> Roxb.	3	2	2	8
<i>Gloriosa superba</i>	—	3	—	—
<i>Grewia</i> sp.	6	10	18	11
<i>Gymnosporia montana</i> Roxb.	18	10	20	20
<i>Holarrhena antidysenterica</i> (L.) Wall.	2	10	10	15
<i>Ipomea muricata</i> Jacq.	—	3	—	—
<i>Indigofera pulchella</i> Roxb.	—	3	—	—
<i>Jatropha</i> sp.	5	3	—	—
<i>Lantana camara</i> L.	90	23	75	80
<i>Notonia grandiflora</i> DC.	8	—	—	12
<i>Osyris arborea</i> Wall.	9	—	25	22
<i>Neuracanthus sphaerostachys</i> Dalz.	7	—	3	6
<i>Rhus mysorensis</i> Heyne.	15	3	10	13
<i>Solanum coagulens</i> Forsk.	—	—	3	5
<i>Vitis pallida</i> W. & A.	—	25	20	22
<i>Woodfordia floribunda</i> Salisb.	2	4	20	16
<i>Zizyphus xylopyrus</i> Willd.	20	29	7	7
Tree saplings:				
<i>Anogeissus latifolia</i> Wall.	12	15	—	11
<i>Boswellia serrata</i> Roxb.	3	—	—	8
<i>Buchanania latifolia</i> Roxb.	—	6	—	2
<i>Dalbergia</i> sp.	—	—	—	7
<i>Ficus glomerata</i> R.	6	3	—	—
<i>Lannea grandis</i> Engl.	8	5	5	27
<i>Morinda tinctoria</i> Roxb.	2	—	—	—
<i>Emblica officinalis</i> L.	2	10	3	6
<i>Salmalia malabarica</i> DC.	—	3	—	2
Herbs:				
<i>Actinopteris dichotoma</i> Bedd.	3	15	12	4
<i>Arisaema murrayi</i> Hook.	3	6	4	2
<i>Curculigo orchoides</i> Gaertn.	5	7	8	9
<i>Curcuma montana</i> Bak.	—	8	2	—
<i>Cocculus</i> sp.	6	6	12	7
<i>Justicia</i> sp.	20	30	28	27
<i>Hemidesmus indicus</i> Br.	3	3	4	3
<i>Polyzygus tuberosus</i> Dalz.	38	6	15	4
<i>Sida</i> sp.	8	5	6	7
<i>Trichodesma indicum</i> Br.	3	6	5	5
<i>Tridax procumbens</i> Wall.	50	29	30	36
Tree seedlings:				
<i>Anogeissus latifolia</i> Wall.	18	10	12	5
<i>Boswellia serrata</i> Roxb.	13	13	35	12
<i>Diospyros</i> sp.	3	6	7	2
<i>Lannea grandis</i> Engl.	15	29	12	7
<i>Salmalia malabarica</i> DC.	—	6	5	—
<i>Tectona grandis</i> L.	—	10	4	3
<i>Terminalia tomentosa</i> Bedd.	5	—	—	—

TABLE II

Grasses on different slopes in the Katraj ghats :

	Slope I	Slope II	Slope III	Slope IV
Names of Grasses :				
<i>Apluda varia</i> Hack.	c	a	a	r
<i>Aristida funiculata</i> Trin. & Rupr.	a	r	r	o
<i>Arthraxon serrulatus</i> Hocst.	r	o	o	o
<i>Arundinella tenella</i> Nees & Wight.	r	o	o	r
<i>Chloris virgata</i> Sw.	c	o	o	c
<i>Cymbopogon martinii</i> Stapf.	c	a	f	r
<i>Dicanthium caricosum</i> A. Camus.	r	r	r	r
<i>Dinebra retroflexa</i> Panzer.	o	o	o	o
<i>Eragrostis bifaria</i> Wight	c	r	r	o
<i>Gracilea royaleana</i> Hook.	o	o	r	o
<i>Heteropogon contortus</i> Beauv.	c	a	a	f
<i>Heteropogon insignis</i> Thw.	r	r	r	—
<i>Heteropogon ritchiei</i> Blatter & McCann.	—	r	r	—
<i>Iseilema antheophroides</i> Hook.	—	r	r	—
<i>Pseudanthistiria hetero-</i> <i>clita</i> Hook.	o	a	a	c
<i>Spodiopogon albidus</i> Benth.	r	c	c	r
<i>Sporobolus diander</i> Beauv.	o	o	o	o

## Note :

- a—Abundant  
f—Frequent  
c—Common  
o—Occasional  
r—Rare.

A brief account of vegetation of different parts is given as under:—

## I. WESTERN SLOPE

On the lower part of the slope in the valley along the nalla alluvium is black, sticky and moist. In the rainy season it becomes water-logged. Rounded and angular boulders are present in the soil. On the rest of slope soil is greyish, gravelly and comparatively dry. Near the top, soil is more red than grey, with huge angular and rounded boulders. The soil is dry and unstable. Soil cover is thin and land slides occur, exposing fresh layer of undecomposed strata of rock from beneath.

There is a good deal of biotic disturbance in this area being very near to a village. The forest is open to grazing and seems to have been coppiced and felled at many places. Lopping of *Boswellia serrata* is very common ; as the foliage is a good goat fodder. Lopping of *Lantana*, *Acacia* sp., *Zizyphus xylopyrus* etc. which are used for

fire is quite common. *Terminalia*, *Lagerstroemia* and *Anogeissus* saplings are occasionally felled.

*Diospyros* sp. are heavily attacked by *Viscum articulatum* which at some places has killed the plant. It appears that *Diospyros* would probably be replaced by *Lannea grandis* and *Boswellia serrata* which are almost free of the parasite.

The commonest tree species on this slope are *Diospyros melanoxylon* and *Diospyros montana*, *Lannea grandis*, *Acacia suma* and *Acacia catechu*. *Zizyphus xylopyrus*, *Anogeissus latifolia* and *Boswellia serrata* are also present and are somewhat common.

*Boswellia serrata* is prominent only in the upper part of the slopes and towards the lower part *Lannea grandis*, *Anogeissus latifolia* and *Diospyros* sp. are present. On the upper part of the slope the percentage of *Boswellia serrata* in each quadrant varies from 4 to 66 and near the top it is almost 80 to 90. On some areas near the top, there are pure patches of *Boswellia* with only small shrubs and herbs forming the ground flora.

*Acacia* sp. and *Lantana camara* are the two shrubs which occur throughout the slope. *Lantana* in many places forms impenetrable thickets to the exclusion of all other species and gives a dark-green appearance to the vegetation. Such a luxuriant growth of *Lantana* is not found on the other slopes of Katraj ghats. Here it is the most common shrub and occurs in 90% of the quadrats. Percentage in each quadrat varies from 11 to 99.

Near the extreme top of the slope, *Boswellia serrata* also becomes rare and is replaced by the dwarf shrubs of *Fluggea*, *Lantana*, *Acacia* sp., *Notonia grandiflora*, and *Neurancanthus sphaerostachys*. Here herbaceous layer has *Tridax procumbens*, *Cyanotis fasciculatus*, etc. Further up usually the above mentioned herbs with thin grass covering the surface are found. At many places near the top, the area is bare without any cover of vegetation.

The top is a flat area and it is covered with short tufted grasses in which are scattered species of *Osyris arborea*, *Argyrea cuneata*, *Lantana*, *Cipadessa fruticosa*, *Zizyphus xylopyrus*, *Acacia* sp. etc.

In the lower half of the slope, the species are varied and common. On this slope occurs a community of *Anogeissus latifolia*—*Lannea grandis*. *Diospyros* sp., and *Anogeissus* are especially abundant on the upper part.

Shrubs like *Zizyphus xylopyrus*, *Rhus mysorensis*, *Lantana*, *Acacia*, *Fluggea* are very common. Some of the shrubs attain the height of a small tree. *Holarrhena antidysenterica*, *Grewia abutilifolia* and *Randia dumetorum* are the rare shrubs.

Among the herbs, *Tridax procumbens*, *Leucas* sp., *Cocculus* sp., *Justicia diffusa*, *Justicia procumbens*, *Gynura angulosa*, *Senecio grahami*, *Vicoa auriculata*, *Celsia coromandeliana*, *Vernonia cinerea*, *Sida* sp., *Euphorbia parviflora*, *Lactuca* sp., *Crotalaria medicaginea*,

etc. are mostly common. *Polyzygus tuberosus*, *Pimpinella monoica* and *Pimpinella heyneana* are less common. *Actiniopteris dichotoma*, *Arisaema* sp. and *Adiantum* sp. are occasionally found. *Celosia argentea* is rare.

#### Grasses

Due to continuous grazing grasses do not attain proper growth. Good growth of grass is seen round about the boulders and in bushy areas where cattle cannot penetrate. The common grasses found on this slope are: *Heteropogon contortus*, *Pseudanthistiria* sp., *Apluda varia*, *Themeda triandra* and *Themeda* sp., *Ergrostis* sp., *Arundinella* sp., *Aristida* sp., and rarely *Spodiopogon albidus*, *Cymbopogon martinii*, *Arundinella tenella*, *Heteropogon insignis*, etc.

*Arisaema* sp., *Sida* sp. and *Adiantum* etc. are occasionally found among grasses.

Seedlings of *Anogeissus latifolia* are one of the commonest tree seedlings but occur only in 18% of the quadrats. Those of *Boswellia serrata*, *Lannea grandis* are less common. Seedlings of *Terminalis tomentosa* and *Diospyros* sp. are rare.

Among the shrub seedlings *Acacia* sp. and *Lantana* are very abundant.

*Tectona grandis* is restricted only to the flood plain at the foot of the slope and is rarely found at other places. Distribution of *Lannea grandis* and *Boswellia* is wide. *Anogeissus latifolia* seems to be localised at certain places on the slopes.

Among the shrubs, *Vitis pallida*, *Fluggea*, *Lantana camara*, *Acacia* sp. and *Rhus mysorensis* are distributed throughout the slope.

At the top portion of the slope, vegetation is mainly restricted to the crevices and foots of boulders, where humus and soil can collect and also the plants are protected against bright sunlight, wind and cattle. Thus *Actiniopteris dichotoma* is found in the crevices of boulders.

None of the trees in the area attain large dimensions. They seldom reach a height of 50 feet and many of the tree species are saplings; e.g. *Lagerstroemia*, *Anogeissus*, *Tectona* and *Terminalia* sp. Trees at the base of the slope are tall and become small at the top.

In most places the area is impenetrable due to a thick growth of *Lantana* and *Acacia*.

## II. EASTERN SLOPE

Poona-Bangalore passes through the eastern slope in the middle.

In the lower part of the slope which is described as Slope II, greater part of the soil is mainly alluvial. It is black or greyish black, sticky and moist. It is deep and rich in humus at places. Due to the dip of the strata towards the east, the soil on this slope is com-

paratively more moist due to seepage. Rounded boulders are present towards the upper part. The alluvial soils are mainly covered with *Tectona grandis* and *Anogeissus latifolia*.

The forest on this slope is reserved and has less biotic interference, though lopping and felling of *Acacia* sp., *Lantana* and *Flacourtia* is a regular feature here also. Saplings of *Terminalia* and *Diospyros* are cut. Though grazing seems to be restricted, grass cutting is allowed. *Diospyros* is heavily attacked by *Viscum* and most of the trees are slowly drying and dying.

*Lannea grandis* is the dominant tree species throughout the slope. It is present in 42% of the quadrats and the percentage of these species in each quadrat varies from 3 to 40. Other common tree species are *Boswellia serrata*, *Diospyros* sp., *Anogeissus latifolia* and *Tectona grandis*. *Sterculia urens* and *Gmelina arborea* are found occasionally. *Diospyros* sp. occur in 23% of quadrats on this slope against only 3% on the western slope. *Erythrina indica* is growing luxuriously throughout the slope and is found in 36% of the quadrats against 3% on the western slope. So also *Tectona grandis* is represented well on this slope than on the other slope.

Among the armed species of the middle layer *Zizyphus xylopyrus* and *Acacia* sp. are prominent.

*Salmalia malabarica* is present in 8% of the quadrats.

Thus the vegetation on this slope is a deciduous forest with a few climber shrubs which flourish well in the open areas generally.

*Lantana camara* occurs in only 23% of the quadrats as against 90% on the Western Slope. *Fluggea* sp. are present in only 13% of the quadrats against 57% on the western slope. Similarly *Flacourtia*, *Gymnosporia* and *Acacia* sp. are not well represented.

In the shrub layer, *Acacia* sp., *Clerodendron serratum*, *Vitis pallida*, *Zizyphus xylopyrus* are the commonest.

*Clerodendron serratum*, which seems to prefer a cool, moist shady area is well represented here. It occurs in 34% of the quadrats as against 3% on the western slope.

Among the herbs, *Curcuma montana*, *Adiantum* sp., *Tridax procumbens*, *Polyzygus tuberosus*, *Pimpinella monoica*, *Justicia* sp., *Arisaema* sp., *Cocculus* sp. are abundant. Other common herbs are *Celosia argentea*, *Crotalaria mysorensis*, *Crotalaria medicaginea*, *Vicoa auriculata*, *Senecio* sp., *Gynura angulosa*, *Blainvillea rhomboidea* etc.

Grasses are quite abundant on this slope as there is restriction of grazing. The common species are *Heteropogon contortus*, *Cymbopogon martinii*, *Apluda varia*, *Themeda* sp., *Spodiopogon albidus* and *Pseudanthistiria heteroclita*. Under heavy shades, *Arundinella tenella* and *Spodiopogon albidus* are common. Photo 2 shows a community of *Cymbopogon martinii* on this slope.

*Lannea grandis* seedlings are common being present in about 29% of the quadrats. Other common tree seedlings are *Boswellia*, *Anogeissus* and *Tectona*. Seedlings of *Salmalia malabarica* and *Diospyros* sp. are rarely present.

With minor exceptions there is not much difference between the lower and upper parts of the slope. Thus *Lannea grandis*, *Boswellia serrata* and *Diospyros* sp. are distributed throughout. But the growth of *Tectona grandis* is restricted towards the lower part on alluvium.

The growth of *Lannea grandis*, *Boswellia* and *Tectona* is better on this slope. Trees are comparatively large with bigger crowns though they are still not mature. Leaves are of rich green colour. Many trees of *Tectona grandis*, *Terminalia tomentosa* and some of the *Lannea grandis* are young. The foliage of *Diospyros* sp. is very poor due to the attack of *Viscum*.

Among the shrubs growth of *Lantana*, *Fluggea* and *Flacourtia* is poor. *Lantana* forms poorly branched, low, sparse shrubs. In shady areas, it climbs on trees and possesses slender branches with long internodes and large leaves. *Osyris arborea* is a low shrub. Grasses are present throughout this slope.

### III. EASTERN SLOPE (top half)

The top half of the slope is precipitous and is composed of residual soil derived from amygdaloid. The colour of the soil is black-grey to grey and somewhat reddish. In the lower portion however it is greyish black, sticky and moist. On this soil *Tectona*, *Erythrina* and *Anogeissus* are principal trees. In the middle portion of the slope soil is greyish black or grey, gravelly rather dry and covered with a shallow layer of humus. Towards the top, soil is dry, shallow, greyish and gravelly, and bears *Boswellia* and some xerophytic species. Boulders of different sizes are found throughout the slope.

Grazing is present, though not as much as on the western slopes. Lopping and felling of *Zizyphus*, *Flacourtia*, *Acacia* and *Lantana* is common. Lopping of *Boswellia* and *Terminalia* is occasional. *Diospyros* is heavily attacked with *Viscum*. Most of the *Embblica officinalis* present are sprouts from the coppiced ends.

The dominant tree species here is *Boswellia serrata*, which is present in 70% of the quadrats. It is very predominant at the top portion of the slope where the percentage in each quadrat varies from 35 to 75. Other common trees are *Diospyros* sp., *Lannea grandis* and *Erythrina indica*. These three species are mainly found in the lower half portion of the slope as they require moister soil for good growth.

*Tectona grandis* occurs in 10% of the quadrats and is restricted to the basal part of the slope. *Terminalia* sp., *Dalbergia latifolia* and *Anogeissus latifolia* are less common species which are found distributed throughout the slope except near the top. So also is the case with *Erythrina indica*.

*Morinda tinctoria* is a very rare plant occurring in only 3% of the quadrats studied. In the shrub layer there are many striking features. *Cryptolepis buchanani* and *Woodfordia floribunda* are present in appreciable number and on no other slope they are so abundant.

*Lantana camara* is the dominant shrub and is present in 75% of quadrats and is common throughout. *Flacourtia* is also a common species occurring in 20% of the quadrats and this number is the maximum in all the slopes. Other common shrubs are *Gymnosporia montana*, *Grewia* sp., *Argyreia cuneata* and *Acacia* sp.

Among the herbs *Tridax procumbens* and *Justicia* sp., *Bidens pilosa*, *Vicoa auriculata*, *Senecio grahami* are common. *Polyzygus tuberosus* and *Cocculus* sp. are also common. *Actiniopteris dichotoma*, *Curcuma montana* and *Neuracanthus sphaerostachys* are rare. Common grasses are *Apluda varia*, *Heteropogon contortus*, *Ergrostis* sp. and *Pseudanthistiria* sp.

*Boswellia serrata* seedlings are abundant and survive well. Those of *Lannea* and *Lagerstroemia* are less common. *Tectona*, *Stereospermum* and *Salmalia* seedlings are rare. *Tectona grandis* does not seem to regenerate well. Most of the seedlings present are planted.

*Erythrina indica* and *Boswellia serrata* are widely distributed on this slope. Among the shrubs, *Lantana*, *Vitis pallida*, *Acacia* and *Zizyphus xylopyrus* are widely distributed. *Notonia grandiflora* is restricted to the top of the slope and sometimes on the lower portion of slope on raised, dry, gravelly bits of land. Among herbs, *Actiniopteris* and *Curcuma montana* grow only in moist, shady places, crevices of boulders and under trees.

The lower part of the slope is covered with a comparatively thick vegetation. Trees of *Boswellia serrata*, *Anogeissus latifolia* and *Salmalia malabarica* are large. *Tectona grandis* are medium size trees. Vegetation gradually thins towards the top. On extreme top there is only grass and scattered dwarf shrubs of *Acacia* sp. and *Zizyphus xylopyrus*. *Zizyphus xylopyrus* has great ability of adaptation. On moist places, it grows as a small tree and on very dry soils it grows as a stunted shrub and all the intermediate forms are found. Huge climbers of *Cryptolepis buchanani* and *Acacia pennata* are found climbing most of the trees. Grass is generally poor, except in areas impenetrable to cattle. Boulders are usually covered with lichens.

### IV. WESTERN SLOPE

The Western Slope is an escarpment and is the longest of all the other slopes studied. The surface is very uneven. At some places it is more steep and at others somewhat less. A nalla runs along the slope diagonally. At the base, there are patches of the alluvium. Somewhat in the middle of the slope there runs an old abandoned field with trees of *Tectona*, *Diospyros* and *Terminalia* growing on edges. Shrubs of *Fluggea*, *Osyris* and *Lantana* are present on edges of the field. Just below this there is an old road.

The soil on the top of the slope is reddish grey, gravelly, dry and shallow. Humus is less or absent. Large boulders are scattered throughout the slope. At

the foot of the slope near the nalla soil is greyish black, sticky and moist, with few exposed boulders. On the rest of the slope, the soil is grey, gravelly, less moist, with moderate humus. Under the thick cover of vegetation soil is moister and humus is deeper.

The area is open to grazing and numerous cattle paths run in all directions. At places soil cover is lost due to heavy grazing. As usual lopping and felling of *Acacia* sp., *Lantana*, *Zizyphus*, *Carissa*, etc. is common.

On this slope *Lannea grandis* with a percentage occurrence of 27 and *Boswellia serrata* with 18 are the only well represented trees. *Zizyphus xylopyrus*, *Erythrina indica* and *Diospyros* occur almost in equal numbers (in 7% of the quadrats). In the upper half portion of the slope *Boswellia* is abundant and its percentage in each quadrat varies from 5 to 48. *Zizyphus xylopyrus* is also found mainly in the upper half of the slope. *Tectona grandis* is a rare species here and is found on the edges of the abandoned field and on the flood plains along the nalla below.

The vegetation of this slope is similar to that of the western slope of the other side of the road except that *Anogeissus latifolia* is present here only in 3% of the quadrats while on the other western slope it has a percentage occurrence of 23. Also *Erythrina indica* is represented well on this slope than the other.

*Lantana* is the dominant shrub (present in 80% of the quadrats) and is distributed throughout the slope; however it is not so abundant and luxuriant as on the corresponding slope. With regard to other shrubs, there is much variation between the two western slopes. On the slope IV, *Cipadessa fruticosa* is present in 30% of the quadrats; *Celastrus paniculata* in 13%, *Erythrina indica* in 11%, *Holarrhena* in 15%, *Osyris* in 22% of the quadrats. On the slope I, the number of these above species is 19, 5, 2, and 9 respectively.

Among the herbs, *Tridax procumbens*, *Leucas* sp., *Justicia* sp. etc. are common. *Cocculus* sp. and *Polyzygus tuberosus* are less common. *Actiniopteris* and *Arisaema* are rare on this slope.

The common grasses are *Eragrostis* sp., *Apluda varia* and *Heteropogon* sp., *Spodiopogon albidus* and *Arundinella tenella* are rare.

The vegetation is chiefly distributed along the nalla and especially on the alluvium of the nalla at the foot of the slope, where all types of trees, shrubs and herbs typical to Katraj ghats are abundantly present. Most of the climbers of the family Leguminosae and Convolvulaceae are present there. *Lannea grandis* is distributed throughout the slope and *Boswellia serrata* is restricted to the upper half part. Among the shrubs, *Cipadessa fruticosa*, *Gymnosporia montana*, *Osyris arborea*, *Vitis pallida* and *Lantana* are widely distributed; whereas *Celastrus paniculata*, *Acacia pennata*, *Gardenia turgida*, *Woodfordia floribunda* and *Notonia grandiflora* are localised.

The growth of *Lantana* is not so rich here as compared to slope I. On the contrary, *Woodfordia*, *Fluggea*,

and *Cipadessa* are large shrubs here. Along the nalla trees are generally large. Growth of grasses and herbs is abundant wherever cattle cannot penetrate. Shrubs at many places form impenetrable thickets.

### RIVERAIN VEGETATION AT KATRAJ GHATS

On many of the streams in the valley, the vegetation is quite luxuriant as regards growth, number and variety of species. The soil is alluvial and moist. A typical riverain vegetation was studied and the data are given in Table III.

TABLE III

	Percentage of quadrats in which the given species were found.
Upper layer:	
<i>Acacia arabica</i> Willd.	30
<i>Anona squamosa</i> L.	80
<i>A. reticulata</i> L.	10
<i>Bauhinia racemosa</i> Vahl	10
<i>Syzygium jambos</i> (L.) Alston	20
<i>Erythrina indica</i> Lam.	20
<i>Ficus glomerata</i> Roxb.	30
<i>Lannea grandis</i> Engl.	20
<i>Mangifera indica</i> L.	10
<i>Salmalia malabarica</i> DC.	20
Saplings:	
<i>Anogeissus latifolia</i> Wall.	10
<i>Syzygium jambos</i> (L.) Alston	40
<i>Salmalia malabarica</i> DC.	30
<i>Terminalia tomentosa</i> Bedd.	10
Shrub layer:	
<i>Acacia pennata</i> Willd.	60
<i>Carissa congesta</i> Wight.	30
<i>Cassia glauca</i> Lam.	30
<i>Dioscorea</i> sp.	10
<i>Gymnosporia montana</i> Roxb.	10
<i>Lantana camara</i> L.	60
<i>Osyris arborea</i> Wall.	20
<i>Prosopis spicigera</i> L.	20
<i>Vitex negundo</i> L.	10
<i>Woodfordia floribunda</i> Salisb.	60
Herb layer:	
<i>Achyranthes aspera</i> L.	10
<i>Apluda varia</i> Hack.	60
<i>Andropogon intermedius</i> K. Schum.	30
<i>Ammania salicifolia</i> Monti	50
<i>Caesulia axillaris</i> Roxb.	10
<i>Cymbopogon martinii</i> Stapf.	10
<i>Cyperus</i> sp.	40
<i>Desmodium</i> sp.	20
<i>Desmodium triflorum</i> DC.	20
<i>Heteropogon contortus</i> Beauv.	50
<i>Lactuca</i> sp.	10
<i>Xanthium strumarium</i> L.	10

The stream runs along the eastern side of the Poona-Bangalore road. On the western side of the stream the gradient of the slope rises rather abruptly upto the road and on the left side it rises for only about a few feet to meet the cultivated fields above. The soil is bouldary



with a deposition of coarse alluvium in pockets. Many plants grow in these pockets due to better quality of soil and abundance of water.

The biotic interference in the area is slight.

*Anona squamosa* is the abundant tree species and chiefly grows along the eastern side of the stream. It occurs in 80% of the quadrats and the maximum percentage in each quadrat is 70. As the fruits of the trees are edible, they are probably looked after by the tillers of nearby fields. Large trees of *Ficus glomerata* and *Syzygium jambos* are found along the stream. The percentage of quadrats in which the two species occur are respectively 30 and 20. Other occasionally occurring trees are *Salmalia malabarica*, *Lannea grandis* and *Acacia arabica*. The rare trees are *Mangifera indica* and *Anona reticulata* and both of them occur only in 10% of the quadrats.

Saplings of many trees are common near about the edge of the stream, commonest among them being *Syzygium jambos*, which occurs in 40% of the quadrats and are distributed all along the stream. Seedlings of *Salmalia malabarica*, are present in 30% of the quadrats. Seedlings of *Anogeissus latifolia* and *Terminalia tomentosa* are rare.

Among the shrubs, *Cipadessa fruticosa*, *Cryptolepis buchanani*, *Woodfordia floribunda*, *Acacia pennata*, *Lantana camara* and *Carissa congesta* are abundant and occur in more than 50% of the quadrats. Climbers of *Acacia pennata* and *Cryptolepis buchanani* are distributed widely. Other common shrubs are *Cassia glauca* and *Prosopis spicigera* which occur in 30% and 20% of the quadrats respectively.

Herbaceous flora is not well represented probably due to the rapid water currents during monsoons. On both sides of the stream, or on the stream beds from where water has receded, the following species were found:—*Desmodium triflorum*, *Ammania salicifolia*, *Caesulia axillaris*, *Cyperus* sp. etc. Grasses are abundant on both banks of the stream in open areas. Common grasses are *Heteropogon contortus* and *Apluda varia* which occur in 50% and 60% of the quadrats respectively. *Cymbopogon martinii* and *Themeda* sp. are less common. On the right bank of the stream towards the road on the western side, the following shrubs and tree saplings were abundant:—*Lantana camara*, *Carissa congesta*, *Fluggea* sp., *Ipomea* sp., *Acacia pennata*, *Vitex negundo*, *Zizyphus xylopyrus*, *Ficus glomerata*, *Dalbergia* sp. and *Diospyros melanoxylon*. In open situations on gravelly coarse soil in river bed, clumps of *Nerium odorum* are present (photo 3). These plants with characteristic pink and white flowers lend a striking colour to the landscape.

From the above description it is clear that the Western slope No. 1 compares well with Western slope No. IV. And Eastern slope No. III is simply a continuation of eastern slope II. Section II of eastern slope is moist and is covered with vegetation of the dry deciduous type with abundant tree species. Section III of eastern slope, being the top portion, is comparatively drier than the

slope II. Slope No. I and slope No. IV generally support a somewhat scrubby vegetation of the dry deciduous type, with few tree species. Slope I is the driest of all.

If the forests are completely closed to human intervention and cattle, it is not impossible that slopes II and III might develop a good deciduous forest as the soil is good and is kept moist due to the seepage of water.

## SINHAGAD GHATS

Sinhagad Ghats are part of the Sayadhari 15 miles on South-west of Poona. They represent a more advanced stage of vegetation than that of the Katraj ghats. If the Central hill of the Ghats (fort hill) is taken as the centre of an imaginary circle, about 6 valleys, originating in the central hill run in all directions. Each valley (photo 4) stretches for about 5 miles in length and about  $\frac{1}{2}$  to 1 mile in breadth. Thus, many hills seem to radiate in all directions from the Central hill. The hills are much higher than the Katraj and the height of the Central hill is 4320 feet. The height of other hills is usually maximum towards the central hill and gradually decreases outwards. At the foots of some of the hills conical scree masses are formed due to landslides from the hill tops.

From the top of the Central hill the gradient falls abruptly for about 30—50 feet and further down also the slope is more or less precipitous. The exposed strata of rock at the top are of basalt on which fort is built. The other hills are also formed of basalt and amygdaloid is very much less in proportion.

The hills are mostly flat topped and have many spurs and ridges (photo 5). Generally, the slopes are abruptly precipitous at the tops and have a gentle gradient at lower levels, due to the presence of river alluvium.

Soil on the slopes is alluvial or trap rock, according to the constitution of such slopes. On lower levels alluvial soil is generally rich and deep. Soil formed of amygdaloid on the upper and middle part of the slopes is gravelly. The soil formed due to the incomplete weathering of basalt is a mixture of small boulders and fine grained soil.

All the valleys are narrow V-shaped and the convexity of these faces towards the fort hill. In the major valleys several smaller valleys also occur.

The drainage of hills is by one or more nallas running in each valley. Near the end of the valleys the smaller nallas unite to form streams and the streams join the Mula-Mutha river near the Sinhagad ghats. The valleys have numerous fertile fields and there are vast stretches of planted teak.

Flood plains deposits of the older streams are present at the foot of the hills along the nallas. The soil here is alluvial and permeable, with most of the boulders weathered. Due to the high fertility flood plain deposits support thick forests of *Tectona grandis* (photo 6),

**General Account of Vegetation:** The vegetation on these hills seems to be closely related with the type of soils and geological features.

The biotic interference, of course, generally upsets the natural relationship. Teak and several other plants are being planted by the Forest Department. The local population is also interested in the planting of Teak. They however clear good patches of forest as well for agriculture and lop trees for cattle fodder. Fortunately the damage due to biota is not heavy in this area.

The precipitous slopes of the fort hill are rocky and in the crevices of rocks growth of *Musa* sp. and *Ficus religiosa* is seen. Wherever the soil is present on the rocky substratum, *Impatiens* sp., *Carvia callosa*, *Cipadessa fruticosa* and many grasses grow along with *Bridelia retusa*.

The plateau of the fort hill is not entirely plain but there are many ridges and depressions. On the ridges the soil is shallow and there is usually a short growth of grasses. The depressions form marshes due to the oozing out of the spring water and vegetation consists of *Impatiens* sp., *Polygonum glabrum*, *Asteracantha longifolia*, *Ammania* sp., some species of grasses and sedges.

On the plateau of other hills, if the soil is very shallow (about 5 cms. deep), then only short, thin and sparse growth of grasses is present. But on deeper soils (15 cms. or more deep), vegetation consists of *Bridelia retusa*, *Notonia grandiflora*, *Lantana camara*, *Gymnosporia montana*, *Flacourtia* sp., *Artemisia parviflora*, *Fluggea* sp., *Carissa congesta*, *Osyris arborea*, *Ficus religiosa*, etc. Among the herbs *Senecio* sp., *Vicoa auriculata*, *Neuracanthus sphaerostachys*, etc., are present. Grasses are *Heteropogon contortus*, *Pseudanthistiria* sp., *Eragrostis* sp., *Aristida* sp., *Arundinella* sp., *Chloris* sp. etc. When the soil is of good quality, *Anogeissus latifolia*, *Emblia officinalis* and *Elaeodendron glaucum* will also be found with some of the above mentioned species.

On steeper slopes there is abundant growth of the following species:—*Artemisia parviflora*, *Artemisia vulgaris*, *Euphorbia ligularia*, *Grewia* sp., *Carvia callosa*, *Garuga pinnata*, *Boswellia serrata*, *Emblia officinalis*, *Lannea grandis*, *Impatiens* sp., *Fluggea* sp., etc. Occasionally, *Anogeissus latifolia*, *Terminalia tomentosa*, *Elaeodendron glaucum* and *Adina cordifolia* and very rarely *Tectona grandis*, may also occur here.

On gentler slopes, especially eastern and north-eastern, *Anogeissus latifolia*, *Tectona grandis* and *Terminalia* sp., are abundant with some of the above mentioned species.

On the flood plains, *Tectona grandis* is predominant with occasional trees of *Anogeissus latifolia*, *Cassia fistula*, *Terminalia tomentosa*, *Adina cordifolia*, *Vangueria spinosa*, *Stephegyne parviflora*, *Elaeodendron glaucum*, etc.

Amongst the Cryptogamic flora three species of ferns namely, *Cheilanthes albomarginata*, *Adiantum* Sp. and rarely *Actiniopteris dichotoma* are present on this hill.

They grow in cool, moist and shady places and especially in the pockets of good soil. *Riccia* sp., *Marchantia* sp., Mosses and Lichens are also present. Liverworts grow on very moist soils. Mosses are seen on the barks of trees in moist places, on moist soils and on boulders. When the area is dry and open, mosses are rarely seen on tree barks. Lichens are always present, especially on newly exposed boulders and rock beds.

Amongst the earliest colonists on basalt is *Cyanotis fasciculatus* accompanied by *Anisochilus carnosus*, *Eragrostis* sp., *Heteropogon contortus*, etc. *Woodfordia floribunda*, *Vitis pallida*, *Neuracanthus sphaerostachys* and *Lantana camara* etc. also come in early in somewhat better soils.

**Detailed account of vegetation:** Detailed studies of the area were made by running a number of transects across the eastern and western slopes in the main valley.

The valley is bounded on the south by the high fort hill and on the east and west by a chain of hills which run nearly for 2 miles to the north. In the middle are two small hills. Between any two successive hills there is a nalla running in a south-north direction.

#### EASTERN SLOPE I, (Near the village)

One transect was run from the top to the foot of the hill along which quadrats of 15 feet radius were studied. The data of vegetation are given in the table IV.

Soil in the lower portion of slope is generally moist, but at the top most of the surface soil is eroded. Humus layer is sufficiently deep under trees. The gradient is gentle upto the  $\frac{3}{4}$ th portion of slope and then it suddenly rises to the top.

The top of the hill is open to grazing, but in the rest of the area only periodical cutting of grasses is done. Here and there are signs of lopping of *Grewia* sp. *Anogeissus latifolia*, *Zizyphus xylopyrus* and occasionally *Tectona grandis*. In many places *Carvia callosa* bushes have been cleared to encourage the growth of suitable fodder grasses and also for afforesting the area with suitable tree species.

The vegetation on this slope is a community of *Anogeissus latifolia*—*Tectona grandis*—*Terminalia tomentosa*.

Towards the top *Anogeissus latifolia* occurs in 74% of the quadrats with a maximum percentage in each quadrat of 55. It is distributed throughout the slope. *Tectona grandis* occurs in 54% of the quadrats and is the next common species. It is not found at the top, but its growth is dense towards the lower portion of the slope. On this slope *Tectona* trees are larger and older than on other slopes. *Terminalia tomentosa* is represented in 41% of the quadrats and is widely distributed, in rather open areas. Trees are of medium size.

Other plants which are found occasionally in this community are *Lannea grandis*, *Ficus religiosa*,

TABLE IV

Percentage occurrence of given species of plants in the five different slopes at Sinhagad Ghats, Poona.

LOCALITY:—	Eastern slope I	Western slope II	Eastern slope III	Western slope IV	Western slope V
ROCK AND GEOLOGY:—	Basalt rock	Basalt rock	Basalt rock.	Basalt rock.	Basalt and amygdaloid rocks.
SOIL:—	Greyish brown, generally fine grained moist and deep. Boulders present.	Greyish brown, generally fine grained less moist than on the western slopes. Boulders present.	Greyish brown, generally fine grained moist and deep. Boulders present.	Greyish brown. Generally fine grained. Boulders present.	Greyish, gravelly, shallow and dry. Boulders present.
ASPECT:—	I Eastern slope. Slope gentle except at the top.	II. Western slope. Slope precipitous.	III Eastern slope. Slope gentle.	IV Western slope. Slope precipitous at the top.	V Western slope. Slope precipitous at the top.
BIOTA:—	Biotic interference little. Grazing only at the top of slope. Occasional lopping of <i>Grewia</i> , <i>Carissa</i> , <i>Phyllanthus</i> and <i>Anogeissus</i> . Some trees at the top of the hill are attached by <i>Viscum</i> . Few foot paths.	No grazing but there is occasional cutting of grass. <i>Carvia</i> patches in many places have been cleared off. Occasional lopping of <i>Grewia</i> , <i>Carissa</i> , <i>Zizyphus</i> , and <i>Phyllanthus</i> . Few foot-paths. Plantation of tree seedlings in open areas.	Occasional grazing on the top half of the slope. A foot path to the Sinhagad fort, passes along the slope in a zig-zag way. Lopping of <i>Zizyphus xylopyrus</i> , <i>Grewia</i> species, <i>Acacia</i> sp. and <i>Emblia officinalis</i> occasional.	Occasional grazing and cutting of grass. Few foot-paths. Occasional lopping of <i>Grewia</i> sp., <i>Acacia</i> sp., <i>Zizyphus xylopyrus</i> , <i>Vitis pallida</i> , and <i>Anogeissus latifolia</i> .	Grazing all round the year. Many footpaths. Frequent lopping of <i>Acacia</i> sp. <i>Zizyphus xylopyrus</i> , <i>Carissa</i> , <i>Grewia</i> and <i>Vitis pallida</i> .
Number of quadrats studied :	125	35	33	22	20
PLANTS:—	Percentage number of quadrats in which the given species were found :				
Upper layer:					
<i>Adina cordifolia</i> Hook.	7	3	10	33	—
<i>Anogeissus latifolia</i> Wall.	74	58	55	65	74
<i>Bauhinia racemosa</i> Vahl.	7	7	5	9	9
<i>Boswellia serrata</i> Roxb.	—	—	3	—	22
<i>Bridelia retusa</i> Spreng.	7	5	14	5	—
<i>Cassia fistula</i> DC.	11	3	—	28	—
<i>Dalbergia</i> sp.	7	7	12	5	5
<i>Elaeodendron glaucum</i> Pers.	7	7	3	14	9
<i>Erythrina indica</i> Lam.	—	—	3	—	—
<i>Ficus religiosa</i> L.	11	—	3	—	—
<i>F. glomerata</i> Roxb.	—	5	—	—	—
<i>Grewia abutilifolia</i> Juss.	15	24	14	33	13
<i>Holarrhena antidysenterica</i> Wall.	7	—	—	—	—
<i>Lagerstroemia lanceolata</i> Wall.	—	—	—	—	26
<i>Lannea grandis</i> Engl.	22	7	17	14	9
<i>Emblia officinalis</i> L.	19	12	3	28	9
<i>Randia dumetorum</i> Lam.	11	—	—	—	—
<i>Salmaal malabarica</i> DC.	—	—	10	5	—
<i>Tectona grandis</i> L.	59	34	48	38	64
<i>Terminalia chebula</i> Retz.	7	—	3	9	—
<i>T. tomentosa</i> Bedd.	41	12	17	19	5
<i>Trema orientalis</i> Blume.	—	3	3	—	—
<i>Vangueria spinosa</i> Roxb.	4	5	—	—	—
<i>Zizyphus jujuba</i> Lam.	4	—	—	—	5
<i>Z. xylopyrus</i> Willd.	15	7	3	28	17
<i>Z. rugosa</i> Lam.	4	—	—	—	—

Number of quadrats studied :	125	35	33	22	20
Herb layer :					
<i>Achyranthes aspera</i> L.	—	—	5	—	—
<i>Adiantum</i> sp.	30	24	—	34	—
<i>Anisochilus carnosus</i> Wall.	4	—	—	—	—
<i>Arisaema murrayi</i> Hook.	19	5	5	—	—
<i>Arthraxon serrulatus</i> Hochst.	—	33	—	18	—
<i>Arundinella tenella</i> Nees.	30	31	37	45	—
<i>Asparagus racemosus</i> Willd.	9	10	10	9	9
<i>Bidens pilosa</i> L.	26	37	30	19	15
<i>Blainvillea rhomboidea</i> Cass.	—	7	—	11	9
<i>Capillepidium hugelli</i> Blatter & McCann.	63	14	14	30	56
<i>Cassia mimosoides</i> L.	—	—	5	—	—
<i>Celosia argentea</i> L.	—	6	24	—	13
<i>Cheilanthes albo-marginata</i> Clarke.	7	38	10	34	9
<i>Cocculus</i> sp.	—	—	—	—	13
<i>Commelina</i> sp.	—	3	7	—	—
<i>Crotalaria medica-ginea</i> Lam.	11	12	21	37	—
<i>Costus speciosus</i> Smith.	—	3	—	3	—
<i>Crotalaria mysorensis</i> Roxb.	15	—	—	—	—
<i>Curculigo orchioidea</i> Gaertn.	15	—	12	—	22
<i>Curcuma montana</i> Baker	31	14	21	11	—
<i>Cyanotis fasciculatus</i> Sch.	—	7	7	—	—
<i>Cymbopogon martinii</i> Stapf.	—	—	—	11	22
<i>Cyperus</i> sp.	—	—	5	—	—
<i>Desmodium rotundifolium</i> Baker.	—	6	—	15	—
<i>Desmodium</i> sp.	34	—	—	—	—
<i>Gynura angulosa</i> DC.	17	17	—	—	—
<i>Heteropogon contortus</i> Roem. & Schult.	37	31	—	22	52
<i>Heylandia latebrosa</i> DC.	—	—	—	—	5
<i>Impatiens</i> sp.	4	5	—	—	—
<i>Justicia</i> sp.	11	7	10	11	—
<i>Lavendula gibsoni</i> Garh.	—	10	10	—	47
<i>Lactuca</i> sp.	—	—	—	—	5
<i>Linum mysorense</i> Heyne.	22	48	—	—	—
<i>Pimpinella heyneana</i> Wall.	—	10	—	11	17
<i>P. monoica</i> Dalz.	15	12	—	22	—
<i>Pseudanthistiria heteroclita</i> Hook.	27	21	—	30	34
<i>Senecio grahami</i> Hook.	30	33	41	60	5
<i>Setaria</i> sp.	—	—	19	—	—
<i>Smithia sensitiva</i> (Ait.) DC.	—	—	14	—	—
<i>Sopubia delphinifolia</i> Don.	5	10	19	—	—
<i>Spodiopogon albidus</i> Benth.	52	33	26	37	—
<i>Sida</i> sp.	12	14	10	10	8
<i>Tripogon</i> sp.	—	17	—	—	—
<i>Themeda</i> sp.	5	7	6	5	3
<i>Terminus labiales</i> Spreng.	—	—	10	—	—
<i>Vernonia cinerea</i> Less.	32	—	37	—	—
<i>Vicoa auriculata</i> Carb.	19	10	24	5	78

Number of quadrats studied :	125	35	33	22	20
<b>Saplings :</b>					
<i>Adina cordifolia</i> Hook.	—	—	—	9	—
<i>Anogeissus latifolia</i> Wall.	27	12	31	5	60
<i>Boswellia serrata</i> Roxb.	7	—	—	—	—
<i>Bridelia retusa</i> Spreng.	7	—	—	—	5
<i>Cassia fistula</i> DC.	4	—	—	9	—
<i>Ficus religiosa</i> L.	—	—	3	—	—
<i>Garuga pinnata</i> Roxb.	4	—	—	—	—
<i>Lannea grandis</i> Engl.	7	7	3	—	—
<i>Murraya koenigii</i> Spr.	10	—	3	8	—
<i>Emblica officinalis</i> L.	—	—	—	5	5
<i>Tectona grandis</i> L.	7	—	7	5	—
<i>Terminalia tomentosa</i> Bedd.	4	7	5	5	9
<b>Shrub layer :</b>					
<i>Aerua tomentosa</i> Jacq.	3	—	3	—	—
<i>Acacia pennata</i> Willd.	4	—	—	—	5
<i>Argyrea cuneata</i> Ker.	—	—	—	9	5
<i>A. sericea</i> Dalz. & Gibbs.	—	—	10	—	—
<i>Artemisia</i> sp.	11	45	17	9	13
<i>Bauhinia racemosa</i> Lam.	—	—	3	—	—
<i>Barleria</i> sp.	3	—	3	4	—
<i>Carissa congesta</i> Wight.	32	24	21	33	30
<i>Carvia callosa</i> Berm.	37	45	38	32	—
<i>Celastrus paniculata</i> Willd.	19	5	—	—	9
<i>Cipadessa fruticosa</i> Blume.	19	21	7	33	—
<i>Clerodendron serratum</i> Spreng.	—	10	—	24	—
<i>Cryptolepis buchana-</i> <i>nani</i> Roem.	33	29	21	47	13
<i>Desmodium latifolium</i> DC.	—	—	3	—	—
<i>Dioscorea diaemona</i> Roxb.	—	—	—	5	—
<i>Dioscorea</i> sp.	49	65	24	82	13
<i>Euphorbia ligularia</i> Roxb.	11	3	24	—	5
<i>Flacourtia</i> sp.	11	7	3	9	22
<i>Fluggea</i> sp.	—	37	10	28	30
<i>Grewia</i> sp.	4	10	—	14	—
<i>Gymnosporia montana</i> Roxb.	15	5	9	—	13
<i>Hamiltonia suaveolens</i> Roxb.	5	31	10	19	—
<i>Holarrhena antidysen-</i> <i>terica</i> (L.) Wall.	19	—	10	9	—
<i>Hemidesmus indicus</i> R. Br.	18	12	9	13	3
<i>Indigofera pulchella</i> Roxb.	8	10	—	42	—
<i>Ipomea</i> sp.	—	—	20	5	—
<i>Lantana camara</i> L.	50	26	31	—	58
<i>Lasiosiphon erio-</i> <i>cephalus</i> Decne.	11	10	—	7	—
<i>Leea macrophylla</i> Roxb.	11	5	58	28	—
<i>Musa</i> sp.	—	—	24	—	—
<i>Neuracanthus sphae-</i> <i>rostachys</i> Dalz.	8	—	—	—	5
<i>Notonia grandiflora</i> DC.	4	5	3	—	5
<i>Ocimum grattissimus</i> L.	—	—	3	—	—
<i>Osyris arborea</i> Wall.	11	24	—	5	9
<i>Ricinus communis</i> L.	3	—	3	—	—
<i>Rubia cordifolia</i> L.	—	3	—	—	—
<i>Solanum coagulans</i> Forsk.	—	—	5	—	5
<i>Vitis</i> sp.	15	12	—	—	—
<i>V. pallida</i>	—	—	—	—	—
Wight & Arn.	32	24	24	19	22
<i>V. rheedei</i> Wight & Arn.	—	—	—	19	—
<i>Woodfordia floribunda</i> Salisb.	4	20	7	9	—
<i>Zizyphus xylopyrus</i> Willd.	4	—	7	—	—
<i>Zizyphus rugosa</i> Lam.	—	7	—	9	—

*Randia dumetorum*, *Zizyphus xylopyrus* and *Emblia officinalis*.

Rarely occurring or localised trees are *Dalbergia* sp., *Adina cordifolia*, *Bridelia retusa*, *Elaeodendron glaucum*, *Bauhinia racemosa*, *Vangueria spinosa*, *Lagerstroemia lanceolata* and *Zizyphus rugosa*.

Saplings of *Anogeissus latifolia* are the most abundant of all, being found in 27% of the quadrats. Saplings of *Tectona grandis* and *Lannea grandis* are occasional and found in only 7% of the quadrats. Saplings of *Anogeissus*, *Tectona* and *Terminalia* chiefly grow in somewhat shady areas, with good soil. Saplings of *Boswellia*, *Garuga* and *Lannea* are found only at the top portion of the slope in open areas and even on poor soils.

Among the shrubs, *Carvia callosa*, *Cryptolepis buehnanii* and *Dioscorea* sp. are the commonest. *Dioscorea* sp. are the common climbers found in moist situations and in places where the tree vegetation is dense. On the upper portion of the slope where tree vegetation is sparse, *Dioscorea* climbers are rare. They are present in 49% of the quadrats. *Carvia callosa* occurs in 37% of the quadrats and is distributed only in the top half of the slope in open areas.

*Cryptolepis buehnanii* is present in 33% of the quadrats and is distributed chiefly in the lower half of slope. *Lantana camara* and *Carissa congesta* occur in 22% and 15% of the quadrats respectively, and are found throughout the slope but are abundant in shady areas and along nallas. In some places they are seen growing to the exclusion of all other shrubs and herbs. Both of them have great tolerance of light condition and grow equally well in shade and in exposed places. *Artemisia* spp. (*A. parviflora* and *A. vulgaris*) are found only in 11% of the quadrats and grow in open places. *Carvia callosa* and *Artemisia* sp. are rarely found together. Among the other common shrubs, *Celastrus paniculata*, *Cipadessa fruticosa*, *Holarrhena antidysenterica* are chiefly distributed in the lower half of the slope. *Osyris arborea*, *Gymnosporia montana*, *Euphorbia ligularia*, *Flacourtia* sp., and *Vitis pallida* are the occasional shrubs and grow in coarse or rocky soils on the top portion of the slope. Plants like *Notonia grandiflora* and *Neuracanthus sphaerostachys* are of xeric nature and grow on rocky soils on the extreme top of slope.

In the herbaceous flora the common Compositae herbs are *Vicoa auriculata*, *Senecio grahami*, *Bidens pilosa* and *Vernonia cinerea* and are distributed all over. They occur in 19%, 30% and 32% of the quadrats, respectively. Among the Papilionaceae herbs, *Desmodium* sp., *Crotalaria mysorensis* and *Crotalaria medicaginea* are common and occur in 34%, 15% and 11% of the quadrats, respectively. They are mainly found in shady areas. *Linum mysorense* is also fairly common.

The moisture-loving herbs are *Cheilanthes albomarginata*, *Adiantum* sp., *Curcuma montana* and *Arisaema murrayi*. They are found in pockets in moist shady places. Grasses are distributed all over but occur abundantly in open areas on good soils. They do not grow

with *Carvia callosa*. The common Grasses are *Heteropogon contortus*, *Arundinella tenella*, *Pseudanthistiria heteroclita*, *Eragrostis* sp., *Tripogon* sp., *Apluda varia* and *Themeda* sp., *Arundinella tenella* and *Spodiopogon albidus* are chiefly found in shady places and they have broad leaves.

Tree barks and boulders in shady moist places are covered with mosses and liverworts.

## WESTERN SLOPE II (Of the Pata Hill)

The western slope is steeper than the eastern. Two transects were run along it, one from near about Pata village upto the foot and the other from the free end of hill to the foot. The second transect passes through vast flood plain area at the foot of this hill.

The soil is formed from trap rock and is usually finely grained and is generally moist. Boulders are present all over the gentler part of slope.

There is no grazing but occasional cutting of grass is done. Many *Carvia* patches are cleared off for planting of trees. Lopping of *Grewia* sp., *Phyllanthus*, *Carissa*, *Lantana* and occasionally *Anogeissus* and *Tectona* is seen. Most of the *Grewia* plants are either coppiced or lopped. Paddy cultivation is done on the lower flood plain deposits along the nallas.

The slope bears a community of *Anogeissus latifolia*—*Tectona grandis*.

*Anogeissus latifolia* out numbers all other trees and is present in 58% of the quadrats. It is distributed throughout the slope, but is abundant on the top of the slope. *Tectona grandis* occurs in 34% of the quadrats and is restricted to flood plain deposits at the foot of hill, rarely occurring on the steeper part of the slope. Other common trees are *Grewia abutilifolia*, *Terminalia tomentosa* and *Emblia officinalis*. *Grewia* occurs in 24% of the quadrats. The occasionally occurring trees are *Cassia fistula*, *Garuga pinnata*, *Adina cordifolia*, *Ficus glomerata*, *Bauhinia racemosa*, *Lannea grandis* and *Elaeodendron glaucum*. *Garuga pinnata* and *Bauhinia racemosa* are found in open areas at the top.

*Trema orientalis* and *Stephegyne parviflora* are represented poorly and occur in 3%, 7% and 5% of the quadrats respectively. *Ricinus communis* grows to a small tree and is distributed along the nallas. It is also cultivated near the Pata village. *Zizyphus xylopyrus* occurs in 7% of the quadrats.

Among the shrubs, *Artemisia* sp., *Carvia callosa* and *Dioscorea* sp. are abundant. *Artemisia* sp. are tall, moderately branched shrubs present in open areas on the slope. *Carvia callosa* is equally abundant, being found in 45% of the quadrats. It is abundantly found on the steeper part of slope in open areas. *Artemisia* and *Carvia* are usually never found together. Other common shrubs are *Cipadessa fruticosa*, *Woodfordia*

*floribunda*, *Lantana camara*, *Carissa congesta*, *Osyris arborea*, *Fluggea* sp., *Dioscorea* sp., *Smilax* sp. and *Hamiltonia suaveolens*. Among the above mentioned shrubs, *Hamiltonia*, *Lantana*, *Dioscorea* and *Woodfordia* are distributed all over the slope. But *Osyris arborea* and *Fluggea* sp., are restricted to the upper half of the slope. The occasionally occurring shrubs are *Clerodendron serratum*, *Lasiosiphon eriocephalus*, *Indigofera pulchella*, *Grewia* sp., *Notonia grandiflora* and *Gymnosporia montana*. *Notonia grandiflora* is a succulent shrub with stout stem and is seen only at the top. *Rubia cordifolia*, which is a much scabrous climbing shrub is rare, occurring only 3% of the quadrats.

The common grasses are *Arundinella tenella*, *Heteropogon contortus*, *Apluda varia*, *Spodiopogon albidus* and *Arthraxon serrulatus*. The first three species occur in 31% and the last two in 33% of the quadrats. Though *Spodiopogon albidus* is represented in 31% of the quadrats, its thick growth is not seen. It grows chiefly in shady places. Other grasses grow abundantly in open areas where there is no growth of *Carvia*. The less common grasses are *Ischeimium* sp., *Tripogon* sp., *Chloris* sp. and *Pseudanthistiria heteroclita*.

The herbs of Compositae family are the commonest and widely distributed. *Senecio grahami*, *Bidens pilosa* and *Vernonia cinerea* occur in 33%, 37% and 43% of the quadrats, respectively.

The less common herbs are *Gynura angulosa*, *Vicoa auriculata*, *Blainvillea rhomboidea* and *Lactuca* sp. The other herb is *Linum mysorensense* which occurs in 48% of the quadrats. Two species of Umbellifereae—*Pimpinella heyneana* and *Pimpinella monoica* are occasional and are present in 10% and 12% of the quadrats, respectively. Herbs occurring in moist situations are *Curcuma montana*, *Costus speciosus*, *Cheilanthes albomarginata*, *Commelina* sp., *Arisaema* sp. and *Adiantum* sp. On rocky soils *Cyanotis fasciculatus* is abundant.

There is a lot of difference in vegetation recorded along the two transects. The first transect passes through a steep part of the slope where undergrowth is only of *Carvia callosa* and trees are rarely found at the top. The second transect passes through a gentle part of the slope with different type of undergrowth. Trees are found all over the transect.

### EASTERN SLOPE III (of Pata Hill)

This slope resembles in vegetation etc. with the eastern slope already described. Edaphic factors are also more or less the same as those on the corresponding slope I. Soil is generally fine grained with many exposed and scattered boulders. At the top it is gravelly but along the nalla being alluvium it is more fertile. Gradient of slope is high only near the top.

This slope is comparatively more disturbed than the eastern slope I. A rough zigzag footpath about 5 feet

broad from the valley to Sinhagad passes along this slope. There are many cattle paths. As a result of forest clearing in many places some years ago, *Euphorbia ligularia* and other shrubs are growing here in abundance. Grazing is generally found on the top of hill and on flood plain at the foot of slope. On flood plain, lopping of shrubs is common and herbaceous flora except grasses, is poorly represented. In open areas plantations of *Anogeissus latifolia*, *Salmalia malabarica* and *Tectona grandis* are being raised. Along footpath, stumps of *Ficus bengalensis* and other species of *Ficus* are being planted.

The vegetation on this slope is mainly a community of *Anogeissus latifolia*—*Tectona grandis*.

*Anogeissus latifolia* is the commonest tree, occurring in 55% of the quadrats as against 74% on the corresponding slope I, and is distributed all over the slope. *Tectona grandis* is restricted to the flood plains below, being present in 48% of the quadrats.

*Lannea grandis* and *Terminalia tomentosa*, which are distributed throughout the slope, are found in 17% of the quadrats. This number is also less than that on slope I.

Some of the trees growing in dry areas, such as *Boswellia serrata* and *Garuga pinnata* are found occasionally on the slope and they are also poorly represented on the corresponding slope I.

Other common trees here are *Bridelia retusa*, *Adina cordifolia* and *Dalbergia* sp., which respectively occur in 14%, 10% and 12% of the quadrats. *Bridelia retusa* occurs throughout the slope, while *Adina cordifolia* is restricted to the lower portion. *Trema orientalis*, *Elaeodendron glaucum* are the other rare species. *Trema orientalis* grows only along the nalla.

In the shrub layer *Leea macrophylla* is abundant and occurs in 58% of the quadrats and the maximum percentage in each quadrat is 52. It is distributed all over in moist and shady places. *Musa* sp. occur in 24% of the quadrats and grow in precipitous rocky areas in the crevices of rocks. Other common shrubs are *Carvia callosa*, *Lantana camara*, *Vitis pallida*, *Dioscorea* sp., *Carissa congesta* and *Cryptolepis buchanani*. *Carvia callosa* is found only in the Ist. transect and is entirely absent in the IInd. transect chiefly due to two reasons:— (1) Shady area with thick growth, (2) and deliberate clearing. The occasional shrubs here are *Holarrhena antidysenterica*, *Euphorbia ligularia*, *Hamiltonia suaveolens*, *Ipomea* sp., *Woodfordia floribunda* and *Zizyphus xylopyrus*. *Euphorbia ligularia* is found in open places at the top and *Holarrhena* in moist and shady places. Rarely occurring shrubs are *Notonia grandiflora* (found in rocky areas at the top), *Fluggea* sp., *Bauhinia racemosa*, *Flacourtia* sp., *Desmodium latifolium*, *Ricinus communis* and *Calotropis procera*. Above mentioned shrubs, except *Desmodium latifolium* and *Ricinus communis* grow on gravelly soils in open areas. *Ricinus* is found along the nalla.

In the herbaceous layer, plants of the Compositae, Leguminosae and Gramineae are well represented. *Senecio grahami* and *Vicoa auriculata* are the commonest Compositae herbs which are represented in 41% and 24% of the quadrats, respectively. They flower during the late monsoon and lend yellow colour to the ground flora stretching over vast areas. Common Leguminosaeous herbs are *Crotalaria medicaginea*, *Smithia sensitiva* and *Cassia mimosoides*. The shade loving herbs like *Curcuma montana* and *Cheilanthes arbomarginata* are also well represented.

*Celosia argentea* occurs in 24% of the quadrats and is widely distributed. *Cyanotis fasciculatus*, *Cyperus* sp., *Achyranthes aspera* and *Arisaema* sp., are rare herbs in this slope.

Among the grasses the abundant species in *Apluda varia*. Other common grasses are *Arundinella tenella*, *Spodiopogon albidus*, *Setaria* sp. and *Pseudanthistiria heteroclita*.

Throughout the slope the trees are generally large. Barks of trees and boulders in shady places are covered with mosses. Moist places are covered with liverworts.

#### WESTERN SLOPE IV (On the right side hill of Pata Hill)

The slope is generally steep except at the northern end of the hill, where it is gentle. With some exceptions the vegetation and edaphic factors on this slope compare very well with those of the corresponding western slope II. As far as tree vegetation is concerned both those western slopes are poorly wooded.

The vegetation here is a community of *Anogeissus latifolia*—*Tectona grandis*—*Garuga pinnata*.—

There is no grazing, but periodical cutting of grass is done. Lopping of *Grewia* sp., *Lantana camara*, *Zizyphus xylopyrus* and *Carissa congesta* is occasionally seen. Footpaths are very few. Planting of *Anogeissus* and *Lannea* is done in open areas. At low levels on flood plains there is cultivation of paddy.

The most common tree here is *Anogeissus latifolia*, which occurs in 65% of the quadrats and is distributed all over the slope. On the other Western slope (slope II), the percentage of this tree is 58%, which is close to the percentage of *Anogeissus* on this slope. *Tectona grandis* is found in 38% of the quadrats as against 34% on the slope II. *Tectona grandis* is more dense on flood plains. *Garuga pinnata* is strikingly abundant on this slope and occurs in 56% of quadrats chiefly on the upper part of the slope. It is not found in such large numbers on other slopes. *Emblica officinalis*, *Cassia fistula* and *Grewia abutilifolia* are also common and occur in 28%, 24% and 33% of the quadrats respectively. *Grewia abutilifolia* and *Emblica officinalis* are distributed throughout the slope.

Less common trees are *Terminalia tomentosa*, *Elaeodendron glaucum* and *Lannea grandis*, which occur in 19%, 14% and 14% of quadrats, respectively.

Occasional trees are *Salmalia malabarica*, *Bauhinia racemosa*, *Bridelia retusa*, *Dalbergia* sp. and *Terminalia chebula*. *Gmelina arborea* and *Careya arborea* are the rare trees.

Saplings of trees are poorly represented and the common ones are of *Cassia fistula* and *Adina cordifolia*. Saplings of *Anogeissus* and *Tectona grandis* are less common.

The common climbers are *Dioscorea* sp., *Cryptolepis buehanani* and *Smilax* sp. They occur in 82%, 47% and 25% of the quadrats, respectively. *Dioscorea* sp., are widely distributed but the maximum density is found on flood plains. *Cryptolepis buehanani* is also widely distributed and in many places it is huge climber. The other occasionally occurring large climber is *Vitis pentaphylla*, which occurs in 19% of the quadrats. *Dioscorea diaemona* is a rare climber but is one of the largest climbers found in Sinhagad. It has trilobed leaves and each lobe is as large as a small canna leaf.

Among the non-climbing shrubs, *Indigofera pulchella*, *Carvia callosa*, *Cipadessa fruticosa*, *Leea macrophylla* and *Fluggea* sp. are common and occur respectively in 42%, 32%, 33%, 28% and 32% of the quadrats. *Indigofera pulchella* and *Fluggea* sp. are found in the upper portion of slope in open areas. *Carvia callosa* is found on the steeper part of the slope in open areas and forms pure colonies almost to the exclusion of all other shrubs and herbs. The shrubs found in the shady areas are *Clerodendron serratum*, *Carissa congesta*, *Lasiophon eriocephalus* and *Hamiltonia sauveolens*. They occur respectively in 24%, 24%, 14% and 19% of the quadrats. Rarely occurring shrubs are *Osyris arborea*, *Argyreia cuneata*, *Holarrhena antidysenterica* and *Zizyphus rugosa*.

Among the herbaceous flora two species of the umbellifereae are common—*Pimpinella heyneana* and *Pimpinella monoica*. They are represented in 19% and 22% of the quadrats, respectively. *Pimpinella monoica* is a very large herb and grows upto 7 ft. high.

Compositae herbs are well represented and found all over the slope, especially in open places. *Senecio grahami* occurs in 60% of the quadrats and *Bidens pilosa*, *Vernonia cinerea*, *Blainvillea* and *Gynura angulosa* are common. Of the Leguminosae, *Crotalaria medicaginea* and *Desmodium rotundifolium* are common, chiefly in shady places. The ferns *Cheilanthes albomarginata* and *Adiantum* sp. are well represented being present in 34% of the quadrats.

Grasses are abundant all over the gentler parts of the slope. *Spodiopogon albidus* and *Arundinella tenella* grow in shady places. In open areas, *Apluda varia*, *Heteropogon contortus*, *Capillipedium hugelli*, *Arthraxon serrulatus* and *Pseudanthistiria* sp. are abundant.

The striking features of the vegetation on this slope are that there is a clear demarcation between the vegeta-



tion found on the gentler part of the slope and the steeper part. The latter slope is covered with stunted species of *Anogeissus latifolia*, *Elaeodendron glaucum*, *Garuga pinnata*, *Bridelia retusa*, *Gymnosporia montana*, *Euphorbia ligularia* and an undergrowth of only *Carvia callosa*. Gentler part of the slope is covered with large trees of various kinds and undergrowth of different shrubs.

Vegetation on the flood plains is very thick with undergrowth of very tall grasses. In moist shady places tree barks and boulders are covered with mosses.

#### WESTERN SLOPE V (Scree Masses)

This slope is quite distinct from the rest of those studied and comprises of scree masses at the lower portion.

Soil is shallow, gravelly and drier than the rest of the slopes studied. It is chiefly derived from amygdaloid. In many places rock beds are exposed. Soil of the scree mass is colluvial.

This area is unrestricted for grazing. Frequent lopping of *Grewia* sp., *Lantana camara*, *Carissa congesta*, *Vitis pallida*, *Embllica officinalis*, *Zizyphus xylopyrus* is present. Due to the frequent trampling by cattle, herbaceous flora is restricted round about shrubs and trees.

One transect was run from the top to the foot passing on the scree portion.

Soil on the top is deeper and more fertile than on the slope. The top is not entirely plain, but there are many ridges and depressions. Vegetation is generally found in the depressions. Trees are stunted in growth with an average height of about 20 feet. *Tectona grandis* is entirely absent. The common species found on good soils are *Anogeissus latifolia*, *Terminalia tomentosa* and *Elaeodendron glaucum*, on ridges, *Embllica officinalis*, *Flacourtia* sp., *Gymnosporia montana*, *Randia dumetorum*, *Gardenia turgida*, *Fluggea* sp., *Acacia pennata*, *Argyreia cuneata*, *Vitis pallida*, *Cipadessa fruticosa* are present. Grasses are short and thin. Common grasses are *Themeda* sp., *Apluda varia*, *Heteropogon contortus*, *Pseudanthistiria heteroclita*, occasionally *Cymbopogon martinii* and *Capillepidium hugelli*. Other herbs are *Celsia coromandeliana*, *Tridax procumbens* and *Vicoa auriculata*.

On the slopes *Anogeissus latifolia* and *Tectona grandis* are common tree species which occur respectively in 74% and 64% of the quadrats. *Anogeissus* is widely distributed and the maximum percentage in each quadrat is 48. Though apparently, *Tectona* is present in 64% of the quadrats, trees are very much scattered and very stunted in growth. They occur in considerable numbers in the depression of the slope. On the scree portion they are absent generally.

Other common tree species are *Boswellia serrata* and *Lagerstroemia lanceolata* which occur respectively in 22% and 26% of the quadrats. *Lagerstroemia* is chiefly found on the scree mass. *Boswellia serrata* naturally prefers gravelly soils and thus it is well represented on this slope. *Terminalia tomentosa*, *Elaeodendron glaucum* and *Lannea grandis* are poorly represented. Some species like *Adina cordifolia*, *Stephegyne parviflora* seem to be entirely absent.

Saplings of *Anogeissus latifolia* are abundant, but saplings of other tree species especially of *Tectona grandis* and *Terminalia tomentosa* are rare.

Shrubs which thrive well even on poor soils are well represented on this slope. Thus *Lantana camara*, *Carissa congesta*, *Fluggea* sp. etc. are abundant and occur in 58%, 30% and 30% of the quadrats respectively. Occasional shrubs are *Gymnosporia montana*, *Artemisia vulgaris*, *Osyris arborea* and *Vitis pallida*. Climbers are poorly represented. Climbers of *Dioscorea* sp., *Smilax* sp., and *Cryptolepis buehneri* occur in only about 13% of the quadrats.

Rare shrubs are *Notonia grandiflora*, *Neuracanthus sphaerostachys*, *Euphorbia ligularia*, *Celastrus paniculata* etc.

As the slope is subjected to grazing all round the year herbs are not found in open areas. *Vicoa auriculata* is the abundant species occurring in 78% of the quadrats with wide distribution. Other compositae herbs, which occur occasionally are *Lactuca* sp., and *Blainvillea*. Ferns and other shade-loving herbs (*Cheilanthes albomarginata*, *Adiantum* sp., and *Curcuma montana*), are poorly represented. Other occasionally occurring herbs are *Cocculus villosus*, *Lavendula gibsoni*, *Celosia argentea*, *Pimpinella heyneana*, *Heylandia latebroşa*, *Biophytum sensitivum*, *Bidens pilosa* and *Sopubia delphinifolia*.

Grasses are generally short, thin and sparse. Common grasses are *Capillepidium hugelli*, *Heteropogon contortus*, *Apluda varia*, *Pseudanthistiria heteroclita* and *Cymbopogon martinii*. *Arundinella tenella* and *Spodiopogon albidus* are rarely found.

#### Summary

The eastern slopes (I and III) at Sinhadag are densely wooded with good regeneration of tree species. These slopes are gentle and the soil is deep and moist. The western slopes (II and IV) are comparatively poorly wooded but shrubs and herbs are predominant. The western slopes are generally steep and soil is comparatively shallow and dry. The western slope V is also poorly wooded. This compares well with the slopes of Katraj, where there is the same kind of difference between the western and eastern slopes.

Comparison and contrasts of Katraj and Sinhadag:

Both the ghats form part of the Sahyadri ranges. Katraj ghats lie on the southeast of Poona and Sinhadag ghats on the southwest of Poona and are connected by a range of hills which have a scrubby type of vegetation.

Sinhagad ghats are much higher than those of Katraj and the average rainfall there, is also high. Soil in Katraj ghats is rather gravelly, dry and chiefly derived from amygdaloid. Soil in Sinhagad ghats generally is fine grained, moist and chiefly derived from basalt and is generally deep. But in Sinhagad also there are some hills with the same quality of soil as of Katraj, e.g., western slope V of Sinhagad.

Though the general aspect of the vegetation is of a dry deciduous nature, the edaphic factors have brought out slightly different kinds of the vegetation on both ghats. In Katraj ghats *Anogeissus latifolia*, *Boswellia serrata*, *Diospyros* sp., are predominant with a small percentage of *Tectona grandis*. The species of *Adina cordifolia*, *Stephegna* sp., *Leea macrophylla* and *Carvia callosa*, which are present in Sinhagad in considerable numbers are rare or entirely absent in Katraj. In Katraj ghats the shrubs are more conspicuous and abundant with scattered tree growth. Most of the trees especially those of *Diospyros* sp., are attacked with *Viscum articulatum*.

In Sinhagad ghats *Anogeissus latifolia*, *Tectona grandis*, *Adina cordifolia*, *Elaeodendron glaucum*, *Terminalia tomentosa*, etc. are abundant. But *Boswellia serrata*, *Randia dumetorum*, *Gardenia turgida* and *Diospyros* sp., etc. are rare. The tree species are abundant and dense and the shrubs are less predominant. *Viscum articulatum* is rarely found.

With regard to the herbaceous flora there is not much difference.

Also there is difference in the periods of leaf fall. In Katraj the leaves begin falling by the end of October and all the trees will be leafless somewhat in the middle of November. In Sinhagad the process is delayed by about a month. Late fall of leaves can be attributed to the better soil, moisture and better type of soil in Sinhagad.

In view of the above features, vegetation in Katraj ghats is of a dry deciduous type and the vegetation of Sinhagad ghats is of a dry deciduous type tending to moist deciduous as some species of plants indigenous to moist deciduous forests of the Poona district are also found.

Thus in every respect Sinhagad ghats show an advancement over Katraj and the vegetation represents a next stage to that found in Katraj ghats.

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Ph. 1. Katraj Ghats: Eastern slopes with better vegetation than the Western. Poona in the background.



Ph. 4. View of Sinhagad Valleys with deciduous forest and cultivated fields.



Ph. 2. Community of *Cymbopogon martinii* on the eastern slope, Katraj Ghats.



Ph. 5. Spurs and valleys of the Sinhagad hills.



Ph. 3. Clumps of *Nerium odorum* on coarse soil in river bed, Katraj Ghats.



Ph. 6. Teak forest on flood plain, Sinhagad in the background, *Anogeissus* and other species on the hill.