

## BIRDS OF DEFORESTED HILLS<sup>1</sup>

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(With two text-figures)

The hills of Western Ghats south of Bombay (roughly between latitude 18°N to 19°N) present more or less a very barren aspect. Large trees or groves of trees are few and far between and extensive tracts even lack shrubbery. During the rainy season these hills are covered with grass but as the dry season is ushered in, grazing and lack of moisture take their toll, grass withers, shrubs wilt and the soil is exposed to the full impact of the sun and the wind. Just before the rainy season, dried grasses are set afire presumably in the hope of getting a luxuriant cover of grass once again.

Rainfall in these hills ranges from 9000 mm to 2000 mm per year and decreases rapidly from west to east. In spite of a prolonged dry season which lasts roughly from October to May, the annual rainfall appears to be sufficient to cover these hills with a varied forest, yet the hills present a barren aspect today.

When and how the process of deforestation of these hills began is nowhere documented in detail. The process might have begun in the closing years of the last century and gradually gathered momentum. For, in the nineteen-thirties one Mr. Garland, a forest officer, in his working plan of Pune District has expressed surprise in finding these hills so barren and bereft of trees (Garland 1934). It means that even more than fifty years ago these hills lacked tree-cover to any appreciable extent.

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What could be the causes that led to deforestation of these hills? The same forest officer's remarks are interesting enough. He says, "In the west (i.e. in Western Ghats) the main influence of man appears to be due to shifting cultivation and in the east due to grazing and cutting for fuel and house timber. Burning for obtaining a grass crop is also evident wherever rainfall is above or about 70 cm." (Garland, loc. cit.). These remarks aptly describe the conditions in Western Ghats in the area which I have been studying for the last two years. This area is the 120.80 sq. km. catchment area of the Panshet dam located about 42 km to the west of Pune city. The Panshet reservoir supplies drinking water to the city as well as irrigation to the areas further to south-east in the direction of Solapur. The dam is built on the river Ambi which is a tributary of the river Mutha which flows through Pune city. The Ambi originates near Dapsar on the main ridge of Western Ghats at a height of about 1200 metres. It flows west through the hills for a distance of about 30 km to Panshet where its valley is reduced to a narrow neck facilitating the construction of the dam.

Before the dam was built the peasants of the Ambi valley cultivated rice on the valley floor which was fertile and practised shifting cultivation on the lower and middle slopes of the surrounding hills by clearing the vegetation but sparing such economically important trees as mango (*Mangifera indica*) and Hirda (*Terminalia chebula*). Forest of moist deciduous

to semi-evergreen type of trees was mainly restricted to upper hill slopes and was categorised as reserve forest. Due to lack of transport facilities these forests were not worked. But when it was decided to construct the dam, a road was built to link Panshet with Pune. As the valley floor was going to be submerged the cultivators sold off the trees standing on their lands to timber and charcoal merchants of Pune who could cart away the wood in trucks thanks to the construction of the road. The contractors from the city even bought out the trees on lower and middle slopes leading to their almost complete deforestation (Gadgil 1979). The people whose lands were submerged under the reservoir were asked to resettle on the stony, dry plateaus near Dhond south-east of Pune near the end of the command area. Many of them returned to Panshet catchment, being unable to adjust to the new surroundings and populated the slopes above the reservoir level where they began the age-old practice of shifting cultivation for hill millets, and became dependent on this type of cultivation having lost their paddy fields under the reservoir. They even encroached upon the reserve forest areas for their fuel needs, timber and to a lesser extent for grazing their cattle. Consequently most of the reserve forest areas have been cut up and burnt. The only redeeming feature in this picture of deforestation is the presence of certain sacred groves which are dedicated to tribal deities and are not to be overtly cut.

#### *Physical Character of the Hills:*

The hills of the Panshet catchment area form part of the great trap region of the Deccan Plateau. The general aspect of the hills is very rugged and much cut up by gorges and ravines, through which a number of streams, many of them only seasonal, flow. Beyond Dapsar (see Fig. 1) near the western end of the catchment,

the descent to the Konkan from the main ridge of the Ghats, is abruptly precipitous. But to the east the hills taper off gradually, though till Panshet their character remains fairly rugged and difficult of access.

Basalt or Deccan trap which is the result of volcanic lava flows, occupies the hills in the catchment area. It is normally dark grey or blue grey in colour. The rock weathers into a disintegrated form known as *Murrum* and finally produces soils of varying depth, texture and colour. The red soils are common in these hills. They are generally shallow and coarse and often spoilt by a mixture of gravel. Soils produced from *Murrum* mostly lack in humus, are non-acid and naturally well-drained by the under-lying *murrum*.

The Western Ghats present a formidable barrier to the monsoon winds that come in from south-west after collecting a lot of moisture over the Arabian sea. Thus during the rainy season the effect of the ridge of Western Ghats on the western boundary is not only to cause excessive precipitation on the ridge itself, but also to create a rain-shadow to leeward side so that there is an amazingly sudden drop in rainfall on the eastern side. This is well illustrated by the rainfall data given in Table 1.

In the table the year 1960 was the year when the dam was almost complete and water was impounded for the first time. I began the present study in July 1983 and the other years in the table present rainfall data of the period just preceding the year 1983. The four rain-gauges are located to the west of the dam site, i.e. Panshet is near the dam site; Shirkoli and Mangaon are respectively further to the west and Dapsar is at the western end of the catchment, just below the crest-line of the main ridge.

It will be seen from Table 1 that village Dapsar which is situated near the western end

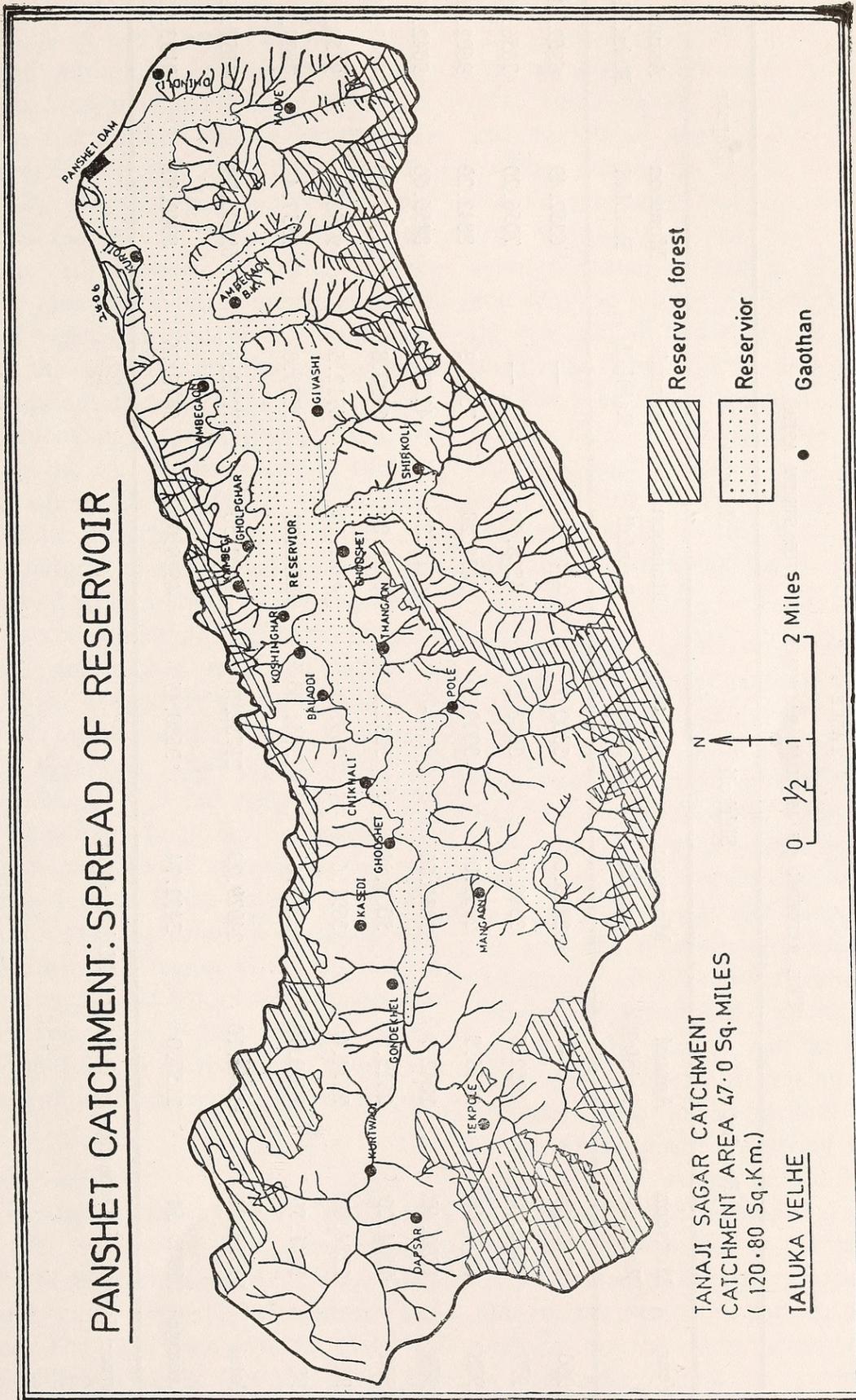


Fig. 1.

TABLE 1  
THE PATTERN OF ANNUAL RAINFALL IN THE STUDY AREA

Year	Panshet		Shirkoli		Mangaon		Dapsar	
	Monsoon Rainfall	Annual Rainfall	Monsoon Rainfall	Annual Rainfall	Monsoon Rainfall	Annual Rainfall	Monsoon Rainfall	Annual Rainfall
1960	1787.64	—	2829.6	3000.0	4473.70	—	6352.49	6352.49
1977	1816.70	1952.5	3348.9	3381.2	4528.90	—	7056.20	7056.20
1978	2057.60	2156.9	2931.0	3009.2	7479.20	7501.3	8842.20	9602.40
1979	1891.40	2042.7	2835.73	—	4117.20	4229.2	8456.60	9042.60
1980	2504.20	2615.7	5003.80	5052.5	6941.20	6790.8	14577.90	14648.80
1981	2284.80	2674.4	3691.6	3697.0	4682.10	4712.5	9758.0	9758.0
1982	1241.50	1499.90	3388.6	3641.80	3580.20	3750.0	7557.4	7897.0
Total	13583.84	12942.10	24029.23	21782.70	32802.50	27233.8	62600.79	64357.49
Average	1940.54	2157.0	3432.74	3630.45	4686.07	5446.76	8942.97	9193.92

Source: Irrigation Department, Govt. of Maharashtra.

of the catchment, experiences an average annual rainfall of 9193 mm. Further east at Mangaon and Shirkoli the average annual rainfall drops to 5446 mm and 3630 mm respectively. While still further east at Panshet the annual average drops to 2157 mm. As said above the dry season begins in October and continues till the end of May during which temperatures vary between 17°-18°C to 35°-37°C. In the absence of biotic interference the character of vegetation and birds should correspond to the climatic conditions. In such climatic conditions the character of vegetation in the catchment may probably vary from dry deciduous in the east to evergreen in the extreme west where the rainfall is the highest. However, biotic disturbances make it difficult to identify natural climax vegetation. It can only be guessed from a study of the vegetation of groves sacred to temples as vegetation in these sacred groves has remained more or less undisturbed over a considerable period of time, and of forest patches found in certain inaccessible situations. The varied nature of vegetation existing over the remainder of the catchment may also help in this guesswork. Likewise the bird-life of sacred groves and that found in remote forest patches may provide clues to the character of bird-life that should prevail in this region in the absence of biotic interference. But before we consider the character of vegetation in greater detail, it will be convenient for our purposes to divide the study area into smaller manageable segments.

#### *The Three Zones:*

Three factors namely, the rainfall, the character of vegetation and the degree of influence of biotic factors, have been taken into account in dividing the catchment into three zones. The first zone extends from the dam site to village Givashi (see Fig. 2) on the right bank of the river Ambi and Ambegaon

Khurd on its left bank. This zone with an annual average rainfall between 2000 and 3000 mm has been subjected to maximum pressure from biotic factors and presents a denuded and devastated aspect. The second zone extending westwards from Ambegaon Khurd and Givashi and reaching Kasedi on the left and Mangaon on the right bank, bears an average annual rainfall of 3100 to 6000 mm and may be termed as a buffer zone between the low rainfall first zone and the high rainfall third zone, lying still to the west. The third or the last zone which includes the source region of the river Ambi stretches westward from Mangaon and Kasedi to the crest-line of the main ridge of the Western Ghats. The annual average rainfall in this zone ranges between 6001 mm to over 9000 mm.

#### *Vegetation of the Three Zones:*

The first zone presents an aspect of intense devastation and denudation. As biotic influences are severe, a sub-climax with grasses as dominants and only scattered trees and shrubs has become established. Only a few mango trees are left standing and lands lying fallow have been run over by *Lantana camara* and less nutritive grasses like *Themeda quadravulvis* and *Heteropogon contortus*. The next in dominance is *Terminalia tomentosa*. But the stability of associations among the sub-climax especially the grasses, can be easily disturbed. Fires and variation of grazing and cutting incidence result in a constant series of sub-series. Other plants occurring in this zone include *Carissa congesta*, *Lasiosiphon eriocephalus* and *Vitex negundo*. As reserve forests have mostly been cut up *Lantana* has invaded these areas also. *T. tomentosa* and climbers like *Dioscorea pentaphylla* and shrubs like *Solanum indicum* are the other plants commonly found in this zone. There are perhaps more trees around villages than in rest of the area of this

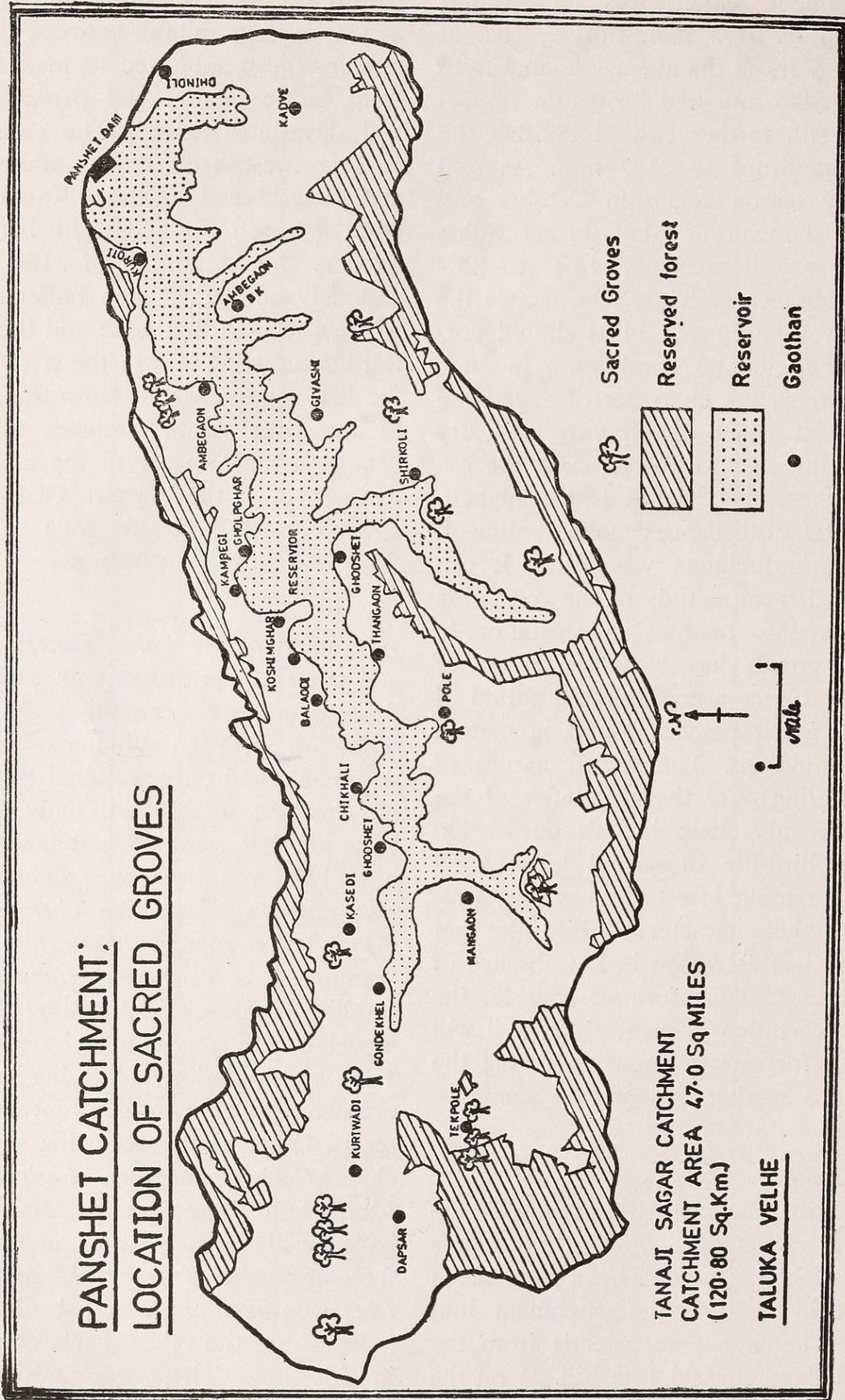


Fig. 2.

zone. They are mostly fruit trees such as mango and banana planted by the villagers. Here and there lone examples of *Alstonia scholaris*, *Salmalia malabarica* and *Erythrina variegata* stand as mute testimony to days gone by when the land was less intensely cultivated and conditions were moister.

The fallow period is as short as one year and slopes are cultivated almost annually in the first zone. As soil becomes exposed to wind and rain, it is quickly lost. Where erosion is particularly severe, rock is exposed and stony plateaux are the result. The slopes where erosion is less support grasses like *Themeda* and *Heteropogon* and herbs like *Smithea hirsuta*, *S. setulosa*, *Celosia argentea* and *Alysicarpus vaginalis*. These stony and grassy patches were seen to support their characteristic bird life too.

Near the western extremity of this zone on the right bank lies the Sacred Grove of Ambe-gaon Khurd. Vegetation in this grove remains more or less undisturbed over a number of years and may be said to exhibit vegetation typical of this zone if biotic influences did not have their full play. *Terminalia tomentosa*, *Vanqueria spinosa*, *Phyllanthus emblica*, *Bridelia retusa*, *Lagerstroemia microcarpa*, *Ficus glomerata*, *Bombax ceiba*, *Bauhinia racemosa*, *Cassia fistula*, *Albizia procera* and *Randia dumetorum* are some of the trees commonly occurring in this grove. As will be seen later the grove harbours its peculiar bird-life also.

Grassy plateaux are not extensive in the second or the middle zone; though wherever they exist the dominant grasses are not different from those found in the first zone. The fallow period is longer in the second zone and the patches lying fallow for more than a year quickly lose their character as grassy plateau and are occupied by plants next in biological succession. *Lantana camara* has invaded areas in this zone also though not as much as in

the first zone and is closely followed by *Carissa congesta*, *Meynea laxiflora*, *Lasiosiphon eriocephalus*, *Woodfordia fruticosa*, *Zizyphus rugosa*, *Emblica officinalis*, and *Syzygium cumini*. Around cultivated patches there are more trees left standing in this zone than in the first zone. Such trees include *Melia composita*, *Bridelia retusa*, *Erythrina indica*, *Butea monosperma*, *Terminalia tomentosa*, *Lagerstroemia microcarpa*, *Albizia procera*, *Cassia fistula* etc. Around hamlets the fruit trees include mango, jackfruit and banana. Besides there are extensive thickets of Bamboo (*Dendrocalamus strictus*) which form a major source of income for the villagers. *Syzygium cumini* and *Ficus glomerata* also occur commonly around hamlets.

There are certain areas in this zone which have remained fallow for more than five to seven years and thus support some characteristic vegetation. Here plants include *Vanqueria spinosa*, *Wrightia tinctoria*, *Randia dumetorum*, *Ficus retusa* *Olea dioica* etc. Here also shrubs and climbers such as *Strobilanthes callosus*, *Randia malabarica*, *Crotalaria triquetra*, *Jasminum malabaricum*, *Flacourtia latifolia* and *Pavetta indica* have enveloped the trees and have provided a peculiar habitat for birds. Steeper slopes are dominated by *Strobilanthes callosus* and *Ficus rumphii*, while reserve forest areas which are less cut up in this zone than in first, are dominated by *T. tomentosa* and *Strobilanthes*. Other plants found in these areas are *Actinodaphne hookeri*, *Carissa congesta*, *Embelia tsjeriam-cottam*, *Lasiosiphon eriocephalus*, *Xeromphis spinosa* etc. Some magnificent specimens of *Bombax ceiba*, *Alstonia scholaris*, *Terminalia belerica* and *Terminalia chebula* still remain in the more remote and inaccessible areas. Near Mangaon on the left bank and near the western end of this zone, lies the Sacred Grove dedicated to the deity *Janni*. Spread over an area of more than 16 ha

this grove provides refuge to a number of trees as well as displays a characteristic bird-life of its own. Trees commonly occurring in this grove include *Bombax ceiba*, *Terminalia belerica*, *T. chebula*, *Sterculia guttata*, *Memecylone edule*, *Acacia concinna*, (climber) *Actinodaphne hookeri*, *Macaranga peltata*, *Caryota urens*, *Mappia foetida* etc.

The vegetation of the third zone with its very high annual rainfall presents a peculiar aspect. Ideally, in the absence of biotic interference, evergreen forest should be the climatic climax in this zone. However, biotic influences coupled with a long dry period are factors adverse to the existence of a pure evergreen crop. A series of sub-climaxes is the inevitable result. In lands lying fallow for less than five years, while no plant could exert as much dominance as *Lantana camara* in the first zone, the following plants were found to be common: *Woodfordia fruticosa*, *Strobilanthes callosus*, *Carissa congesta*, *Embelia tsjeriam-cottam*, *Lasiosiphon eriocephalus*, and *Glochidion hohenackeri*. Where erosion is heavy and rock is exposed *Euphorbia neriiifolia* has become established. Where the soil is poor and shallow a dwarf type of forest forms a sub-climax in which *Memecylone edule* remains dominant. *Syzygium cuminii* and *Actinodaphne hookeri* dominate in areas which are under some degree of protection. The hamlets in this zone, as in the middle, remain concealed among lush growth of Bamboo and fruit trees such as *Syzygium cuminii* and mango. There are sacred groves in this zone also though not as large as in the middle zone. For example, in the group of three sacred groves at Dapsar the plants commonly found include *Entada scandens*, *Mappia foetida*, *Actinodaphne hookeri*, and *Ficus sp.*

#### *Bird-life in the Three Zones:*

The character of vegetation should reflect

the character of bird-life. Broadly speaking, the character of bird-life depends upon the availability of habitat. But in these hills a general lack of vegetation density and of botanical variety have restricted the availability of habitat. Human practices like shifting cultivation, cutting and burning of vegetation for clearing the ground and for making coal have created tension zones and disturbances which are not likely to be favourable to the existence of a varied avifauna. Further the valley floor stands submerged under a large and deep sheet of water. Water of considerable depth, steeply sloping and often rocky banks and lack of protective vegetation along the shoreline are also not conducive to birds. On this background therefore, the character of bird-life of these deforested hills has to be examined.

Very few birds were encountered on the deep, open sheet of water of the reservoir. A few Spotbill ducks, an occasional Little and a Large Cormorant and once a Blackheaded Gull were seen on the reservoir. As the reservoir water is let out during the dry season (usually from December onwards) and the water level goes down, Little and Median egrets, Common Sandpipers and Little Stints come to forage near the edges of water and the rapidly drying up mudflats. Common and Pied Kingfishers, Grey and Large Pied wagtails are also normally to be found along the water's edge. Whitenecked Storks and an Osprey have also been noted in sheltered bays and inlets of the reservoir. However, many other species that frequent aquatic and semi-aquatic habitats in the plains were never encountered in the catchment. It appears therefore, that these deep, open sheets of water in the mountains are not much favoured by birds presumably because they do not provide adequate food and shelter.

## Birds in the I Zone:

It may be recalled that in this zone due to severe biotic pressures forests have been replaced by such habitat-types as thorn and scrub, rocky and grassy plateau, scattered trees and cultivation and village environs. In addition there were certain birds that were always observed only in flight. The sacred grove near Ambegaon Khurd constitutes a distinct habitat also. Table 2 sets out the distribution of birds recorded in zone I according to broad habitat-types.

In this table a particular habitat is assigned to a bird species if it is frequently encountered in it. This does not mean it can never be seen in other habitat-types. Indeed birds such as Pond heron, Redwattled lapwing, Common green bee-eater, Little brown dove, Redvented and Redwhiskered bulbuls, Jungle babbler, Jungle crow, Indian robin and Pied bush chat were seen to be widely distributed in the catchment and were sometimes encountered in other habitats also.

It is seen from the table that out of the total number of 89 species recorded in this zone, the comparatively undisturbed area of the sacred grove appears to harbour less than 10% only. These may be said to indicate avifauna that was once typical of this zone. As biotic influences have eliminated most of the dry deciduous to moist deciduous types of forest, the birds characteristic of these biotopes have disappeared also. As xerophytic conditions are created birds belonging to stony, barren, thorn and scrub types of habitat have invaded this zone. Such species now constitute about 45% of the total avifauna recorded in this zone. These species perhaps indicate the degree of degradation of habitat from an idyllic state dictated solely by environmental conditions. The complete disappearance of birds belonging to moist deciduous biotope

may also provide another indication of the degradation of the habitat.

## Birds in the II Zone:

Table 3 likewise shows the distribution of birds in the second or middle zone. The table shows that this zone is far richer in birds than the first. The highest number of species are from the habitat, 'trees interspersed with shrubs' followed by those from 'trees' and 'sacred groves'. If species recorded in the sacred grove are to be considered as typical of this zone, their percentage in the total recorded number is 12 only; i.e. species belonging to moist deciduous and semi-evergreen biotopes have been reduced to 12%. Species from dry deciduous and to a lesser extent open, thorn and scrub types of habitat seem to have invaded this zone due to biotic pressures. However, these pressures do not appear to be strong enough to reduce to insignificance the species from moist deciduous and semi-evergreen biotopes. Neither do they seem to be restricted to sacred groves only. Outside sacred groves such species have been recorded from 'trees interspersed with shrubs' and 'trees and village environs'. Indeed the existence of scattered groups of trees, of lush vegetation around villages and of a large sacred grove in this zone appear to have contributed to the maintenance of many species that otherwise would have been eliminated. While the degree of degradation of the habitat in this zone may be gauged by the number of species belonging to more open and drier habitats, the process of degradation itself appears to have been arrested by certain conservation practices of the local people.

## Birds in the III Zone:

The third zone again presents a very peculiar picture if its bird-life is examined. Table 4

TABLE 2  
DISTRIBUTION OF BIRDS ACCORDING TO HABITAT IN ZONE I IN THE CATCHMENT OF PANSHET DAM

HABITAT TYPES

1	2	3	4	5	6	7	8
Aquatic	Rocky Plateau	Grassy Plateau	Thorny Scrub	Shrubs & Trees	Trees & Village Environs	Sacred Groves	Seen in Flight
<i>Phalacrocorax carbo</i>	<i>Coturnix coromandelica</i>	<i>Bubulcus ibis</i>	<i>Pedicularia asiatica</i>	<i>Accipiter nisus</i>	<i>Columba livia</i>	<i>Gallorpedix spadicea</i>	<i>Elanus caeruleus</i>
<i>Phalacrocorax niger</i>	<i>Pedicularia argoondah</i>	<i>Circus macrourus</i>	<i>Merops orientalis</i>	<i>Butastur teesa</i>	<i>Streptopelia decaocto</i>	<i>Treron phoenicoptera</i>	<i>Milvus migrans govinda</i>
<i>Tringa ochropus</i>	<i>Vanellus indicus</i>	<i>Francolinus pictus</i>	<i>Lanius schach</i>	<i>Falco tinnunculus</i>	<i>Psittacula krameri</i>	<i>Psittacula cyanocephala</i>	<i>Gyps indicus</i>
<i>Tringa hypoleucos</i>	<i>Streptopelia senegalensis</i>	<i>Alauda gulgula</i>	<i>Pycnonotus cafer</i>	<i>Clamator jacobinus</i>	<i>Halcyon smyrnensis</i>	<i>Caprimulgus indicus</i>	<i>Gyps bengalensis</i>
<i>Ceryle rudis</i>	<i>Caprimulgus asiaticus</i>	<i>Cisticola juncidis</i>	<i>Chrysomma sinense</i>	<i>Taccocua leschenaultii</i>	<i>Dicurus adsimilis</i>	<i>Megalaima viridis</i>	<i>Neophron percnopterus</i>
<i>Alcedo atthis</i>	<i>Mirafra erythroptera</i>	<i>Anthus similis</i>	<i>Turdoides caudatus</i>	<i>Lanius vittatus</i>	<i>Sturnus pagodarum</i>	<i>Tephrodornis pondicerianus</i>	<i>Spilornis cheela</i>
<i>Motacilla maderaspatensis</i>	<i>Eremopterix grisea</i>	<i>Estrilda amandava</i>	<i>Turdoides striatus</i>	<i>Pycnonotus jocosus</i>	<i>Acridotheres tristis</i>	<i>Pomatorhinus horsefieldii</i>	<i>Apus affinis</i>
	<i>Ammomanes phoenicurus</i>	<i>Emberiza buchanani</i>	<i>Prinia hodgsonii</i>	<i>Prinia socialis</i>	<i>Corvus macrorhynchos</i>	<i>Alcippe poiocephala</i>	<i>Hirundo concolor</i>
	<i>Galerida malabarica</i>		<i>Prinia subflava</i>	<i>Prinia sylvatica</i>	<i>Pericrocotus cinnamomeus</i>	<i>Terpsiphone paradisi</i>	<i>Hirundo rustica</i>
	<i>Saxicola torquata</i>		<i>Sylvia curruca</i>	<i>Acrocephalus dumetorum</i>	<i>Aegithina tiphia</i>		<i>Hirundo smithii</i>
	<i>Monticola solitarius</i>		<i>Phylloscopus collybita</i>	<i>Turdus merula</i>	<i>Anthus trivialis</i>		<i>Hirundo daurica</i>
	<i>Motacilla alba</i>		<i>Phylloscopus sp.</i>	<i>Lonchura punctulata</i>	<i>Passer domesticus</i>		
	<i>Melophus lathamii</i>		<i>Lonchura malabarica</i>		<i>Ploceus philippinus</i>		

TABLE 3  
DISTRIBUTION OF BIRDS ACCORDING TO HABITAT IN ZONE II IN THE CATCHMENT OF PANSHET DAM

Aquatic	Grassy Plateau	Thorny Scrub	Shrubs & Trees	Trees & Village Environs	Sacred Groves	Seen in Flight
1	2	3	4	5	6	7
<i>Ardeola grayii</i>	<i>Bubulcus ibis</i>	<i>Turnix suscitator</i>	<i>Accipiter badius</i>	<i>Amaurornis phoenicurus</i>	<i>Spilornis cheela</i>	<i>Elanus caeruleus</i>
<i>Egretta intermedia</i>	<i>Circus macrourus</i>	<i>Streptopelia senegalensis</i>	<i>Accipiter nisus</i>	<i>Columba livia</i>	<i>Chalcophaps indica</i>	<i>Pernis ptilorhynchus</i>
<i>Egretta garzetta</i>	<i>Coturnix coromandelica</i>	<i>Merops orientalis</i>	<i>Falco tinnunculus</i>	<i>Streptopelia chinensis</i>	<i>Otus bakkamoena</i>	<i>Spizaetus cirrhatous</i>
<i>Ciconia episcopus</i>	<i>Vanellus indicus</i>	<i>Lanius schach</i>	<i>Perdicula asiatica</i>	<i>Psittacula krameri</i>	<i>Bubo bubo</i>	<i>Hieraetus pennatus</i>
<i>Pandion haliaetus</i>	<i>Upupa epops</i>	<i>Pycnonotus cafer</i>	<i>Gallorpedix spadicea</i>	<i>Eudynamis scolopacea</i>	<i>Dicrurus leucophaeus</i>	<i>Aquila rapax</i>
<i>Tringa ochropus</i>	<i>Galerida malabarica</i>	<i>Turdoides striatus</i>	<i>Treron phoenicoptera</i>	<i>Centropus sinensis</i>	<i>Sturnus malabaricus</i>	<i>Gyps indicus</i>
<i>Tringa hypoleucos</i>	<i>Alauda gulgula</i>	<i>Prinia subflava</i>	<i>Psittacula phoenicoptera</i>	<i>Athene brama</i>	<i>Pericrocotus flammicus</i>	<i>Gyps bengalensis</i>
<i>Calidris minuta</i>	<i>Cisticola juncidis</i>	<i>Prinia sylvatica</i>	<i>Cuculus micropterus</i>	<i>Halcyon smyrnensis</i>	<i>Hypsipetes madagascariensis</i>	<i>Falco peregrinus</i>
<i>Alcedo atthis</i>	<i>Motacilla alba</i>	<i>Phylloscopus collybita</i>	<i>Caprimulgus indicus</i>	<i>Megalaima haemaccephala</i>	<i>Pellorneum ruficeps</i>	<i>Apus melba</i>
<i>Myiophonus horsefieldii</i>		<i>Phylloscopus sp.</i>	<i>Megalaima viridis</i>	<i>Oriolus oriolus</i>	<i>Alcippe poioicephala</i>	<i>Apus affinis</i>
<i>Motacilla cinerea</i>		<i>Saxicola caprata</i>	<i>Lanius vittatus</i>	<i>Sturnum pagodarum</i>	<i>Culicicapa ceylonensis</i>	<i>Hemiprocne longipennis</i>
<i>Motacilla maderaspatensis</i>		<i>Saxicoloides fulvicata</i>	<i>Acridotheres fuscus</i>	<i>Corvus macrorhynchos</i>	<i>Hypothymis azurea</i>	<i>Hirundo rupestris</i>



TABLE 2

DISTRIBUTION OF BIRDS ACCORDING TO HABITAT IN ZONE I IN THE CATCHMENT OF PANSHET DAM

## HABITAT TYPES

Aquatic 1	Rocky Plateau 2	Grassy Plateau 3	Thorny Scrub 4	Shrubs & Trees 5	Trees & Village Environs 6	Sacred Groves 7	Seen in Flight 8
<i>Phalacrocorax carbo</i>	<i>Coturnix coromandelica</i>	<i>Bubulcus ibis</i>	<i>Perdica asiatica</i>	<i>Accipiter nisus</i>	<i>Columba livia</i>	<i>Galliperdix spadicea</i>	<i>Elanus caeruleus</i>
<i>Phalacrocorax niger</i>	<i>Perdica argoondah</i>	<i>Circus macrourus</i>	<i>Merops orientalis</i>	<i>Butastur teesa</i>	<i>Streptopelia decaocto</i>	<i>Treron phoenicoptera</i>	<i>Milvus migrans govinda</i>
<i>Tringa ochropus</i>	<i>Vanellus indicus</i>	<i>Francolinus pictus</i>	<i>Lanius schach</i>	<i>Falco tinnunculus</i>	<i>Psittacula krameri</i>	<i>Psittacula cyanocephala</i>	<i>Gyps indicus</i>
<i>Tringa hypoleucos</i>	<i>Streptopelia senegalensis</i>	<i>Alauda gulgula</i>	<i>Pycnonotus cafer</i>	<i>Clamator jacobinus</i>	<i>Halcyon smyrnensis</i>	<i>Caprimulgus indicus</i>	<i>Gyps bengalensis</i>
<i>Ceryle rudis</i>	<i>Caprimulgus asiaticus</i>	<i>Cisticola juncidis</i>	<i>Chrysomma sinense</i>	<i>Taccocua leschenaultii</i>	<i>Dicrurus adsimilis</i>	<i>Megalaima viridis</i>	<i>Neophron percnopterus</i>
<i>Alcedo atthis</i>	<i>Mirafra erythroptera</i>	<i>Anthus similis</i>	<i>Turdoides caudatus</i>	<i>Lanius vittatus</i>	<i>Sturnus pagodarum</i>	<i>Tephrodornis pondicerianus</i>	<i>Spilornis cheela</i>
<i>Motacilla maderaspatensis</i>	<i>Eremopterix grisea</i>	<i>Estrilda amandava</i>	<i>Turdoides striatus</i>	<i>Pycnonotus jocosus</i>	<i>Acridotheres tristis</i>	<i>Pomatorhinus horsefieldii</i>	<i>Apus affinis</i>
	<i>Ammomanes phoenicurus</i>	<i>Emberiza buchanani</i>	<i>Prinia hodgsonii</i>	<i>Prinia socialis</i>	<i>Corvus macrorhynchos</i>	<i>Alcippe poiocephala</i>	<i>Hirundo concolor</i>
	<i>Galerida malabarica</i>		<i>Prinia subflava</i>	<i>Prinia sylvatica</i>	<i>Pericrocotus cinnamomeus</i>	<i>Terpsiphone paradisii</i>	<i>Hirundo rustica</i>
	<i>Saxicola torquata</i>		<i>Sylvia curruca</i>	<i>Acrocephalus dumetorum</i>	<i>Aegithina tiphia</i>		<i>Hirundo smithii</i>
	<i>Monticola solitarius</i>		<i>Phylloscopus collybita</i>	<i>Turdus merula</i>	<i>Anthus trivialis</i>		<i>Hirundo daurica</i>
	<i>Motacilla alba</i>		<i>Phylloscopus sp.</i>	<i>Lonchura punctulata</i>	<i>Passer domesticus</i>		
	<i>Melophus lathamii</i>		<i>Lonchura malabarica</i>		<i>Ploceus philippinus</i>		

TABLE 3

DISTRIBUTION OF BIRDS ACCORDING TO HABITAT IN ZONE II IN THE CATCHMENT OF PANSHET DAM

Aquatic 1	Grassy Plateau 2	Thorny Scrub 3	Shrubs & Trees 4	Trees & Village Environs 5	Sacred Groves 6	Seen in Flight 7
<i>Ardeola grayii</i>	<i>Bubulcus ibis</i>	<i>Turnix suscitator</i>	<i>Accipiter badius</i>	<i>Amaurornis phoenicurus</i>	<i>Spilornis cheela</i>	<i>Elanus caeruleus</i>
<i>Egretta intermedia</i>	<i>Circus macrourus</i>	<i>Streptopelia senegalensis</i>	<i>Accipiter nisus</i>	<i>Columba livia</i>	<i>Chalcophaps indica</i>	<i>Pernis ptilorhynchus</i>
<i>Egretta garzetta</i>	<i>Coturnix coromandelica</i>	<i>Merops orientalis</i>	<i>Falco tinnunculus</i>	<i>Streptopelia chinensis</i>	<i>Otus bakkamoena</i>	<i>Spizaetus cirrhatous</i>
<i>Ciconia episcopus</i>	<i>Vanellus indicus</i>	<i>Lanius schach</i>	<i>Perdica asiatica</i>	<i>Psittacula krameri</i>	<i>Bubo bubo</i>	<i>Hieraetus pennatus</i>
<i>Pandion haliaetus</i>	<i>Upupa epops</i>	<i>Pycnonotus cafer</i>	<i>Galliperdix spadicea</i>	<i>Eudynamis scolopacea</i>	<i>Dicrurus leucophaeus</i>	<i>Aquila rapax</i>
<i>Tringa ochropus</i>	<i>Galerida malabarica</i>	<i>Turdoides striatus</i>	<i>Treron phoenicoptera</i>	<i>Centropus sinensis</i>	<i>Sturnus malabaricus</i>	<i>Gyps indicus</i>
<i>Tringa hypoleucos</i>	<i>Alauda gulgula</i>	<i>Prinia subflava</i>	<i>Psittacula phoenicoptera</i>	<i>Athene brama</i>	<i>Pericrocotus flammeus</i>	<i>Gyps bengalensis</i>
<i>Calidris minuta</i>	<i>Cisticola juncidis</i>	<i>Prinia sylvatica</i>	<i>Cuculus micropterus</i>	<i>Halcyon smyrnensis</i>	<i>Hypsipetes madagascariensis</i>	<i>Falco peregrinus</i>
<i>Alcedo atthis</i>	<i>Motacilla alba</i>	<i>Phylloscopus collybita</i>	<i>Caprimulgus indicus</i>	<i>Megalaima haemaccephala</i>	<i>Pellorneum ruficeps</i>	<i>Apus melba</i>
<i>Myiophonus horsefieldii</i>		<i>Phylloscopus sp.</i>	<i>Megalaima viridis</i>	<i>Oriolus oriolus</i>	<i>Alcippe poiocephala</i>	<i>Apus affinis</i>
<i>Motacilla cinerea</i>		<i>Saxicola caprata</i>	<i>Lanius vittatus</i>	<i>Sturnus pagodarum</i>	<i>Culicicapa ceylonensis</i>	<i>Hemiprocne longipennis</i>
<i>Motacilla maderaspatensis</i>		<i>Saxicoloides fulicata</i>	<i>Acridotheres fuscus</i>	<i>Corvus macrorhynchos</i>	<i>Hypothymis azurea</i>	<i>Hirundo rupestris</i>

TABLE 3 (contd.)

Aquatic 1	Grassy Plateau 2	Thorny Scrub 3	Shrubs & Trees 4	Trees & Village Environs 5	Sacred Groves 6	Seen in Flight 7
		<i>Nectarinia asiatica</i>	<i>Aegithina tiphia</i>	<i>Pomatorhinus horsefieldii</i>	<i>Monticola cinclorhynchus</i>	<i>Hirundo concolor</i>
		<i>Petronia xanthocollis</i>	<i>Tephrodoris pondicerianus</i>	<i>Muscicapa parva</i>	<i>Zoothera citrina</i>	<i>Hirundo smithii</i>
		<i>Ploceus philippinus</i>	<i>Coracina melanoptera</i>	<i>Muscicapa pallipes</i>	<i>Anthus trivialis</i>	
			<i>Pericrocotus cinnamomeus</i>	<i>Muscicapa tickelliae</i>		
			<i>Pycnonotus jocosus</i>	<i>Rhipidura aureola</i>		
			<i>Pycnonotus luteolus</i>	<i>Orthotomus sutorius</i>		
			<i>Turdoides subrufus</i>	<i>Copsychus sauraris</i>		
			<i>Muscicapa thalassina</i>	<i>Phoenicurus ochruros</i>		
			<i>Acrocephalus dumetorum</i>	<i>Parus major</i>		
			<i>Turdus merula</i>	<i>Parus xanthogenys</i>		
				<i>Dicaeum agile</i>		
				<i>Dicaeum erythrorhynchus</i>		
				<i>Zosterops palpebrosa</i>		
				<i>Lonchura punctulata</i>		



TABLE 3 (contd.)

Aquatic 1	Grassy Plateau 2	Thorny Scrub 3	Shrubs & Trees 4	Trees & Village Environs 5	Sacred Groves 6	Seen in Flight 7
		<i>Nectarinia asiatica</i>	<i>Aegithina tiphia</i>	<i>Pomatorhinus horsefieldii</i>	<i>Monticola cinclorhynchus</i>	<i>Hirundo concolor</i>
		<i>Petronia xanthocollis</i>	<i>Tephrodornis pondicerianus</i>	<i>Muscicapa parva</i>	<i>Zoothera citrina</i>	<i>Hirundo smithii</i>
		<i>Ploceus philippinus</i>	<i>Coracina melanoptera</i>	<i>Muscicapa pallipes</i>	<i>Anthus trivialis</i>	
			<i>Pericrocotus cinnamomeus</i>	<i>Muscicapa tickelliae</i>		
			<i>Pycnonotus jocosus</i>	<i>Rhipidura aureola</i>		
			<i>Pycnonotus luteolus</i>	<i>Orthotomus sutorius</i>		
			<i>Turdoides subrufus</i>	<i>Copsychus saularis</i>		
			<i>Muscicapa thalassina</i>	<i>Phoenicurus ochruros</i>		
			<i>Acrocephalus dumetorum</i>	<i>Parus major</i>		
			<i>Turdus merula</i>	<i>Parus xanthogenys</i>		
				<i>Dicaeum agile</i>		
				<i>Dicaeum erythrorhynchos</i>		
				<i>Zosterops palpebrosa</i>		
				<i>Lonchura punctulata</i>		



Gole, Prakash V. 1987. "BIRDS OF DEFORESTED HILLS." *The journal of the Bombay Natural History Society* 84, 275–290.

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