
CHAPTER FOUR

IMPACT OF HUMAN ACTIVITIES IN CHANDOLI WILDLIFE
SANCTUARY.

1. Deforestation :

Like most of the forest ecosystems in the world, the Western Ghats too, in the recent years, have come under tremendous human pressure and for natural resources. This has mainly resulted from the ever increasing human population requiring areas in the higher ranges for human settlements, expansion in agriculture, exploitation of fuelwood for various purposes, clearing of large areas of natural vegetation for developmental activities etc.

The Warna dam catchment has also ineritably become victim of the so called developmental processes within the catchment and outside. This has made significant and adverse impact on the last strong holds of the wild animal populations in the region in the Western Ghats. The direct and indirect human and wild animal interactions in the Warna Catchment has continued undisturbed even after Maharashtra Government declaring this area as Chandoli Wildlife Sanctuary in 1985.

The deforestation of the region caused mainly by clear felling, shifting cultivation practices, expansion in agriculture and lately submergence due to warna dam has affected the age old forest ecosystem. The environmental changes have increased the sates of soil erosion on the steep slopes in the hilly catchment, siltation and loss of water retaintion capacity of the sub soil layers reducing the perennial water sources.

The situation at places has been agrevated by collection of fuel wood, shifting cultivation practices and animal husbandary by the local inhabitants. Particularly more popular

villages of Durgawadi, Tambve, Dhakale, Nivale, Gothane (K) etc. have badly degraded their adjoining areas. In contrast to this the thinly populated villages apparently had least impact on the adjoining forest ecosystems ex. Gave, Chandoli (K), Kolane, which had retained excellent vegetation (Plate 6, a).

However it was also observed that the exploitation of the forest was dependant on the human need rather than the population density in the village and the distance from the forest. Chandel was a good example of a village with significant population living in harmony with nature as the thickly vegetated catchment provides it with perennial water supply. This water supply supports higher crop yields due to which the villagers do not have to depend on shifting cultivation as in case of many villages in the catchment. Therefore good vegetation and perennial water supply are nonseperable and extremely important to maintain the local carrying capacity for humans as well as wildlife.

The degradation of natural vegetation for any reason has been found to be more drastic to the Wild animals than their poaching in the study area. The habitat reduction or destruction reduces the population density of the Wild animals, creates food scarcity, cuts off local migration routes, destroys shelter and protection, creates water shortage and makes the wild animals more vulnerable to poaching thus drastically reducing their survival chances.

Over a period of years forest deforestation has been taking place in this region on own land. The wood was sold mainly to fuelwood contractors from outside the catchment. Also

during the shifting cultivation operations a considerable amount of wood is made available which is sold to timber merchants and contractors. In the remote areas, where often the land boundaries are not clear encroachment on government forest land was reported.

Prior to the declaration of the study area as Wildlife Sanctuary, forest working plans were operative in the region. These had been instrumental in clear felling of the prime mature forests having unparalleled ecological importance to the Wildlife in it. After the declaration of ^{the} dam project in 1979, forest which would be submerged was removed rapidly thus exposing vast barren lands in the low lying areas and river valleys which supported excellent patches of vegetation (Plate 6, b).

All deforestation activities either for dam purpose, industrial use or domestic purpose of the local residents have drastically made almost irreversible impact on the animal diversity of the region (Plate 7, a). Therefore it is necessary to know the quantum and kind of impact created and still continued in the Chandoli Wildlife Sanctuary by the people. After the creation of the sanctuary all the forest working plans in it are suspended. Also a ban on shifting cultivation was imposed by the State Govt. in 1984, which was supposed to be lifted in 1988 due to local and political pressure.

After the impoundment of the Warna dam the villages in the river valley were rehabilitated outside the catchment. In some cases either the land was submerged or the settlement areas, in many villages this shifting of dam affected people was partial

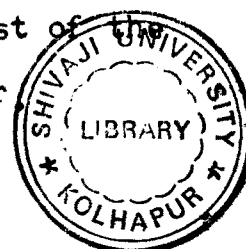
resulting in the reduced human pressure on the adjoining forests. But Where the village lands were submerged but not the villages the pressure on the contrary has increased. Petland and Sonarali villages is the example of the former whereas Durgewadi, Tambve, Nandoli are the examples of later type.

Traditionally the fuel used for the domestic purposes in the study area comprises of wood (99.25 %), dry twigs (0.29 %) and cow dung (3.58 %). No agriculture waste is used as domestic fuel.

It was observed that each household had atleast two hearths, one for cooking and the other for heating water for bathing purpose. The designs of the hearths were primitive and less efficient as the energy conversion was poor. Normally the cooking hearths were two pot but if the family is nuclear usually one pot hearth is used. The hearth used for heating water is much crude and made of three stones, it was noted that heat as much as 70 % in wasted (Desai et al., 1987).

The hearth used for cooking is used twice a day. Whereas the one used for heating water is used ones or twice a day depending on the season and working men folks in the family who take bath also in the evening after returning from work. Warm water bath is taken throughout the year by both sexes.

Due to the cool climate and wind in the high altitude areas like Chandoli Wildlife Sanctuary, it takes long time and requires large quantity of fuelwood to heat water. In severe winters and the entire rainy season there is fire pit burning in each household to maintain the warmth in the hut. In most of the cases this was in operation for 7-8 months in a year.



Availability of ample and free fuelwood supply from the near vicinity has imposed no restrictions on the use of fuelwood for domestic purpose in the study area and the entire population depends on forest for the total fuelwood supply.

Apparently there is still enough fuelwood (though reducing rapidly) to meet the existing requirements of the people. When the respondents were asked about whether there is any shortage in the availability of the fuelwood, only 4.5 % felt the increasing shortage when 94.3 % of the respondents did not claim any shortage. About 1.2 % of the respondents could not make their opinion. Also there were illicit tree cuttings reported on some occasions on own land and Govt. land (Plate 7,b).

However, when asked about whether they require same time for collecting fuelwood as before the response was very interesting. Though 68.3 % felt the same time is required even today (mainly people from zone A), 30.5 % of the respondents, much more than expected, felt that they require more time for collection of fuelwood for daily use. This may be taken as an indication of the gradual degradation of the forest resources in the nearer area.

But this increase in time for collection of fuelwood was attributed by 25.7 % of the respondents to increasing vigilance by the forest staff and only 0.41 % respondents felt it was due to the degradation of the vegetation in the area around the village. A large proportion i.e. 73.9 % were of the confused opinion but obviously were not aware of the over exploitation of the fuelwood in the region.

It was clear from the field investigations that since the process of degradation was gradual no immediate effects are felt and even if minor fluctuations are experienced they are attributed to other causes by the local people. Secondly the local population exploits trees and their branches and not the bushes and scrub therefore for the people there is no apparent degradation in the diversity of plants. This has resulted in gradual replacement of the natural mixed forest into a secondary scrub land in many areas.

Table 13 gives the mean distance (one way) travelled and time taken (both ways) for the collection of daily fuelwood requirements per household in each village in the Chandoli Wildlife Sanctuary.

The distance travelled (one way) per household/day ranged from a maximum of 5.42 km at Sonarli to 2.38 at ^hKundlapur. The average distance travelled in the sanctuary is 3.66 km (1.88 S.D.). ^hKundlapur has no forests owned by the villagers in the study area but since it is located near the boundry of the sanctuary and Patan taluk of Satara district the residents collect their fuelwood requirements from adjacent thick forest in Patan taluka. Other low values of distance travelled are recorded from Gave, Takale, Tambve, etc.

Time needed per day for fuelwood collection per day per household ranged from a maximum of 3 hours 27 minutes (1.10 S.D.) from village Sonarli. Other villages which showed high time values were Nivale, Tanali, and Gothane (K), all these villages are from zone C with degraded forest area. The low

Table 12 : Type of fuel used by the households in the
Chandoli Wildlife Sanctuary.

Obs. No.	Type of fuel	Percentage
1.	Wood	99.25
2.	Twigs	00.29
3.	Agricultural waste	00.00
4.	Cow dung	03.58

Table 13 : Mean distance travelled (one way) and time taken (both ways) for collection of daily fuelwood requirements by the households in each villages in the Chandoli Wildlife Sanctuary.

Sr. No.	Villages	Distance (one way)		Time (m)	
		Mean	Std. deviation	Mean	Std. deviation
1.	Gothane	3.87	2.26	1.55	0.33
2.	Nivale	4.57	2.97	3.00	0.88
3.	Tanali	4.61	2.10	3.19	1.02
4.	Dhakale	2.91	1.77	2.16	1.35
5.	Chandel	4.75	2.37	3.37	1.06
6.	Sonarli	-	1.28	-	1.10
7.	Durgawadi	2.97	1.24	2.30	2.54
8.	Tambave	2.46	0.81	2.35	2.11
9.	Khundalapur	2.38	0.47	1.45	1.61
10.	Nandoli	3.03	1.06	1.50	1.58
11.	Petlond	2.60	0.45	1.07	0.75
12.	Zolambi	2.55	0.32	1.15	0.98
13.	Takale	2.50	0.00	1.50	2.05
14.	Yeti	2.85	1.08	2.06	2.19
15.	Lotiv	2.50	-	0.00	-
16.	Nivale	2.83	0.76	1.27	1.56
17.	Gave	-	1.26	1.50	1.44
18.	Chandoli Kh.	3.21	0.99	1.15	1.17
19.	Jawali	3.44	1.02	2.13	1.07
20.	Rundiv	3.38	1.02	2.15	2.20
21.	Male	4.16	1.51	3.35	1.08
22.	Kolne	3.58	2.45	2.54	1.25
23.	Patherpunj	3.97	1.49	3.05	1.25
24.	Gothane	3.89	1.40	3.13	1.30
		3.66	1.88	2.13	1.53

values of time required for fuelwood collection were recorded from Chandoli (K) i.e. 1 hour 15 minutes (1.17 S.D.) other villages where less time was required were Nivale, Takale, Zolambi etc.

No correlation could be established between the average distance travelled and time required for collection of fuelwood in each village as the relation was dependent on a large number of variables including village population, availability of fuelwood, distance to the nearest forest, altitude and the extent of shifting cultivation near village. Some of the villages situated on the sanctuary boundry also collected their requirements of fuelwood beyond the boundries.

The daily average fuelwood requirement per household of 6 individuals was estimated to be 49.9 kg (20.1 S.D.) (Table 14). This requirement was dependent on many factors, normally availability of fuelwood nearby the residence played a major role, the other factors included season available man power, type of requirement, ownership of land, closeness of market place etc. (Plate 8, a).

The monthly requirement per household was 1317 kg (603 S.D.) this quantum appears to be significant but considering the type of domestic consumption^{of} fuelwood in the study area these are moderate figures. In addition to the monthly average requirements of fuelwood, in the monsoon season additional fuelwood is utilized. The monsoon climate for about four months is very cold and humid. Also it is not possible to collect fresh fuelwood due to the heavy down pour and fog. Therefore there is a practice of

Table 14 : Profile of fuelwood requirements of a household and time taken and distance travelled to collect it, mean values from the 24 villages in the CWS.

	<u>Mean</u>	<u>S.D.</u>
1. Daily requirement (kg)	49.9	20.1
2. Monthly requirement (kg)	1317.0	603
3. Annual requirement (kg)	16023.5	7336.5
4. Add. Monsoon provision (kg)	2071.2	172.48
5. Time required household/ day (hr.)	2.13	1.53
6. Distance travelled (one way) household/day (km.)	3.66	1.88

storing the monsoon provision in advance. An average of 2071.2 kg (7336 S.D.) of additional fuel is stored per household in the study area. Again this quantity depends on various factors. In higher altitudes because of the severe cold during winter more fuelwood may be used to keep the houses warm (Plate 8, b).

Considering the various requirements the annual fuelwood consumption of an average household from the area works out to be 16.02 Tonns (7.33 S.D.). During the investigations the number of households in the study area were around 2380 (1981 Census) (Table 3). Therefore annual total fuelwood consumption in the study area could be worked out to be 38127.6 Tonns and according to the present survey 1360 households were residing in the area. Thus the annual fuelwood consumption comes to 21,787.2 Tonnes. Though this figure might appear to be huge, the field observations revealed that it is just normal as fuelwood extraction is one of the major and continuous processes in the hill area in which almost every able individual is involved. The high rate of fuelwood extraction by the people in the scattered settlements throughout the sanctuary are bound to make an impact on the carrying capacity of the forest. The limits of which are already apparent in some villages in zone C.

In addition to the utilization of fuelwood for domestic purpose. There are reports of illicit tree cutting on owned land and at times on adjoining Govt. land by traders and contractors which often goes unnoticed. At many places in the sanctuary roads were made by the illicit wood cutters for the swift transport of wood. Under the pretext of transporting wood

from the own land (which is also banned in the sanctuary) residue of shifting cultivation, illicit cutting was continued. At village Tambve and many other places illicit cutting was noticed even with the protests from the local inhabitants, where locals are involved with traders and concerned authorities there was no check on exploitation. The practice of shifting cultivation and 'Rab' (burning of foliage for dweeding activity) also destroys huge amount of forest biomass every year.

According to forest department estimates the mature type of evergreen and semievergreen forests of this region yield around 30-35 Tonns of fuelwood/acre, in clear felling operations. Therefore the annual utilization of fuelwood of this region alone is equivalent to 249 ha of prime forest every year. Though there is a high rate of regeneration of vegetation in the tropics and sub tropics, the rate at which the deforestation is taking place; soon it will reach analarming level as the regeneration rate and afforestation activities (yet to begin) will not be able to replace the quantity exploited.

This degradation is bound to leave a permanant impact on the biological diversity of the region. Therefore it is essential to arrest the rate of deforestation. Suspending of the clear felling operations on Govt. land and declaring the area as a wildlife sanctuary are the first and necessary steps in saving the last patches of excellent forest left in this part of the Western Ghats.

2. Water resources :

Water is an important natural resource for wild animals and human alike. In the Western Ghats, due to the heavy annual precipitation, streams and springs are known to be perennial and shortage in water resources is not anticipated.

The man induced changes in the environment are partially responsible for alterations in water quality, quantity and duration of flow in the study area. Apparently there is no direct relation between changes in the water resource due to human utilization and wild animal diversity of the region. However, it was felt that the knowledge about the changes was useful as an indication of the degradation of nature in general. Therefore use of water by local inhabitants was studied in detail. In the hilly high rainfall area the main water source for the remote scattered settlements was springs and streams. From the time immemorable these sources have been perennial where ever their origin is in the thickly vegetated hills.

The table 15 gives an idea about various water sources in the study area on which the local population depends for their requirements in different seasons. The main source is spring followed by well, tubwell, stream water through pipe and river water. Usually the settlements are located near perennial water source therefore in the study area maximum households collect their water requirements from springs (59.37 %) during all seasons. Even during summer more people collect water from spring than well and tubewell. Well was the source used by 35.9 % people, in different seasons. It is also clear from the

Table 15 : Number of households from the study area using different water sources in Summer, Rainy and Winter seasons.

Obs.Seasons No.	Well	Tubewell	Spring	River	Dam	Water hole	St/p
1. Rainy	-	-	4	-	-	-	-
2. Winter	-	-	-	-	-	-	-
3. Summer	8	2	17	-	-	-	-
4. Rainy + Summer	-	-	7	2	-	-	-
5. Rainy + winter	17	-	-	-	-	-	-
6. Winter + Summer	3	-	-	-	-	-	-
7. Rainy + Winter + Summer	223	26	387	7	-	-	15
Total	251	28	415	9	0	0	15

table 15, that in all the seasons maximum number of people collected their water requirements from the same source spring which was perhaps perennial and nearer to them.

Water source

As a developmental activity tubewells have been provided by Zilla Parishad in village Nivale (Dist. Kolhapur). Similarly as a new facility in the remote hilly villages in the Western Ghats, spring water has been supplied by gravitation through pipe line to two villages namely Petlond and Nivale (Dist. Sangli). The tubewell and water through pipe supply water to 26 and 15 households respectively in the villages through out the year. This indicates the success of the facility in the hill region.

There are observations by other workers on tapping the waterholes by pipe line in the other Wildlife sanctuaries (Desai, 1987). It is feared that if practiced extensively in the hill region this might proved detrimental to Wildlife in the adverse summer months when the limited water holes dry up. Also because of the pipe line water percolation is not allowed and the stream course becomes dry which otherwise would provide open running water to wild animals for a long distance. This aspect needs further investigations. Interestingly enough the villages situated on hill slopes and hill tops can not make use of the dam water even in adverse conditions due to the distance and climb.

The water collected at different sources is used basically for drinking, cooking, bathing and domestic animals. The

quantity of water required by a household is based on several factors like number of individuals, season, distance and nature of the water source use of water etc. Table 16 shows the percentage of households using different quantities of water per day. About 30.6 % of the households had a requirement of 121 to 200 lit/day. and 20.44 % households utilized less than that quantity of water. A small fraction i.e. 0.28 % of the households, basically old people, did not collect water as it was supplied to them by neighbours in a Wadi of village Kundlapur. A significant proportion of households, i.e. 38.9 %, used water from 201 to 500 lit/day. Whereas 5.41 % households used water liberally i.e. 500 lit to 800 lit and above per day per household. The households having larger water requirements were generally joint families with more number of individuals. In case of smaller households more animal holdings was the main reason for the higher water requirements. In the cases where animal holdings were larger the animals were taken to the water source instead of collecting the required water.

Surprisingly in the remote areas also untouchability was observed on streams while collecting water. While all the castes shared the same water source did not mind domestic animals or wild animals using it but the Harijans or Nav Buddha had a separate spot downstream. At some places the wells for untouchables are different. This was observed in the villages Nivale, Durgewadi, Petlond etc.

The distance covered to collect the daily requirement of water also changed drastically as many factors contributed to it.

Table 16 : The Percentage of Households using different quantities of water in liters per day in the CWS.

	Water in liters	Percentage

1.	0	0.28
2.	1 - 40	0.42
3.	41 - 80	4.72
4.	81 - 120	15.30
5.	121 - 200	30.61
6.	201 - 300	17.88
7.	301 - 400	16.73
8.	401 - 500	4.29
9.	501 - 600	2.14
10.	601 - 700	0.14
11.	701 - 800	1.85
12.	800 and above	1.28

Table 17 : The percentage of households covering distance
in meters (one way) for fetching water per day
in the CWS.

	Meters	Percentage
1.	0	-
2.	0 - 50	14.02
3.	51 - 100	19.51
4.	101 - 150	1.82
5.	151 - 200	17.83
6.	201 - 250	3.04
7.	251 - 300	3.96
8.	301 - 400	2.74
9.	401 - 500	19.81
10.	501 - 1000	12.5
11.	1001 - 2000	3.65
12.	2001 - 3000	0.30
13.	3001 - 4000	0.76

The major ones being closeness of the source, the quantity available, quality of water, and the man power available. The range of the distance travelled was from merely 50 meters to 4 km one way. However, the households who travelled less than 100 meters one way for collection of water were 33.53 %. Between 101 to 500 meters were 49.2 %, between 501 - 1000 meters were 12.5 % and above 1000 meters were 4.71 %. The people in the last categories were mainly from the villages in the 'C' zone where severe degradation of forest has made adverse impact on the quantity and availability of water ex. Khundalapur and Nandoli, villages. According to the old inhabitants in the villages the reduction in the availability of water today is comparatively a recent phenomenon and is correlated to the degradation of vegetation in hills and soil erosion.

The distance travelled for fetching water is proportional to the time spent for the activity and is inversely correlated to the status of the forest around. Generally the time spent for collection depends upon the water quantity and the distance to be covered. The minimum time required was 5 minutes and the maximum was 1 hour 31 minutes. However due to the closeness of the water source 79.27 % of the households required less than 20 minutes both ways to fetch the daily requirement of water. Only 2.62 % of the households from the C zone villages required more than 60 minutes to fetch their daily quota (Table 18). In general so far the water availability in the study area is good and only at few places the picture is poor. This is attributed to the degradation of natural vegetation. Also it

Table 18 : The percentage of households spending time
for collection of water per day in the CWS.

Time in minutes (Both ways)		Percentage
1.	0 - 05	15.45
2.	06 - 10	31.99
3.	11 - 15	11.90
4.	16 - 20	19.93
5.	21 - 25	1.39
6.	26 - 30	14.99
7.	31 - 35	0.15
8.	36 - 40	1.39
9.	41 - 45	-
10.	46 - 50	0.15
11.	51 - 55	-
12.	56 - 60	1.70
13.	61 - 90	0.15
14.	91 and above	0.77

was observed that though most of the wild mammals of the region are nocturnal, during the water collection activity throughout the day disturbs wildlife to some extent.

3. Hunting

The major population in the study area belongs to Hindu religion and is comprised of Marathas, Dhangar and Harijans castes. Marathas being a martial community, since beginning hunting is a traditional practice which has gained a social status. Dhangars though basically pastoral nomads now they too, indulge in hunting so are the Harijans who are not known to be hunters.

As most of the inhabitants are non vegetarians they readily consume meat. There is no bazar facility in the entire sanctuary area and people have to travel 25 - 30 km for essential commodities and minor things like spices, serials, salt etc. to villages like Aral, Devarukh, Morgiri and Nayari outside the sanctuary. Because of the poor economical conditions the people could not purchase meat, which was expensive and beyond the reach of most of them. Therefore for meat requirements the local people depend heavily on wildlife from the sanctuary area.

Hunting of wild animals for subsistence was a common practice among the locals. In almost all villages one day in a week is reserved for hunting which differs in every village. On this day locally called as 'Paliv Diwas' no agricultural activity is done. For example in village Chandel Tuesday is

reserved for hunting when in Gothane it is Sunday. The same day is not observed as a Paliv Diwas in all the villages perhaps in order to avoid overlapping hunting activity in the potential hunting grounds and for better hunting chances.

Group hunting done by the villagers with the help of traps , local fire arms (muzzel loaders) and shotguns given for crop protection is a common practice. For trap hunting the nets supported by sticks are commonly used. Depending on the nature of the hunt, use of axe and stones is not infrequent.

Fish is another source of animal protein to the people in the dam catchment. Fishing is normally done in the streams with the help of traps, plant poisons and in the recent years with dynamite. For seasonal fishing in the streams bag nets and traps locally called as 'Ghala' or 'Kharvi' are used. These are made up of wood and tree branches and are operated against running stream water at narrow places to trap the swift stream fishes. For poisoning fish in the shallow pools poisons made from the fruits of Gela trees (Randis dumetorum) and leaves of other trees are used. But compared to the meat of wild animals the fish consists just a fraction in the animal protein diet of the local inhabitants.

With the reduction in 'Game' from the neighbouring forest areas which are being degraded, the hunters from outside the sanctuary area frequently visit the forests in the sanctuary. These people with the help of local guides indulge in little more organised hunting of bigger animals with the help of sophisticated and powerful fire arms. Except in the monsoon

months these hunters can operate in jeeps and trucks on the temporary roads made by the wood contractors almost throughout the area. Due to the involvement of the local people and lethargy and under-staff of the forest department the poaching continues without disturbance. Initially hunting with proper licence was done in many forests of the Western Ghats. After the stricter wildlife protection act for the conservations of endangered and rapidly dwindling wildlife populations by the Govt. of India the rate of illicit killing of wild animals or poaching has reached an alarming proportion in the area.

It was found difficult to assess the damage caused by the subsistence hunting by the locals and outsiders in the sanctuary, as it is illegal, collection of the information on the secretly performed operations was difficult. At the same time there were plenty of secondary evidences which confirmed the scanty information. In most of the stays in the remote villages during field study meat of some kind of wild animals was often served. On many occasions fresh killings by poachers were reported by villagers and often it was noticed that under the pretext of crop protection and pig hunting other harmless animals were killed by visiting far off places in the forest at suitable times for hunting. In general the current uncontrolled hunting practices in the study area has created severe threat to the animal diversity and even if the forests are protected on paper by declaring the area as wildlife sanctuary, the wildlife of the region is dwindling very fast.

In order to secure the vital information on poaching, contacts were made ^{with} to the local people and some outsiders involved in the act and under the disguise the information was collected. All these people were regular hunters and initially refused even to acknowledge they knew hunting because of the illegal nature of the hunting in the newly created wildlife sanctuary. During the investigations information about 15 commonly hunted wild animals could be collected from only 17 villages in the study area (Table 19).

The data is based on the information collected from 154 informants and personal visits to all the villages at different times. The interesting thing observed about the subsistence hunting was ^{that} in most of the cases the hunters were not specific or particular about the animal to be killed. As the local population consumes a wide range of animals including mammals, birds and reptiles, there was indiscriminate killing of animals of both sexes and all ages throughout the season. Whereas the outside hunters were selective and pursued layer animals like Sambar, Barking deer etc.

The commonly hunted animals in the study area were Hare (84.41 %), Barking deer (59.74 %), Mouse deer (54.54 %), Wild pig (53.89 %) and Wild fowl (37.01 %). Other animals commonly hunted in the area are Pangolin, Porcupine, Giant Squirrel, Pea fowl, Sambar, Varanus and even Gaur and Wild dogs.

The kind of animal hunted was dependant on hunting gear, man power, type of forest, nature of hunt and of course the availability of the wild animals in the region.

The wildlife is closely associated with the good vegetation in the study area, all the 10 villages in zone A comparatively supported the highest poaching activity. In villages Rundiv, Jawali and Chandel hunting is much more common as compared to the other villages. Local people also correlate the rich animal diversity of the region to the excellent plant diversity, thick vegetation and availability of perennial water source in this region. This situation attracts poachers from other zones ^{of} the study area and even from outside. It can be seen from the Table 19 that at Rundiv and Chandel almost 13 different types of animals were hunted.

The picture in the villages of the zone B is different as the forest area of this region is less damaged hunting activities are restricted to areas around villages Lotiv, Yeti, Takale, Zolambi and Sonarli. The hunting activities are concentrated around village Yeti. The additional reason for the activity being the rough road approach to the village. It was observed that due to good perennial water supply in this region the crops are grown on irrigation water supply. During summer months, when there is no green fodder and plenty of water in the forest, wild animals are attracted to these green crops and are killed at night by poachers with shotguns or locally made fire arms.

The villages of Gothane, Khundapur and Nanoli are known for hunting in the zone 'C'. Village Gothane due to the vegetation in the nearby hills and the rough road facility it is the most sought after spot for poachers, where a wide spectrum of animals are hunted including Gaur (11.53 %), Sambar (46.15 %), Barking

deer (76.92 %) and Mouse deer (76.92 %). During the investigations the people from Dhawadewadi of village Gothane had killed a Gaur for meat purpose. Generally Gaur is considered to be the sacred Bull 'Nandi' of Lord Shiva and is not hunted in the region dominated by Hindu community, but the above mentioned incidence was striking and now it is clear that there is no discrimination in the animals hunted as far as they provide the necessary meat.

Other important observations made during the study are, the local people and also the outside hunters are not aware of the endangered species on schedule I, II in the wildlife protection act, and as they think that since the species are commonly found in the area they are hunted by ignorance.

Most of the animals hunted are not near the crops or fields but in the forests, wastelands and degraded areas i.e. in the natural habitat of the wild animals. The crop protection guns issued are thus used for poaching not only crop pest but a variety of wild animals including carnivores.

In the areas where the forest is either removed or degraded small scattered patches of vegetation is still intact this includes the sacred groves and forests on own land and Govt. lands which are the last refuge of the isolated wildlife populations. The local people are of the opinion that since they hunt the animals on their own land it is not an offence.

The majority of the wild animals of the region are nocturnal and hunting takes place at night with the help of spot lights and powerful torches. Wildboar, Porcupine, Giant

Squirrel are hunted with this technique.

Some farmers cultivate groundnut on small patches exclusively to attract wildboars and other animals which according to them prefer ground to other crops. These plots are conveniently selected to facilitate night hunting.

Perhaps the subsistence hunting at moderate rate by the local inhabitants could not have affected the wild animals diversity of the study area. But the combined effect of various factors like road facility; use of firearms, jeep and powerful search light for hunting by outsiders and removal of vast vegetation belts in clear felling or in shifting cultivation has made a drastic and adverse impact on the once very rich animal diversity in this region.

4. Agriculture

Agriculture is the main occupation of the people in the Chandoli Wildlife Sanctuary. The table 20 shows that there is almost no change in the agriculture practices as the traditional occupation and present main occupation, is almost same i.e., 97.75 % and 97.01 % respectively. This confirms the fact that the inhabitants solely depend on agriculture in spite of the developmental activities in the region in last few years.

Even the Dhangar Community which is traditionally a pastoral nomadic community has switched over to agriculture as main occupation and animal husbandry as secondary occupation, Excepting the Dhangar settlements at villages Takale, Male and Dhakale where cattle rearing is the main occupation and agriculture secondary.

Agricultural practice in the area is basically of two types i.e., traditional agriculture in river valleys and terraces, based on perennial water supply and secondly shifting cultivation on hill slopes with the help of monsoon rains.

The distribution of land holdings is shown in Table 21, about 17.7 % of households had no land holdings of their own. These people were doing agriculture on lands belonging to others, on lease basis, from the catchment or people rehabilitated outside. It was also noticed that part of the people were engaged in agriculture on lands belonging to either forest or revenue departments. Thus a portion of the forests reported in the Govt. report owned by forest or revenue departments actually had agriculture on it as an encroachment. The justification given

Table 20 : The traditional and present main occupation
of the people from the study area.

Obs. No.	Occupation	Traditional	Present main	Change
1.	Agriculture	97.75	97.01	- 0.74
2.	Carpenter	0.42	0.44	+ 0.02
3.	Barber	0.14	0	- 0.14
4.	Cattle rearing	0.85	0.44	- 0.41
5.	Labour	0.28	0.14	- 0.14
6.	Govt. Service	0	0.14	+ 0.14
7.	Other	0	0.29	+ 0.29

Table 21 : Distribution of total land holdings per household
in the Chandoli Wildlife Sanctuary.

Obs.No.	Land holdings (acres)	Percentage
1.	-	17.7
2.	1	5.5
3.	2	8.6
4.	3	5.2
5.	4	7.1
6.	5	4.6
7.	6	4.6
8.	7	4.5
9.	8	3.1
10.	9	1.6
11.	10	37.0

for this encroachment is that for some people own land is insufficient to grow the minimum required food production. Also some were of the opinion that the warna dam has submerged the fertile farm lands in the river basin which provided farm labour to the land less people along with general labour in the larger villages which are shifted due to submergence.

About 26.4 % of the households had land holdings upto 5 acres, 18.4 % had land holdings from 5 to 9 acres and 37 % households had holding of 10 or more acres, (Table 21).

Shifting cultivation locally known as 'Kumri' is a traditional 'slash and burn' type of agriculture in the Western Ghats. As its counter part in the north east 'Zum' cultivation the farmers cut the mixed natural vegetation, by selecting a patch of forest. After clear felling the logs of wood are removed for timber or fuelwood purpose if possible. The branches with foliage is burnt on the spot. At times vast areas of vegetation on steep slopes is set on fire in the premonsoon months. Due to hardships involved in the activity and shortage of man power, fuelwood of good quality is burnt to increase the fertility of the soil and removing the possible weeds.

The exposed land is used for the cultivation of hill millets of much inferior productivity namely Nachna and Vari. After cultivating these crops for a couple of years the poor soil can not support any crop and is left fallow for another 4-5 years till the secondary vegetation covers the soil. The shifting cultivation operations are performed in cyclic manner

after every 4.5 years on the same land.

Table 22 shows that about 59.4 % of the local population is involved in shifting cultivation on land ranging from 1 acre to more than 10 acres per year. The people, who are not involved in shifting cultivation (40.6 %) have their lands with perennial supply of water. They get more crops in a year and do not have to go in for less productive and more labour intensive shifting cultivation. It is revealed from the table that 42 % of the people have upto 2 acres of land under shifting cultivation, largely because these are nuclear families and can not do shifting cultivation at larger scale. About 14.6 % households from 2-6 acres of land, most of them are larger joint families. Only 2.7 % of the households were engaged in shifting cultivation in more than 6 acres/yr (Plate 9, a). The percentage of householders practicing shifting cultivation is shown graphically in fig. 8.

As mentioned earlier where the own land is not sufficient for shifting cultivation for the very nature of the practice which requires at least 3-4 years of idal period for regeneration of vegetation, land on lease is taken from others who have it in excess. The table 23, shows the land used for shifting cultivation from the study area wherein all villages it is done on own land, in 8 villages i.e. 33.33 % cases adjoining forest land belonging to government departments was brought under shifting cultivation.

The said land use practice which may have been proper when the forests were vast and human pressure minimum, has now become a serious threat to the biological diversity of the

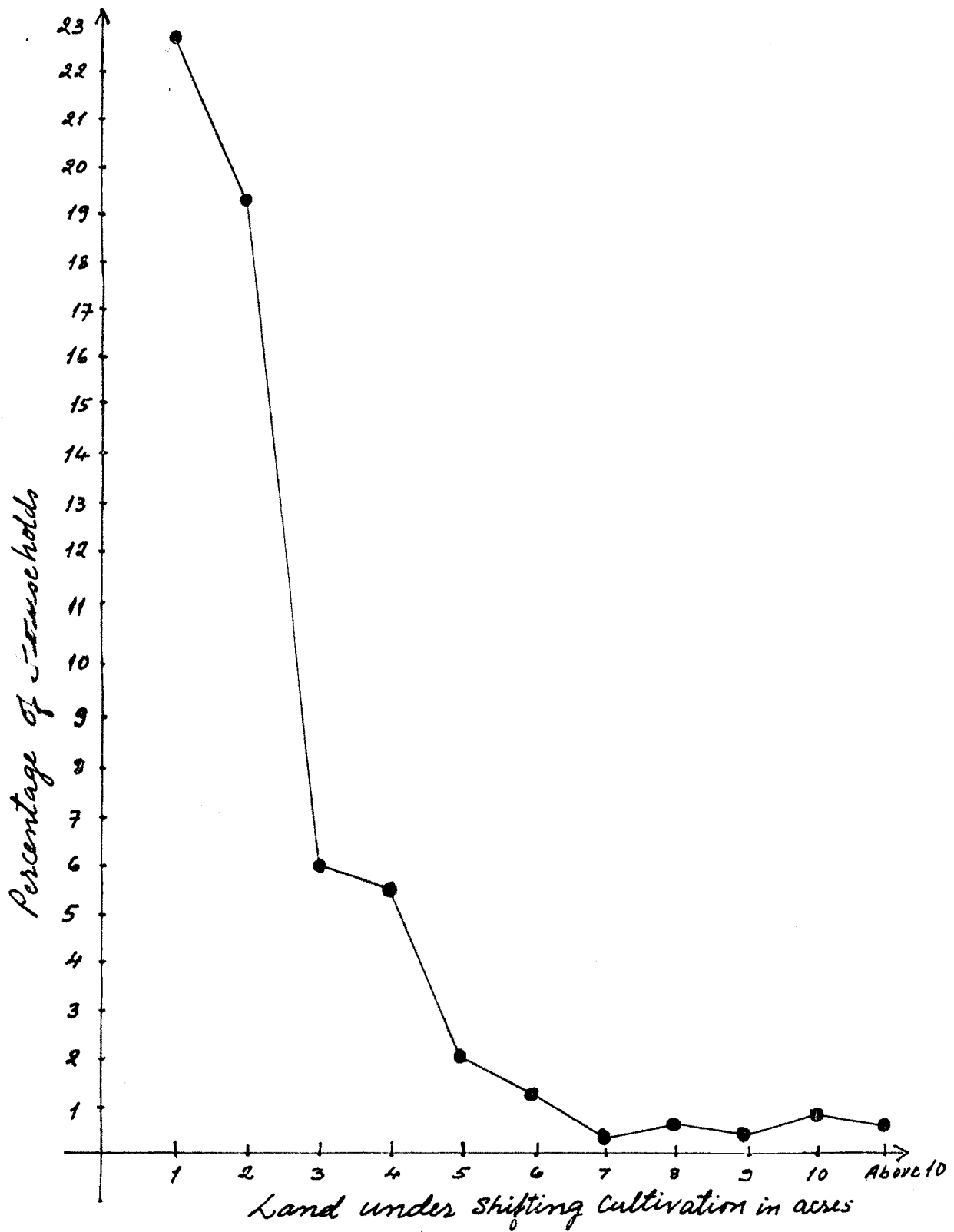


Fig 8 : Percentage of Households practicing shifting cultivation and land under it.

Table 22 : Distribution of land under shifting cultivation
with per household from CWS.

Obs.No.	Acres	Percentage
1.	-	40.6
2.	0 - 1	22.7
3.	1 - 2	19.3
4.	2 - 3	5.9
5.	3 - 4	5.5
6.	4 - 5	2.0
7.	5 - 6	1.2
8.	6 - 7	0.3
9.	7 - 8	0.6
10.	8 - 9	0.4
11.	9 - 10	0.8
12.	Above 10	0.6

Table 23 : Use of Own and Government land for shifting
cultivation in the 24 villages in the Chandoli
Wildlife Sanctuary.

Obs. No.	Villages	Shifting Cultivation	
		Own land	Govt. land Forest+Revenue
1.	Gothane (K)	✓	No Govt. land
2.	Nivale	✓	-
3.	Tanali	✓	-
4.	Dhakale	✓	-
5.	Chandel	✓	-
6.	Sonarli (Owd)	✓	-
7.	Durgawadi	✓	-
8.	Tambave	✓	-
9.	Khundalapur	✓	-
10.	Nandoli	✓	✓
11.	Petlond	✓	-
12.	Zolambi	✓	-
13.	Takale	✓	-
14.	Yeti	✓	-
15.	Lotiv	✓	-
16.	Nivale	✓	-
17.	Gave	✓	✓
18.	Chandoli Kh	✓	✓
19.	Jawali	✓	✓
20.	Rundiv	✓	✓
21.	Male	✓	✓
22.	Kolne	✓	✓
23.	Patherpunj	✓	✓
24.	Gothane	✓	No Govt. land

region. As the wildlife can not differentiate between a forest on own land and Govt. land the agricultural practice has been found drastically reducing the natural habitat of several wild species. Mainly this is a serious blow to arboreal animals and birds. The fire used in the activity causes permanent damage to the flora and fauna of the region changing the very composition of the ecosystem. This reduces the survival chances of animal populations from the isolated patches of forests (Plate 9, 6).

It was observed during the field studies that shifting cultivation practice was suspended in the state of Maharashtra for a couple ^{of} years in the catchments, wildlife sanctuaries and potential sensitive areas from 1984 onwards, on environmental grounds. However, due to the growing local and political pressure it was to be resumed from 1988. The major role played in this pressure building is by wood contractors and politicians behind the curtain. Some of the respondents disclosed that they were made aware of their rights of performing the traditional shifting cultivation practice which would automatically supply now most valued timber and fuelwood to the contractors who would manage to transport it out of the catchment before the practical ban on tree cutting is imposed by the government in the Wildlife Sanctuary.

The traditional crops grown in the area are Paddy, in the river valleys and terraces on low lands and the millets Nachna, Vari, Rai and Til on the steep slopes of the hills (Plate 10, a). Due to the less fertile and shallow top soils the agriculture is less productive except in the river basins where silted soils and perennial water supply gives good yields. Most of these lands

are likely to submerge in the impoundment of Warna Dam.

Altogether six non traditional crops are grown in the region for some time by the 46.4 % of the farmers (Table 24). These crops include wheat (29.9 %), maize (7.6 %), vegetables (2.8 %), groundnut (2.5 %), grass (1.9) and jawar (1.7 %).

Surprisingly the most common cash crop of the Western Maharashtra i.e. sugarcane is not grown in the catchment. This crop has caused serious environmental problems and controversy in the recent years in the catchments of many dams in the Western Ghats region of Maharashtra. The reasons for not growing sugarcane in the Chandoli Wildlife Sanctuary are as follows. In spite of the basic requirement of the perennial water necessary for the crop it is not grown as some do not have the adequate knowledge or experience, others do not have man power or economic condition to maintain the crop upto harvesting stage. Some complain about lack of roads and proper transportation facilities to reach the harvest to the nearest sugar factory. Some informants were of the opinion that sugarcane attracts Wildboar and that was the reason why it was not cultivated.

In other words the non feasibility of the cultivation of sugarcane in the areas has indirectly saved the natural vegetation from wantan distruction for more land and also the fuel wood which is required in huge quantities for sugar factories (a minimum of around 500 Tonns per year per sugar mill) Wheat which is grown by about 30 % of the households is the main non-traditional crop. This is because the villages cultivating wheat have an alternate water source. Also it is a short

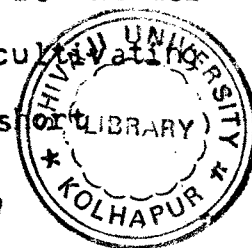


Table 24 : Percentage of households cultivating traditional
and major non-traditional crops in addition to
the traditional crops.

Crops		Traditional	Non-traditional
1.	Paddy	100 %	-
2.	Nachana	100 %	-
3.	Vari	100 %	-
4.	Rai/Til	100 %	-
5.	Maize	-	7.6
6.	Jawar	-	1.7
7.	Wheat	-	29.9
8.	Gram	-	1.9
9.	Groundnut	-	2.5
10.	Sugarcane	-	-
11.	Vegetables	-	2.8

duration crop in contrast to sugarcane, and it grows well in the local conditions. Maize is grown in the areas where water is available for irrigation after wheat is harvested. The striking features of the villages Gave and Chandel is ^{that} they grow non traditional crops like vegetables for subsistence. If the crop is good the people from Gave village take the vegetables to market at Morgiri which is approximately 25 km. away from the village and outside the Warna Catchment. The past experience of groundnut cultivation is not very encouraging because inspite of the good growth of the crop in some areas wildboar caused heavy damage. According to the local people wildboar ^{prefers} groundnut to any other crop.

In general availability of water and crop pest are the major factors which ^{te} ~~de~~termine the choice of crop to be cultivated. In many villages the perennial water source is in the nearby valley and the fields are on slopes or in the top of the hills. Thus the water can not be used for agriculture by gravitational irrigation. The poor socioeconomic status of the people does not permit them to go in for lift irrigation and also in most of the villages electricity is absent. Therefore in general the agriculture of the area is not economically viable considering the huge non tangible environmental losses incurred to support the existing poor returns and land use practices. Also the paucity of funds for investment in agriculture and the high prohibitive maintainance costs of the infrastructure like electricity. A better and environmentally suitable alternative appears to be shifting to horticulture and social forestry from the comentional shifting cultivation in the rapidly degrading

area, which is sensitive as a wildlife sanctuary and a dam catchment.

5. Crop Pest

There is always an inter species competition for food in any ecosystem. Man and wild animals interaction is at its maximum it has a direct competition for food as in the case of crop pests. This relation has been existing since beginning in the hills and in the cultivated areas surrounded by forests. However there are fluctuations in the intensity of the interactions which basically depends on several variables like nature and extent of cultivations, quality of adjoining forest habitat animal density and diversity, carrying capacity of the forests, climatic and crop harvest seasons, crop protection measures etc.

During the present investigations ten major mammalian crop pests were studied. Though the crop pest problem was high in the study area it was some what uniform and its intensity varied from place to place and season to season. Wildboar (Sus scrofa) was the single largest and widely distributed crop pest on a large variety of crops. It was reported in 98.6 % of cases, but considering its past status (97.7 %) the increase in its abundance is insignificant (0.9 %) (Table 25).

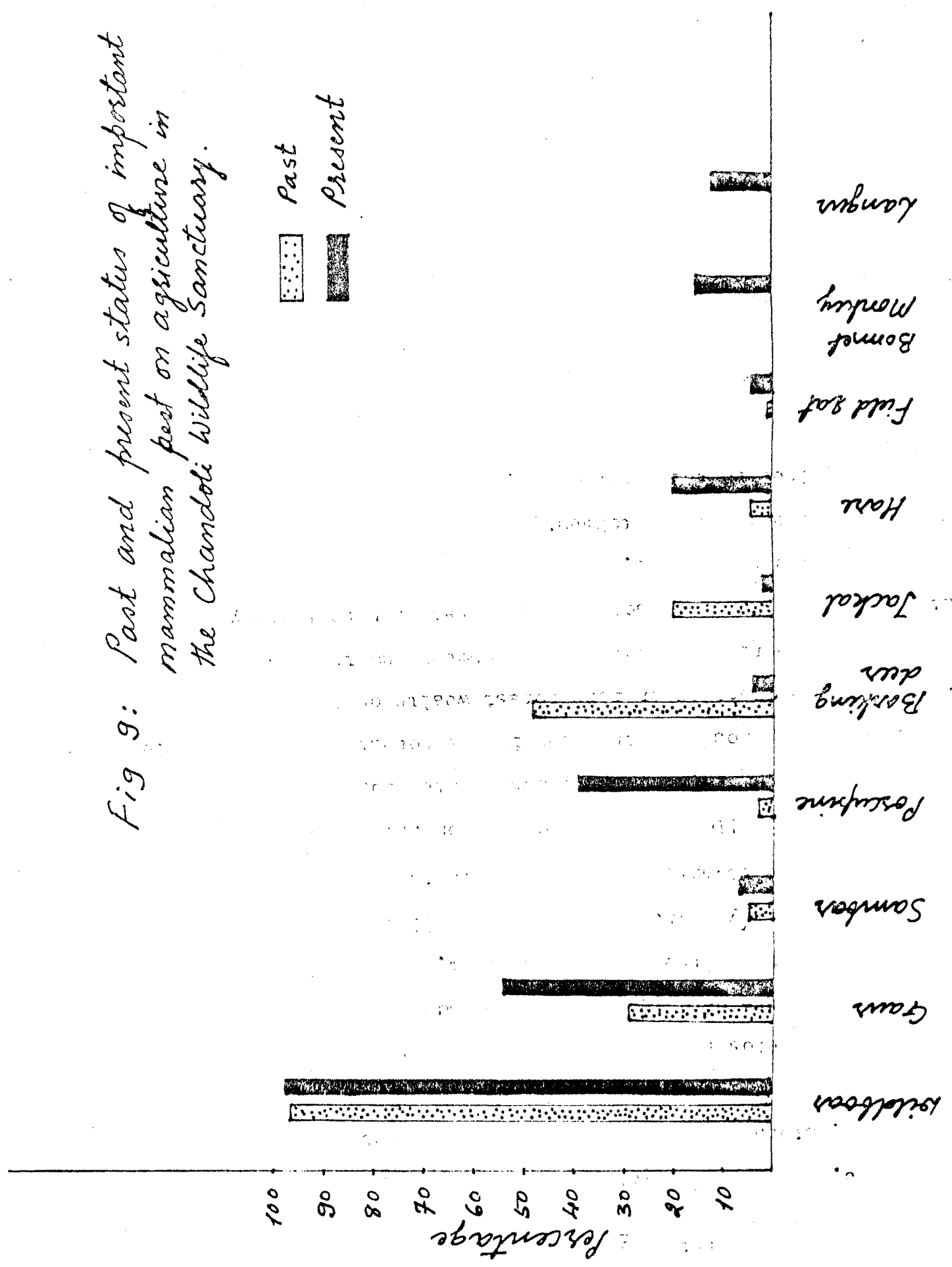
The real increase recorded in the incidence of crop raids is in the case of Gaur and Porcupine which was + 24 % and + 47 % respectively. The other pests which have registered positive change in their status are Hare (11.8 %), Field rats (2.5 %), Bonnet monkey (13.9 %) and Langur (11.6 %).

This increase in the incidence of raids is attributed to

Table 25 : Past and Present status of the major mammalian
crop pests in the Chandoli Wildlife Sanctuary.

Obs. No.	Animals	Present (%)	Past (%)	Change
1.	Wildboar	98.6	97.7	+ 0.9
2.	Gaur	54.4	29.5	+ 24.9
3.	Samber	5.5	4.6	+ 0.9
4.	Porcupine	49.4	2.2	+ 47.2
5.	Barking deer	2.9	46.7	- 43.8
6.	Jackal	1.0	14.6	- 13.6
7.	Hare	15.4	3.6	+ 11.8
8.	Field rats	3.7	1.2	+ 2.5
9.	Bonnet macaque	13.9	-	+ 13.9
10.	Langur	11.6	-	+ 11.6

Fig 9: Past and present status of important mammalian pest on agriculture in the Chandoli Wildlife Sanctuary.



several factors. The major being the destruction of natural habitat of the animals in the adjoining areas, expansion of agriculture and replacement of earlier forest and cultivable waste lands by cultivations, drastic reduction in the carnivore populations and as some respondents mentioned increase in the number of wild animals and the non traditional crops attracting the animals from the forest. The increase in the crop raids is a cumulative effect of some of the factors but at one time one or more factors may be dominant in exerting their influence. Like Gaur population is on increase because its main predator tiger is almost totally wiped out of the area. Similarly most of the Hindus consider it to be sacred 'Nandi' and is not killed. In case of wildboar apperantly there is no increase in its populations but there is wider dispersal of this sturdy and nocturnal omniver (Ahamad, 1988). Samber population (+ 0.9 %) also at no point of time has caused any threat to crops due to its low density and solitary nature in the sanctuary.

Sudden increase (+ 47.2 %) in the destruction of crops by Porcupine in the study area can not be correlated to any specific factors as similar trends have also been reported by Samant et al. (1988). Perhaps favourable conditions provided by extensive agricultural areas and reduction in the predation pressure may have been associated with its increased post activity.

Hare (+ 11.8 %) and field rats (+ 2.5 %) have always been the minor pest on crops though the later at times causes significant damage. Villages having increasing open and degraded lands have these pests as a cronic problem.

Another interesting observation in the field study was the significant increase in the primate-man interaction as a crop pest. The primates enjoy protection in the country due to religious beliefs and are normally not hunted except by some tribals. Also both the species from the study area were known to be seasonal visitors to orchards but never on the crops as a regular pest. The main reason for this change appears to be the destruction of forests i.e., the natural habitat of the arboreal species, which provided them with shelter and food.

Due to the clear fellings and shifting cultivation practices the primates have lost local migratory corridors to other forest habitats and have become residents of isolated forest patches and orchards. This has increased their presence in a given area causing frequent raids on variety of crops in different seasons. Lack of their natural predation by the ever dwindling number of tigers and panthers is also responsible for increase in the primate population or crop raids.

A common complain made by the respondents was that agriculture has become more labourous and not cost effective due to the increasing agriculture pest problems.

The people have to spend all the night awake and guarding their crop for a period of few month in winds, rains and cold till it is harvested. Inspite of this labour the animals always succeeded in feeding on the megeare crops, the damage is of course variable. The annual crop production is just sufficient for 4-6 months to a household.

Therefore Crop protection is considered to be a very

important and essential activity by the residents of the study area. It can also be understood why the local people have strong feelings against wild animals, as their food competition and are against conserving them. This attitude of the local population may pose some problems in the effective management of the newly created wildlife sanctuary.

For crop protection about ten different measures are commonly usedⁱⁿ the Western Ghats region of Maharashtra. Since no crop protection measure is full proof different measures are often used simultaneously in the study area (Table 26). The most commonly used method is making of loud vocal noise made at intervals or noise made by beating empty tins. If no person is available to guard the field a mobile made of empty tins and sticks is hanged to trees which makes noise with the wind. About 93.7 % of the farmers use this method of preventing or discouraging the wild animals from approaching the crops.

Fire is used by 82.11 % of the respondents to scare away the raids of the animal pest at night. Most of the crop pests are being nocturnal animals this method is found effective. Also the fire provides warmth to the person on guard. As there is no shortage of fuelwood this method is quite common.

Another effective method of mammalian pest control used by 66.95 % of the people in the area is scare crows of various dimensions and shapes made from hey, earthen pots and old garments and white cloth. Since this is effective only at day time its use against the nocturnal pest is doubtful. Perhaps this may prove effective against birds which attack crops at day time or animals coming to remote unguarded fields at outskirts of forests.

Table 26 : Precautionary measures taken against
mammalian crop pests in the CWS.

Obs. No.	Precautionary measures	Yes (%)
1.	Noise	93.70
2.	Fire	82.11
3.	Fire arms	2.71
4.	Crackers	4.00
5.	Electricity (light)	0.28
6.	Scare crow	66.95
7.	Stone throwing	81.11
8.	Fencus	-
9.	Trenches	-
10.	Crude Bombs	-

Stone throwing a method preferred by 81.11 % of the people for crop protection is effective only during day time as a person guarding the fields can throw stones in the directions of approaching birds and animals to scare them away.

Use of crackers (4. %) and illumination by electric lights (.28 %) are uncommon methods due to their costs and non practicability in the area. Fences made of *strobilanthus* stems or wood, stone walls, trenches are also used occasionally in the study area though they are common in other dam catchments (Samant et al., 1988). Though crude bombs and dynamites are widely used in Konkan and neighbouring regions the practice has not yet reached in this sanctuary (Ahamad 1988).

Use of firearms for crop protection is a common practice throughout the Western Ghats in Maharashtra. Even if only few (2.71 %) respondents mention the use of firearms the true number is many fold larger.

It is observed in the field survey that every village has at least few licenced or unli cenced fire arms, mainly .12 bore shotguns. The number of country made and illicitly used firearms is much larger. Even forest a concerned Govt. departments were not aware of the exact number of firearms in the sanctuary. Many people have facility to refill the used cartridges. Therefore there is no record of cartridges used for poaching and hunting for crop protection.

During the 'Grow more food Campaign' a couple of decades ago, many firearm licences for crop protection guns were liberally issued. These arms were also used for hunting and poaching ever since. The crop pests are not only killed when

they come to the fields but under the pretext of pest control local and outside hunters visit interior areas for hunting of Wild animals. Due to the new forest protection acts usually the activity is carried out with at most secrecy and no information about it is leaked out.

After the initial difficulties report was established with local amateur hunters and experienced poachers to get interesting information. According to these sources it is more difficult to kill wildboar which is an intelligent animal with unpredictable behaviour. When suspicious about noise, movements smell etc. it abandons the area for a while. Being Shy and nocturnal in habit it is very difficult to shoot at plenty of incidents of serious wildboar attacks on hunters were reported during the investigations which clearly reveals that it is a dangerous proposition.

Therefore on several occasions the firearms to be used for crop protection are used in killing other wild animals in their habitat. An excellent example is of the Barking deer which is reported to be reduced drastically (-43.8 %). As it is a defenceless, solitary herbivore visiting the same waterhole and place of defecation every day making it a most easy prey.

6. Animal Husbandry and Grazing

The domestic animal population in any nature reserve is bound to cause direct or indirect impact on the Wild animals, particularly the wild herbivores. Past experiences from different wildlife sanctuaries and National parks have confirmed that over population of domestic animals and their distribution in the areas is often detrimental to the wildlife. Therefore it becomes necessary to study the domestic animal populations before assessing their impact on nature in general and wildlife population in particular.

During the present investigations attempts were made to evaluate the various aspects of animal husbandry practices from the Chandoli Wildlife Sanctuary. The table 20 shows that only 0.85 % of the informants had animal husbandry as the main occupation in the past which has dropped down to 0.44 % today. The Dhangar Community which is traditionally a pastoral community was 15.55 % of the total population of the study area during investigations. However, the significant drop in the animal husbandry as a main occupation today was due to the shifting of the traditional occupation by the Dhangars to agriculture as a main occupation.

The reasons for the changing pattern of animal husbandry from traditional to a supplementary occupation is due to some of the factors mentioned below. The lack of transportation facility to the remote villages, absence of market place in the neighbourhood, changing agricultural practices and poor economic returns are making the once very lucrative traditional occupation of animal husbandry a less profitable proposition.

The less milk yields, in the rapidly changing environments, have forced the people of the area to increase the herd size to compensate the loss in the yields of milk which in turn has further deteriorated the situation.

It was learnt during investigations that the animal husbandry practice though not yet changed drastically, the composition of the animals is gradually changing.

Basically Buffalo, Cattle and Goats are the three kinds of animals domesticated in the area. Their uses being Buffalo and cattle for milk and agriculture labour and Goats for milk and meat. The animal holdings per household showed that 36.1% households had buffaloes, 88.4 % had cattle and 25.9 % had Goats. (Table 27). Figure 10 gives graphical presentation of the buffalo, Cattle and Goat and their household-wise distribution in the study area.

The buffaloes were mainly maintained by the Dhangar community from the early times. According to Gadgil and Malhotra (1979) the Western Ghats were once dominated by the pastoral community having large herds of buffalos. This picture has changed today. The table 27 shows that the largest proportion (19 %) of buffalo owners have only 1-2-animals and only 2.8 % had 10 or more animals. This clearly reveals that today, low density of buffaloes per households is mainly for subsistence. An exceptional case of a Dhangar household with a herd size of 60 buffaloes was recorded from an isolated Dhangarwadi near village Takale. The herd was freely grazed in the forest patch nearby.

Buffalo being endemic to tropical climatic conditions .

Table 27 : The distribution of the percentage of households
having buffelo, cattle and goats in the study area.

Sr. No.	No. of Animals	Percentage of households		
		Buffelo	Cattle	Goats
1.	0	63.9	11.6	74.1
2.	1	8.5	2.2	2.5
3.	2	11.5	6.3	3.2
4.	3	3.7	7.0	1.3
5.	4	2.7	8.8	2.1
6.	5	1.8	9.3	1.1
7.	6	2.7	7.5	2.1
8.	7	0.7	5.7	0.4
9.	8	1.2	3.9	0.7
10.	9	0.3	4.6	0.7
11.	10 or more	2.8	33.0	11.36

requires large quantity of green fodder and plenty of water. Naturally the areas which no longer provide these basic requirements have decline in buffalo populations. Perhaps the unique case of the large herd at Takale is a last remenant of the earlier animal husbandry tradition in the study area. Comparatively the households maintaining buffalos^e are more in Zone A than the other two.(Plate 11, a).

Cattle population in the study area was the largest and dominated the animal husbandry scene. Though 88.4 % of the informants had cattle, 33.6 % people had lesser than 5 cattle per household. About the same proportion of people had animal holdings from 6-9 and the percentage of people having 10 or more cattle was also 33 %.

As compared to the distribution of buffalos^e, cattle were more uniformly distributed per household in the study area (Table 27). In most cases of larger herds of cattle the milk was not proportionally more as most of the larger herds of cattle belonged to villages from zones B and C having degraded type of environment with scrub forest and wastelands (Plate 11, b). The 11.6 % of the people without cattle belonged to castes other than Maratha and Dhangar. These were economically poor or did not have sufficient man power to look after animal husbandary.

It was noted that, except in the villages Chandel, Khundalapur and Lotiv, where each household had cattle, most of the people maintained cattle for subsistence and at times it is considered as secondary occupation with agriculture as

the main occupation. In case of the some households having more cattle, their economic conditions were sound. But in case of Dhangar households, where ever animal husbandry was the main occupation, inspite of the large herds, due to lack of agriculture lands to support their life, the economic conditions were very poor. In the case of large cattle herds the number of individuals in a household was a contributing factor. Where ever only 1-3 cattle were maintained (15.5 % households) they were normally bulls for agricultural use.

Goat is comparatively a recent introduction in the study area. Though at present only 25.9 % of the households keep goats, their number is on the increase. The presence of goat population is more in zone C, moderate in zone B and they are almost absent in Zone A. It is reported that just about 15 years back there were no goats in the study area. The respondents attributed the absence of goats in the past to the high rainfall and more predation frequency. Also there appears to be direct correlation between the degradation of vegetation and increase in number of goats or vice a versa (Plate 12, a & b). Most of the households having goats (10 %) had 2-3 animals which were kept for subsistance i.e. meat purpose only 11.36 % of the households had 10 or more goats, rared for subsistance as well as commercial purpose.

The Figure 10 gives a good presentation of correlation between buffalo, cattle and goat distribution per household in the study area. Initially cattle population is more per household which gradually declines as the no per households

Goats
Buffalo
Cattle

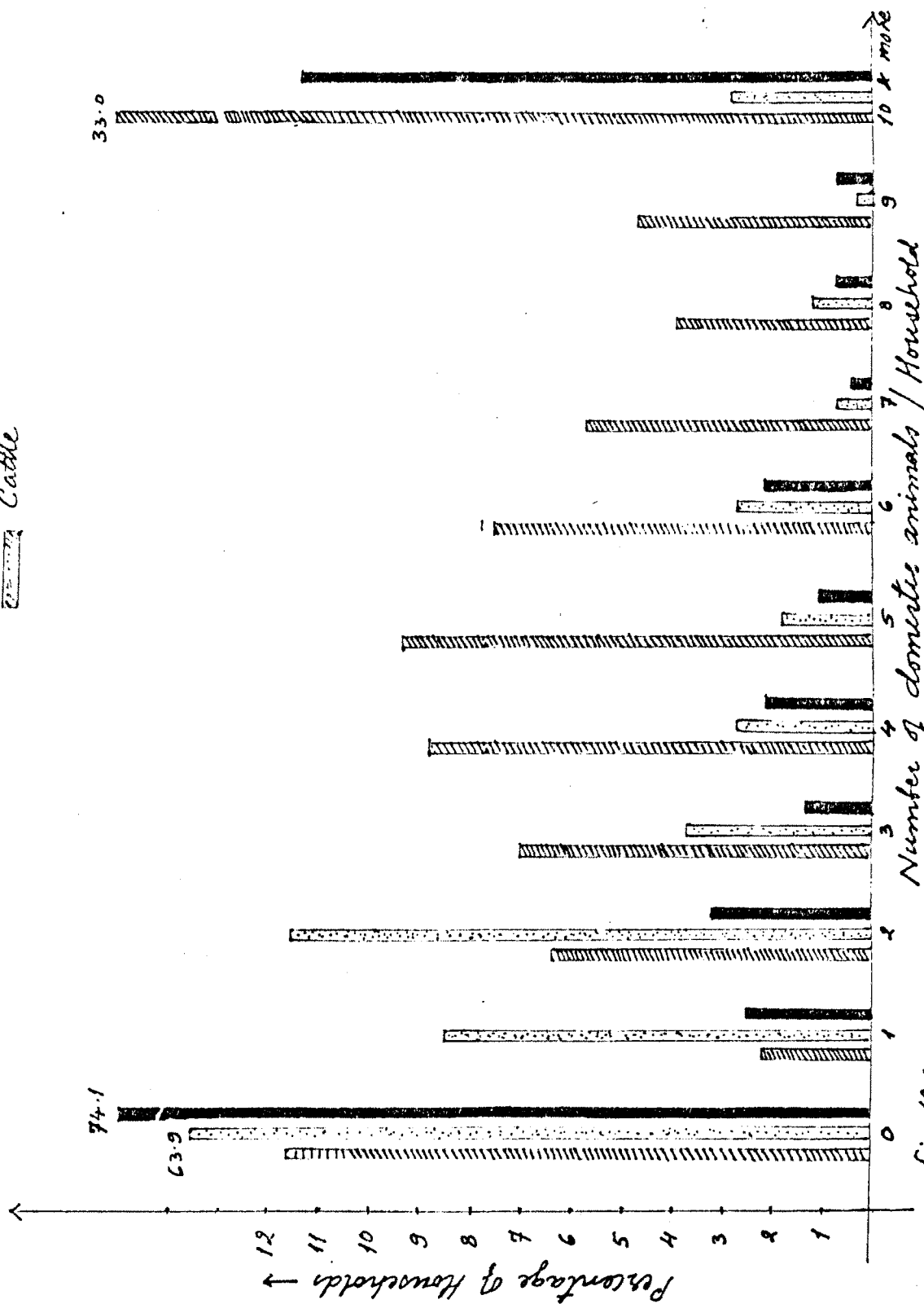


Fig 10: Percentage of households having different number of cattle, buffalos & Goats.

increases. In contrast to this the cattle population per household is initially low and reaches its high levels around 5 cattle/household and again declines to reach the highest level, i.e. 10 or more cattle per household at the end (33 %). The goat population per household is characteristic with low values throughout with the maximum value i.e. 10 or more animals per households at the end (11.36 %).

From the data collected the domestic animal populations in the Chandoli Wildlife Sanctuary it is estimated that there are 1708 Buffalo^es, 11,468 cattle and 3416 goats. In other words out of the 16,592 domestic animals in the study area, the percentage of the three groups is 10.29 % buffaloes, 69.11 % cattle and 20.58 goats.

The domestic animals and wildlife in the sanctuary strongly interact for food, water, space and also predation by the carnivores. There is inevitable competition between the domestic animals and the wildlife of the Chandoli wildlife sanctuary, particularly in herbivores for food, water and space. Also there is a significant pre-predator relationship between the domestic animals and carnivores. Human involvement in controlling the predator population and encouraging the live - stock to use more of natural habitats has additional dimensions in the conservation problems of the area.

The normal grazing practice followed is to accompany the herd in the areas where sufficient fodder and water is available. Preferably these are the areas near villages as far as possible unless they are badly degraded. In order to

avoid grazing in the cultivated land a herdsman takes them to forest lands and waste lands. Only in the villages of Male, Kolane and Patharpunj free grazing of animals without a herdsman was observed. In this case animals used to return home on their own in the evenings. In other cases normally the animals are taken out in the mornings to the specific grazing grounds and the accompanying people go in search of fuelwood. The animals are gathered in the evening before coming back to village. However, on many occasions, if this could not be done due to some reasons, the buffeloes and cattle stayed back in the grazing grounds and forests and were collected next day. The animals are adapted to the forest conditions perfectly and usually protect themselves from the predators.

Table 28 gives an account of the different types of lands used by the people for grazing domestic animals. Except the small percentage of people (14.2 %), who either have no domestic animals or have one or two bulls for agriculture purpose which are fed on supplementary diet, all the animals are grazed on own land, wasteland or forest.

The bulls are stall fed because no time is wasted in grazing and secondly more nutritious diet is given to them in order to exploit more work. For stall feeding mainly agriculture residue, locally called as 'Bhatyan' (Paddy) and 'Nachyan' (Nachani) was used. When this was not available in adequate quantity the grasses from the wastelands and forest were used. The size of the herd used for agriculture work depends on the availability of the agriculture residue.

Table 28 : Percentage of households using different categories of lands for grazing purpose in the CWS.

Obs. No.	Type of grazing land	Household (%)
1.	Own land	1.49
2.	Waste land	3.43
3.	Forest land	4.02
4.	Own + Waste	7.76
5.	Own + Forest	0.89
6.	Waste + Forest	37.31
7.	Own + Waste + Forest	30.74
8.	Not applicable	14.2

It was interesting to note that almost cent percent people extensively used the forest and waste lands around the village for grazing and only 1.40 % of the total population used own land for grazing their domestic animals. Waste land and forest was used by 44.76 % of the households. The own land with forest and waste land combined was used by 39.39 % of the households. In short wastelands and forest areas, along with the small own lands, belonging to the forest and revenue department are extensively used for grazing about 16,500 domestic animals in the Chandoli Wildlife Sanctuary.

The distance travelled for grazing is being dependent on the availability of fodder around the settlements, it was not uniform for the villages in the study area, (Table 29). In the villages Zolambi, Yeti, Lotiv etc, minimum distance (2 km) was covered for grazing due to the availability of rich fodder in the surrounding area. In contrast to this in village Dhakale longest distance travelled for grazing was reported (7.06 km one way). For the entire study area average distance (one way) covered for grazing per village was worked out to be 4.65 km. Normally wastelands and old shifting cultivation lands with scrub and degraded vegetation offered better grazing grounds. This was due to the large open patches with stunted vegetation in easy reach of the animals. Such areas were largely represented by the villages in zone B.

Time spent in the free grazing practice is dependent on the distance travelled, availability of the fodder, season and topography of the region in the vicinity of the village.

Table 30, shows that 11.9 % of the households didnot

Table 29 : Mean distance travelled by domestic animals per day
(one way) for grazing in each village in the CWS.

Villages		Mean distance (km)	Std. deviation (km)
1.	Gothane	5.83	3.73
2.	Nivale	5.25	2.61
3.	Tanali	6.60	2.63
4.	Dhakale	7.06	3.59
5.	Chandel	6.45	3.59
6.	Sonarli	6.83	3.18
7.	Durgawadi	5.16	3.22
8.	Tambave	4.11	2.10
9.	Khundalapur	5.39	3.01
10.	Nandoli	4.75	1.80
11.	Lond	3.55	1.75
12.	Zolambi	2.14	1.26
13.	Takale	3.01	1.88
14.	Yeti	2.72	1.29
15.	Lotiv	2.73	2.42
16.	Nivale	3.50	1.92
17.	Gave	3.5	1.55
18.	Chandoli Kh.	3.36	1.92
19.	Jawali	3.81	3.04
20.	Rundiv	3.69	1.94
21.	Male	6.20	2.70
22.	Kolne	2.39	3.01
23.	Patherpunj	4.59	1.83
24.	Gothane	4.23	2.04

Table 30 : Time spent per day and distance travelled (one way)
per day for grazing by domestic animals.

Sr.No.	<u>Time spent (Hrs/day)</u>		Distance travelled (one way) (km/day) (%)
	Range	(%)	
1.	0	11.9	11.9
2.	1 - 2	0.3	5.8
3.	3 - 4	1.5	39.4
4.	5 - 6	2.7	15.4
5.	7 - 8	11.0	17.3
6.	9 - 10	6.4	6.5
7.	Above 10	65.9	3.3

spend any time on grazing because they had less animals and mainly bulls for agriculture, where stall feeding was done. In case of people who took their animals for grazing spent 11 % ^{spent} - 7 to 8 hr, 6.4 % - 9 to 10 hr, and 65.9 % more than 10 hours per day. This information reveals the fact that for grazing almost 8 to 10 hours per day are spent because all the free grazing animals are scattered in all possible directions in the sanctuary. During this time they are bound to make an impact on the local biological diversity.

In the past the spread of the deadly epidemics of Rinderpest and foot and Mouth disease in many wild life sanctuaries in the country had claimed large populations of wild animals. Stray grazing cattle were held solely responsible for the un precedent damage. Therefore there is a constant threat of the spread of such disease, in the Chandoli Wildlife Sanctuary by the vast population of domestic animals which penetrates the most exterior parts of the sanctuary.

There has been no change in the grazing practice in the area which is subjected to phenomenal change after construction of Warna Dam. When asked about the changing size of the herd, it was stated by some respondents that this entirely depends on availability of the fodder. In other wards the 'carrying capacity' of the region will ultimately determine the potential of how many animals could be supported by the ecosystem. Obviously the people of the area are concerned about their domestic animals and give no thought to the endemic wild

animals of the region.

About 56.6 % of the people have almost kept constant the number of domestic animals for last 20 years or more. This was done by the sale of the extra animals to others. The reasons for decrease in the animal population was mainly due to disease (4.8 %), predation (4.0 %), rainfall (3.4 %), severe cold (1.5 %), and accidents (0.4 %).

Presently there is an increasing trend in the number of domestic animals due to the availability of loans, improved economic conditions etc. Around 29.3 % of the households reported increase in the number of domestic animals in the recent years. However the pattern of increase in the number of buffalo, cattle and goats was not uniform. In general buffalo population is reduced a little whereas there is an increase in the cattle and goat population in the study area.

The dam impoundment has submerged low lying grass lands and wastelands which was expected to have some impact on the animal husbandry of the region. About 11.5 % of the respondents reported decrease in area available for grazing due to submergence and expansion in agriculture land. Opposite to this 14.5 % of the people were of the opinion that there is an increase in the grazing lands. These were the people from the villages on hill slopes. The increase in open land or wastelands suitable for grazing is mainly due to shifting cultivations, which has exposed large areas for the growth of grass. Similarly the land belonging to the rehabilitated people, who are shifted outside the Warna dam catchment, has provided additional area for grazing.

A major proportion of people i.e. 68.2 % (Table 31) feel that there is no significant change in the area used for grazing for a number of years. These were the people who had small and limited livestock and it^{is} used mainly for subsistence purpose. As the limited number of domestic animals was looked after properly by personal attention and around the settlements there was no noticeable change in the grazing area. Though 5.7% of the respondents were unable to form their opinion about the change in the area available for grazing their answers were more inclined to decrease than increase in the area.

Attempts were made during the investigation to try to see whether the nature of the grasslands is also degraded like the forests of the area. About 72.9 % of the respondents reported no change in the productivity of the grasslands as there was apparently no visible degradation.

The people (12.4 %) who have been now grazing their animals on the earlier cultivated lands of the dam affected (rehabilitated) people, have found increase in the availability of the fodder per unit area. The newly shifting cultivated lands and deforested areas also supported good fodder growth, which is expected in any newly cleared forested in the initial stages of succession. However the erosion of the top soil and over-grazing has degraded some highly productive grasslands. This might be attributed to the gradual process of laterization of the top soil, which is characteristics of the Western Ghats. About 7.6 % of the people, basically from zones B and C complained about the drop in the productivity in the fodder per unit area in the last decade. Again 7 % of the people



Table 31 : Respondents opinion about the pattern of change
in the grazing area and yield of fodder per unit
area in the CWS.

Sr.No.	Opinion	Area available for grazing (%)	Availability of fodder per unit area (%)
1.	Can not say	5.7	7.0
2.	Decreased	11.5	7.6
3.	Increased	14.5	12.4
4.	Remained same	68.2	72.9

could not form their opinion about the change in the yield of fodder.

The use of leaf fodder as supplementary feeding to domestic cattle was observed during investigations. The Dhangar Community makes maximum use of leaf fodder throughout the year. The other communities use leaf fodder only during summer months because of the absence of green fodder such as grass. In the sanctuary about 63.1 % people use leaf fodder during different seasons, when 29.2 % people do not use leaf fodder at all. Largely the leaf fodder is collected from the forest from the trees like Bilva, Kevan, Chandwad, Cardal, Kharwat, Kharuti, Bobidasa etc. The leaf fodder is normally collected from ground and not by climbing the trees. This clears the fodder from the branches of the trees upto 6-7 feet height from ground and the low canopy growth. This creates problems for the wild herbivores including Gaur, as the wild animals can not browse beyond 7 feet from ground and during the adverse summer months this is the only green fodder available.

In contrast the domestic animals in the sanctuary are supplied with supplementary diet during adverse conditions. This might provide them with an upper hand in the survival value in the rapidly changing environment.

In addition to the about 16,600 domestic animals in the Chandoli Wildlife Sanctuary, every year during summer months, hundreds of domestic animals from outside the area come for grazing. These are usually buffalo^s belonging to the Dhangars from neighbouring hilly areas, catchments and Konkan region. Therefore during adverse summer months there is additional

pressure on the forests of the sanctuary.

Large herds of these animals from outside areas spend about 12-14 hours a day grazing in the forest areas. The herdsmen make camping in or around good vegetation which provides them fooder, water, shelter and fuel. These camps last for 3-4 months during summer.

Therefore this apparently harmless are old practice of animal husbandry in the Chandoli Wildlife Sanctuary has stated creating imbalance in the ecosystem due to the over exploitation of essential natural resources to wildlife, like food, water and Shelter, space etc. This human activity is indirectly responsible for increasing pressure on the biological diversity and has long lasting and irreversible effects on the Chandoli Wildlife Sanctuary.

7. Developmental Activities :

The main goal of the undertaken work was to survey the mammalian diversity from the so far totally unexplored area in the Western Ghats. In the post independence period in many parts of the country the rate of development is just unprecedented. The process of industrialization and agricultural revolution were two of the important objectives fixed in the beginning by the planners of the Five Year Plans. Large Hydel projects at suitable sites provided ideal solutions to both the above mentioned priorities. Therefore after independence a large number of river valley projects have come up all over the country. The basic idea of the development was to improve the life standards of the common man from rural India.

It is very much debated today that how much we are successful in achieving our objectives by building large dams? This has given rise to wide controversies over the completed and proposed large river valley projects like Tehari Dam, Narmada Sagar, Bhopalpatnam etc. Apart from this controversies, it is now really necessary to look back and see the fate of the completed projects rationally and learn some lessons not to commit, the same mistakes in the future.

There are two very important aspects of any dam project which are usually ignored by the planners. First is the likely impact of the project on the environment of the area and secondly the human population which would be affected by the developmental activity. Even today as in the past, undue importance is given to the command area of the dams which is going to get water for irrigation and electricity for industrial and other developments

depending on it. However, the dam affected people from the catchments are always totally ignored and left to their fate. These are the people who have done great sacrifice for the improvement of the other areas but they themselves remain totally deprived of the slightest developmental changes. None of the dam projects in the state of Maharashtra, built after independence has properly solved the problems of the dam affected people even to this date. The striking example is the prestigious Koyna hydel project (Shinde, 1988).

Another dimension of the dam projects is the non tangible damage caused to the local natural environment. Whenever such large projects had been undertaken dam sites, canals, transmission lines, power houses, roads and colonies for the dam staff were given importance in planning and proportionally expenditures were made. Unfortunately the catchment area received very little attention and money. The wonton destruction of the vegetation in the proposed submergence becomes a routine, sometimes even before beginning of the dam work. Construction of the approach roads in the remote areas provide easy access for poachers and illicit tree cutters to the intact prime forests. Thus the destruction of flora and fauna sets in much prior to the expected time and before we image the whole wealth of nature disappears causing permanent damage to the entire ecosystem.

Same things have happened even in case of Warna Dam so far as the dam project is still in progress. Local people are a non separable component of the catchment ecosystem and their future totally depends on the health of the environment therein.

Therefore it is very much necessary to study the man and nature interactions in the catchment before going in for extensive conservation plans to save the biological diversity and gene pool of the area like Chandoli Wildlife Sanctuary. No conservation programme will ever be successful without full support and participation of the inhabitants of the area. The participation largely depends on the motivation of the people which can only be created by environmental awareness, nature education and its application to solve the local environmental problems. This should encourage local people to make use of the natural resources at sustainable level. The undertaken work being pioneering in the field of conservation biology and socio-ecology, no basic data was available from the study area. Main emphasis of the study was on the interaction with the residents of the area. This helped in understanding and to identify their problems and to learn about the impact caused by these populations on the local environment. The basic information about the local inhabitants would help a long way in successfully implimenting the future conservation policies in the region.

Size of a household in the thinly poulated and scattered hilly settlements is an important parameter. Because the very size of the household determines the requirements and its impact on the immediate surroundings natural resources. Traditionally there are large size, undivided families in the rural area. However the average number of individuals in a households was 6 in the Chandoli Wildlife Sanctuary, (Table 32).

The size of a households ranged from individual to 10 or more individuals per household.

The villages in the study area are small and have an average of 50.83 households per village (Table 3). A large population stays in the small scattered settlements or locally known as 'Wadi'. Particularly these Dhangarwadis are situated on plateaus and higher altitudes. All the members of a household young and old of both sexes have to work hard. Therefore the household is a very active human unit in the study area, as it exerts impact on its immediate surroundings. The magnitude of the impact will be determined on the number of individuals in the household. From the study area more than 50 % of the households had 4-7 individuals in each household. However there are some larger families and 10.91 % of the households had 11 or more individuals in them.

As discussed earlier the cast pattern of the area (Table 33) showed three dominant castes, Maratha (69.21 %), Dhangar (15.55 %) and Harijan (12.65 %). Each of the castes were involved in agriculture and their life styles much similar. This may be because of the lack of the so called development, observed in the other areas, which as often brought about more discrimination and socio-economic difference in the castes than in the people from the isolated poor people. These people solely relied on the nature for their subsistence and survival and the nature does not discriminate among the creatures live in it.

The average age of the respondent was 45 years though

Table 32 : Percentage of households having a number of
individuals per household.

No. of Persons	Household %
1	0.59
2	6.87
3	8.22
4	13.59
5	16.14
6	12.55
7	13.01
8	6.15
9	5.29
10	4.00
11	10.91

Table 33 : Caste distribution in the study area.

Caste	Percentage

1. Maratha (Kshatriya)	69.21
2. Dhanagar (Pastoral nomads)	15.55
3. Nhavi (Barbar)	0.61
4. Kasar (Bangle Seller)	0.15
5. Sutar (Carpenter)	1.68
6. Sonar (Goldsmith)	0.15
7. Harijan (Scheduled Castes)	12.65

it ranged from 99 to 15 years in two extreme cases.

Preferably the interviews of the seniormost members, still active, were taken to recorded the past and present status of wildlife and environmental changes in the regions around village. This provided excellent information at least for two generations and the changes after the post independence period.

Ours being a patriarcal system, 96.26 % of the respondents were male heads of the households. This was also necessary because they took part in hunting, wood gathering, grazing and agriculture activities and imparted more information than their better halves. Only in case of 3.74 % households women were interviewed as either the men were out of station or the respondent was head of the household and a widow. Because of the upper age group of the respondents, 93.26 % were married and 6.74 % were single i.e. divorce, bachelor or widower (Table 34).

The religion of the inhabitants was mainly Hindu (98.2%) and only in village Dhakale, Chandel and Gothane some muslim (1.8 %) population was recorded.

The study area being totally underdeveloped the educational facility was poor i.e. 11 villages having school facility upto standard IV and in 2 upto VII Std. Except in Nivale, Gothane and Chandel teachers were present for a period of 4-5 months in year. In the past even this facility did not exist. This reflected from the very poor literacy level (reading and writing) among the respondents i.e. 16.20 % and 0% in males and female respectively. The extremely poor rate of

Table 34 : Personal information about the 669 heads
of households from the study area.

Personal Information	Percentage								
Age in years	maximum yr. 99.00 average yr. 45 minimum yr. 15.00								
Sex	male 96.26 female 3.74								
Marital status	single 6.74 married 93.26								
Religion	Hindu 98.20 Muslim 1.80								
Literacy level (Reading & writing)	Male <table> <tr> <td>literate</td> <td>16.20</td> </tr> <tr> <td>illiterate</td> <td>83.20</td> </tr> </table> Female <table> <tr> <td>literate</td> <td>0.00</td> </tr> <tr> <td>illiterate</td> <td>100</td> </tr> </table>	literate	16.20	illiterate	83.20	literate	0.00	illiterate	100
literate	16.20								
illiterate	83.20								
literate	0.00								
illiterate	100								

literacy was also responsible in the general ignorance of people and lack of understanding of the environmental problems and the impact of the over exploitation on natural resources.

The Western Ghats region has been known for a long time as a major labour supplying area to big cities like Bombay, Pune etc. This region is also known to live on 'Money order Economy', like konkan to certain extent. All the able youth with a slightest opportunity of leaving the area go to towns and cities for livelihood. During the investigations it was recorded that 539 persons had left the area in search of better opportunities, out of them 58.25 % were literate and 41.74 % illiterate. The reasons for leaving the areas was basically employment (86.45 %). A small portion only (10.2 %) mainly boys, left the villages for better education to join highschools outside the sanctuary area (Table 35).

The exodors of the able bodied and literate youth outside the sanctuary leaves behind illiterate old people and women who certainly can not be expected to change their living style and make progressive changes in the age old agriculture practices. It was also noticed that delay in receiving financial assistance from the relatives working in cities or in termination of this help, as in later case these people settle in cities, the inhabitants had to depend more on the local natural resources. In case of forest and agriculture lands new investments or very little but the withdrawal is ever increasing. With the recent ban on wood cutting, on Government or Own land, by the Central Government, the illicit tree cutting with the help of wood contractors has reached new

Table 35 : Total number of persons left the study area during last six years (1980-86) and the reasons for leaving the area.

Total No. of Persons	Persons left	Literacy		Reason for leaving		
		literate (%)	illiterate (%)	Employment (%)	Education (%)	Other (%)
4276	539	58.25	41.74	86.45	10.20	3.33

heights.

All this has been attributed to severe degradation of nature in the Chandoli Wildlife sanctuary. People living in cities often feel that the dams are the only solutions to the problems of rural people as they provide regulated water supply of irrigation, produce "Cheap" power for industrialization and being about rapid change in the forms of roads and new settlements and educational facilities. This picture is perhaps true with the changes in the command areas of the large dams. But in the catchments the people who have done great sacrifice for the dams are usually totally ignored and never get an opportunity to make up with the losses. The rehabilitation of the people is another painful experience. Even after two generations, dam affected people from Pavana, Mulshi, Koyna and several other dams in the Western Ghats of Maharashtra, have not been able to get proper treatment and many of them live in much poorer and degraded conditions than before.

The local people due to the lack of exposure to the happenings in the world are totally unaware of the massive degradation of biological diversity elsewhere. In other words they are not aware of the natural wealth being destroyed by them due to their traditional life style. This was revealed when they were asked questions about the changing biological diversity in the area (Table 36).

To all the questions asked about the impact of agriculture, new settlements, shifting cultivation, road construction, deforestation etc, on the biological diversity

Table 36 : Openion of the respondents about the change
in the Biological Diversity in the CWS due
to various human activities.

Obs. No.	Activities	Yes (%)	No (%)
1.	Agriculture	9.56	90.43
2.	New Settlements	2.69	97.30
3.	Shifting cultivation	2.69	97.30
4.	Road construction	2.24	93.56
5.	Old Road Dyfund	2.24	93.56
6.	Deforestation	0.89	99.10

in the Wildlife Sanctuary the answers were negative.

This was either due to their ignorance of the gradually changing environmental situation or due to the fear that if the changes are reported the Wildlife Sanctuary rules would be strictly imposed on them resulting in the shifting of villages outside the sanctuary like in case of Warna dam affected people.

When asked about the impact of the Warna dam on the life of people in catchment area in general and particularly job opportunities and improvement in the necessary facilities like transportation medical, market etc. the reaction was also negative. Except marginal changes in the villages near dam site i.e. transportation and electricity 4.1 % and 6.87 % respectively. There was no apparent sign of development (Table 37) according to the residents of the study area.

Because of the fresh experience of the rehabilitation of the Warna dam affected people the people from the Chandoli Wildlife Sanctuary are sensitive about shifting outside the area. When they were explained the importance of the sanctuary and hardships they are facing today due to the want of even ordinary common facilities they disclosed their choice of compensation for leaving the Wildlife Sanctuary (Table 38). The choice given was almost unanimous i.e. hand compensation and total rehabilitation, 97.6 % and 95.95 % respectively, was justful. Surprisingly no body preferred cash compensation (1.19 %) and job opportunities in the sanctuary 0.89 %.

Road construction in the remote areas is always given a top priority. In the Chandoli Wildlife Sanctuary prior to its creation many such roads were constructed to transport the

Table 37 : Openion of the respondents about the impact of
Warna Dam Construction and associated developmental
activities on the life of people in the study area.

Obs. No.	Activities	Better (%)	Poor (%)
1.	New job apporunities	1.49	98.50
2.	Adequate transportation	4.18	95.81
3.	Better medical facilities	2.09	97.90
4.	Increase in prosperity	0.59	99.40
5.	Rise in income	0.59	99.40
6.	Bazar facility	2.24	97.75
7.	More food production	1.34	98.65
8.	New electricity supply	6.87	93.12
9.	Improved Govt. Administration	0.29	99.70

Table 38 : Preference for compensation by the people
from the Chandoli Wildlife Sanctuary.

Compensation	Percentage

1. Cash Compensation	1.19
2. Land Compensation	97.6
3. Job in Sanctuary	0.89
4. Total rehabilitation (outside CWS)	95.95

fuelwood by contractors. The figure 11 shows the present roads in the sanctuary area. All of these roads were constructed during early dam construction and have no importance as far as management of the sanctuary is concerned. On the contrary these roads cause problems because of the wider exposure and access to poachers and illicit tree cutters. Also these roads have penetrated the sanctuary boundry from many directives making it difficult for the understaffed and illequipped forest department to guard the sanctuary.

All these roads are temporary and are washed out during rainy season (Plate 13a and b). Roads from Udgiri to Nivale (3.5 km) and Udgiri to Gothane (4 km) from the boundry of the sanctuary are in proper condition. About 12 villages are connected by temporary roads which are used only for transportation of timber and fuelwood during the favourable seasons. The villagers prefer footpaths and shortcuts through forest for movement in the area.

In the study area various Govt. departments have prepared about 27.2 km (32.11 %) roads whereas 57.5 km (67.88%) roads are prepared by wood contractors. The length of the roads made by the wood contractors is directly proportional to the increased damage of vegetation in the remote area and ones the vegetation of the area is removed the roads are neglected which are normally washed down causing great damage due to soil erosion (Plate 13 b).

A new project has been proposed in Wildlife Sanctuary to generate more electricity. The Tanali hydroelectric project is named as the Kardi hydroelectric project. The river Kardi

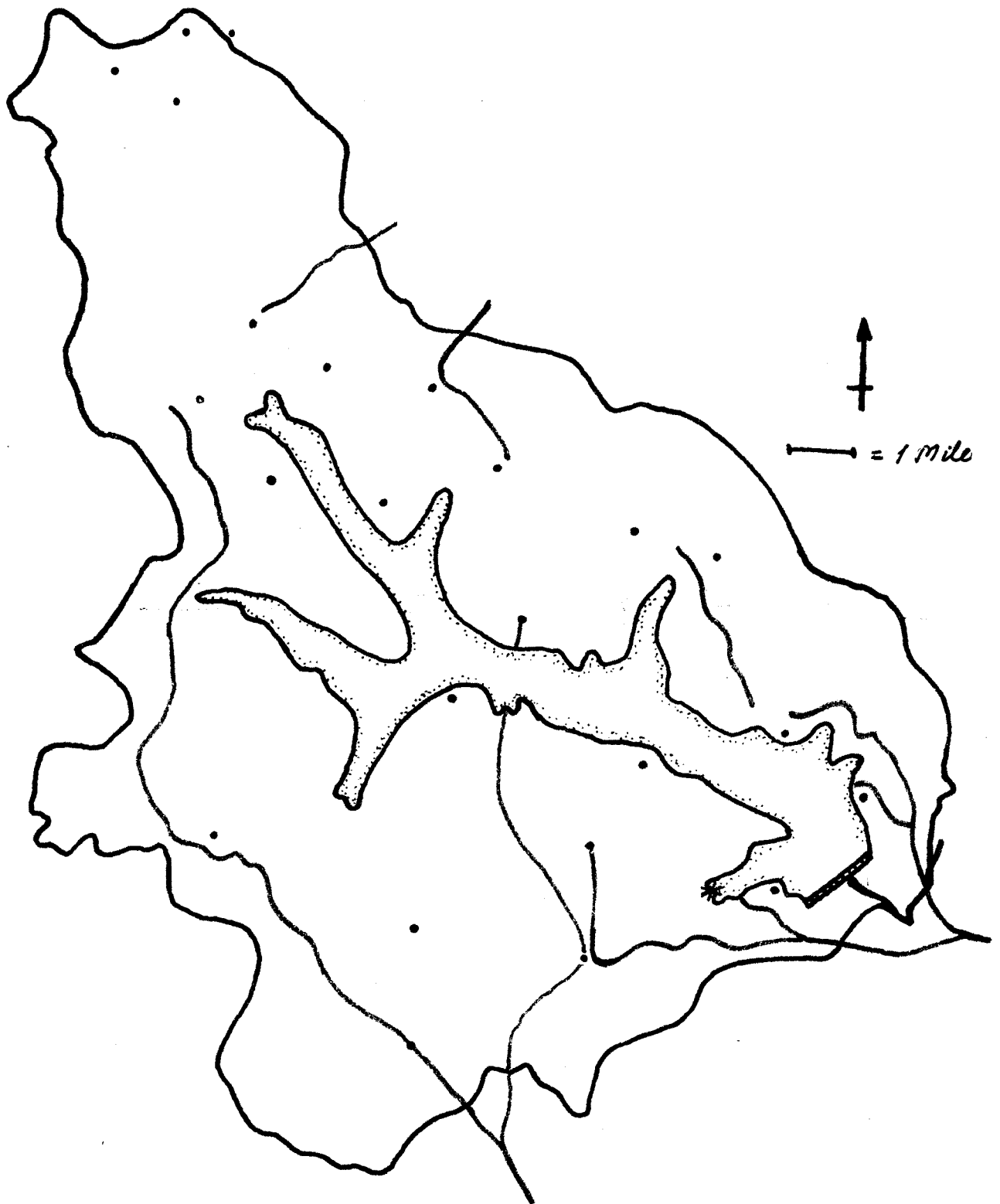


Fig 11. Map showing the existing roads
Warna Dam and the proposed Tanali
Hydel Project in the Study area.

and Bhogiv are the right bank tributaries of Warna river. Both the rivers originate at an elevation of about 920 meters above mean sea level. The origin of Kardi river is near village Gothane (Sangmeshwar, tahsil). The rivers flow for 10 km. in straight reach and then follow rapids and cascades. They meet Warna river at a lower elevation of about 570 meters where it forms a waterfall near village Tanali, the site of the proposed project.

The salient features in brief of the proposed Kardi Hydroelectric Project are as below :

Location :

Dist. - Kolhapur

Tal. - Shahuwadi

Longitude - $73^{\circ}-44'$ to $73^{\circ}-49'$ E

Latitude - $17^{\circ}-5'$ to $17^{\circ}-8'$ N

Name of river - Kardi River and Bhogiv Nalla

Hydrology :

	Kardi	Bhogiv
Catchment area	14.25 km ²	14.43 km ²
Average rainfall	6680 mm	6985 mm
Flood discharge	470 cumecs	470 cumecs
Submergence area :	0.114 sq. km.	0.208 sq. km.
Total length of Dam:	708.00 m	930.00 m.

Type of Dam :

Masonry dam with gated spillway and earthen flanks.

Power house :

Type - Underground near tanali village

Size - 16 m (w) X 28 m (L) X 27 m (H).

Power Generation :

(a) Installation :- 1 X 40 MW Francis unit.

Financial Aspect :

a) Capital cost of scheme	10700.00 lakhs
b) Annual expenses	
1) Interest charges at 8 %	856.00
2) Deo. operation & maint. charges	191.97
3) Cost of peak generation	172.00

Total	1220.17 lakhs.
c) Annual Revenue	
i) Demand charges	160.00
ii) Energy charges	1576.80

Total	1736.80 lakhs.
d) Cost of installation - Rs.26,750/Kw.	

The illicit tree cutting and road construction of hilly area has increased not only made large land surface exposed to erosional activities (Plate 14 a) but has threatened the life of the Warna dam by erosion as in the case of many newly constructed river valley projects in the Western Ghats (Plate 14 b).

The human activities in the Chandoli Wildlife Sanctuary have therefore created a situation which has direct and indirect impact on the environment in general and Wildlife in particular. The study revealed for the first time some of the important aspects of the man and Wildlife correlation and its changing nature from the Western Ghats. This study has tremendous applied significance as there has been growing debate

about conservation against development of the region. In the opinion of the investigator for the protection of the Warna dam as well as the rich biological diversity of this part of the Western Ghats strict and immediate conservation measures are necessary. Otherwise the nature and the man dependent on it will have a bleak future either in the Chandoli Wildlife Sanctuary or the Warna Dam Catchment (Plate 15 a & b).