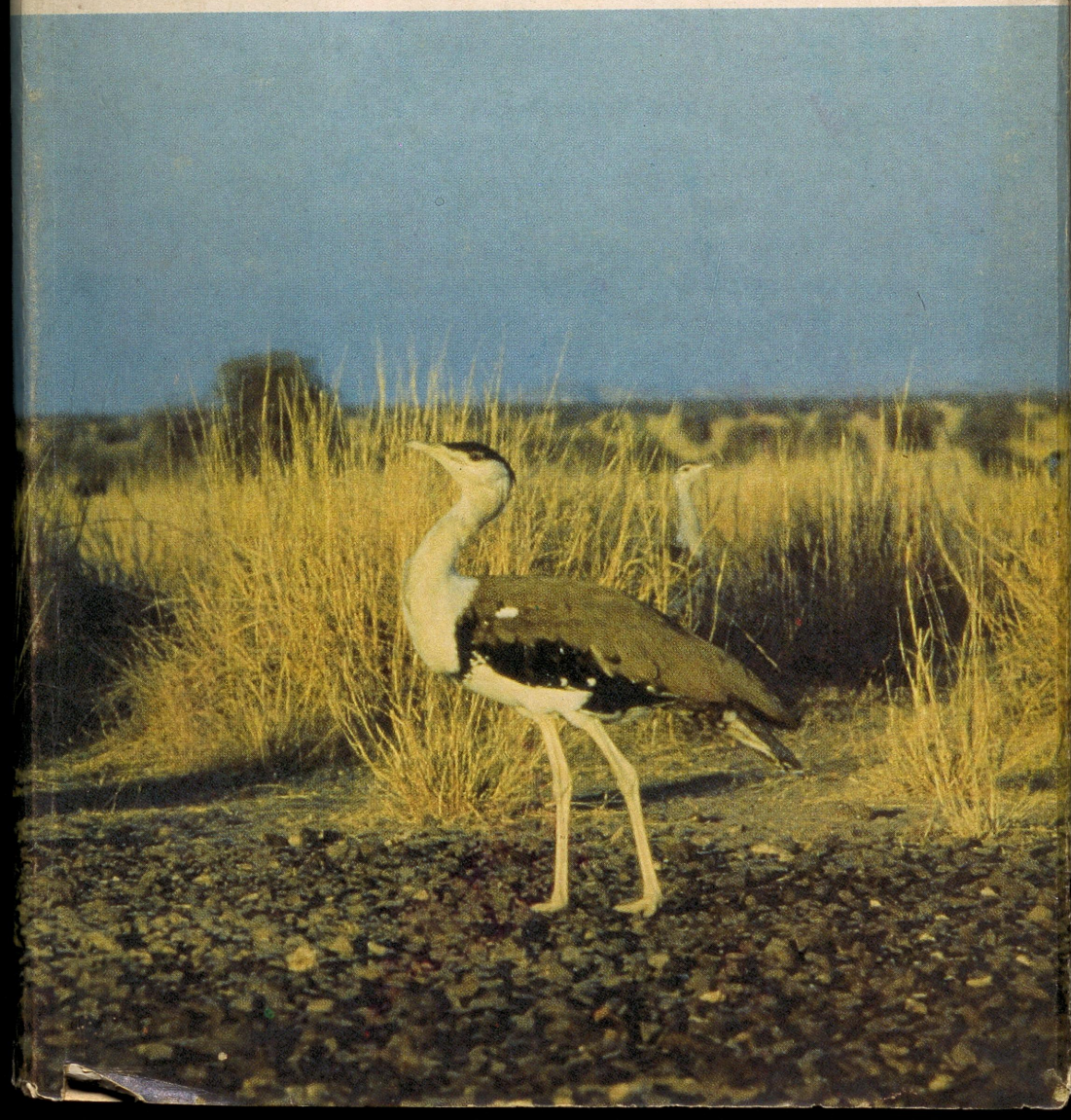


# JOURNAL OF ECOLOGICAL SOCIETY

Vol. 2, 1989

*Editor*  
*Prakash Gole*



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## Attention Contributors

Contributors of articles are requested to assist the editor by observing the following:

1. Articles which have at the same time been offered for publication to other journals or periodicals, or have already been published elsewhere, should not be submitted.
2. The MS should be typed (double spacing) on one side of a sheet only, and the sheets properly numbered.
3. All scientific names to be printed in italics, should be underlined.
4. Trinomials for subspecies should only be used where identification has been authentically established by comparison of specimens actually collected.
5. Photographs for reproduction must be in black and white, clear and show good contrast. They should be post-card size or larger and on glossy paper.
6. Text-figures, line drawings and maps should be in Indian ink.
7. References to literature should be placed at the end of the paper, alphabetically arranged under author's name, with the abridged titles of journals or periodicals underlined (italics) and titles of books *not* underlined.
8. Reference to literature in the text should be made by quoting the author's name and year of publication.
9. Each scientific paper should be accompanied by a concise clearly written synopsis, normally not exceeding 200 words.
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*Editor*  
*Journal of Ecological Society*

## Foreword

The Journal of our Society is entering upon the second year of its career. It becomes then necessary to pause and review if our environment has in any way improved or worsened. The answer is not encouraging, and this is all because 'users' of our natural resources (to which I referred in my earlier foreword) are busier than ever, exploiting regardless of ecological costs. But this I suppose, cannot be avoided until and unless a powerful movement builds up and every department of activity has within it a sizeable proportion of people who understand the value of conservation. Whether it is the management of bird sanctuaries or balancing the uses of wetlands or revival of Vanarais (Sacred Groves) or helping the Great Indian Bustard or the Blackbuck to return to their favourite grounds or growing oranges in lieu of known earlier crops—all these need not only be propaganda but a conscious effort at all social strata to conserve and enhance what is clearly necessary for everybody, viz. parks, riverside trees, pools of water and above all natural environment as against grossly overbuilt concrete jungles. Our Society would do well to organize a multi-pronged drive to create a larger awareness of the vital need for preserving what nature has gifted us with. We do not want to turn a California into an Ethiopia.

Once again, I have to acknowledge our gratitude to the Department of Science and Technology and to the Department of Environment for their most valuable aid and encouragement.

L. G. Rajwade  
*Chairman, Ecological Society*

## **Balancing the Uses of Wetlands**

*John Berry*

### **Synopsis**

The British Isles, and especially the Scottish Highlands, although small in size when contrasted with continental areas, can provide examples of errors and of successes of techniques for environmental conservation in hydro-electric and other water-use developments. Some U.K. experience in wetland conservation is of general application throughout the world.

The history of water storage works is sketched briefly from some 3,000 years ago to the present time. Ruthless exploitation of water resources for a single purpose, such as power generation, is now being succeeded by multi-purpose planning. The environmental importance of maintaining wetlands is increasingly appreciated. To replace lost wetlands, new water areas can be made: antipodal examples are given from England and from New Zealand.

The initiative of the Government of Guyana is commended for holding an international symposium on "Hydropower and the Environment". A seminar, to which selected specialists in wetland ecology were invited, is claimed to have 'lighted a candle' for wetlands throughout the world.

### **Introduction**

In the Chairman's Foreword to the first number of the Journal of the Ecological Society, Mr L. G. Rajwade drew attention to the realisation

in recent years that "... Natural Resources like land, trees, water and air..." are not, as previously regarded, "...in such plentiful supply as not to need any particular care or attention with regard to the extent of their use and exploitation." The global importance of Mr Rajwade's wise counsel is not yet sufficiently appreciated. But, as he indicates, in some countries so much environmental damage has been done that Governments are now giving attention to the advice of voluntary bodies such as the Ecological Society, who have been warning of trouble and offering the help of expert advice.

It has been my personal concern to study, in particular, the ecological consequences of use and misuse of water resources. Over many years I have been involved in hydro-electric and other water storage projects, and in efforts to ameliorate damage which some water schemes have done to freshwater fisheries, agriculture, forestry, wildlife and scenery.

### **The Setting**

When the International Union for Conservation of Nature and Natural Resources met in New Delhi in November, 1969, for the Union's General Assembly and Technical Meeting, "The Ecological Effects of Water Storage" was a main topic of study and report. Introducing a Paper on Studies of Water Storage in the British United Kingdom (Berry, J. 1970), it was claimed that although it might seem trivial in the vast sub-continent of India to consider studies of water-use in such a small island country, yet "...the United Kingdom and particularly in this context, the Highlands of Scotland, can be regarded as a research laboratory where techniques can be studied and data obtained some of which can be of general application throughout the world. Thus a dam only 70 feet (21 metres) high in Scotland (seemed)... to have parallels in its ecological problems with those of the Idikki Dam... (then)... being constructed in Kerala, about 700 feet (210 metres) high...". Before the I.U.C.N. November meeting in New Delhi, a team of four ecological specialists, each man from a different continent, had been appointed to carry out an inspection and to report to the I.U.C.N., for the Indian Government, on the Periyar Wild Life Sanctuary in Kerala State. In particular the team was charged to recommend the best multiple use of the large reservoir, Lake Periyar, which had been created by a dam on the Periyar River built in 1895. In the Periyar survey it was of relevance to consider experimental use of Scottish hydro-electric reservoirs for wild-life conservation, fisheries, tourism, flood-control and other purposes additional to the generation of electricity (Berry, J & others 1971).

### **Hydro-Electric Development in Scotland**

Although it is about a century since the first hydro-electric scheme in Britain was built in the Scottish Highlands, the country was slow to make further use of this great self-renewing and non-polluting source of power. Some early schemes had made maximum use of the water with ruthless disregard of other interests. Opposition to all hydro developments increased. The strongest opposition arose from fears that irreparable harm would be done to stocks of salmon and trout in lakes and rivers liable to be affected and that beautiful scenery would be irrevocably marred. Apart from aesthetic aspects, this opposition was based upon economic grounds; the netting of salmon and sea-trout was an industry of growing value, and angling, scenery and wildlife are major attractions for tourism which is of financial importance in many rural areas. Such was the strength of the opposition that it seemed impossible for any hydro-power promotion in the Scottish Highlands to receive the necessary Parliamentary approval. At last, in 1943, an Act was passed in the United Kingdom Parliament creating a public utility organisation for the generation and distribution of electricity throughout north and west Scotland and the islands where waterpower could be the main source of supply. The unique importance of this Hydro-Electric Development Act was that, perhaps for the first time in any country, the Act placed on the new Board a statutory duty not only to produce electricity, but to safeguard so far as practicably possible, stocks of fish and scenic amenity in all areas affected by its works. Statutory Advisory Committees were set up for Fisheries and for Amenity, and the Board also appointed specialist advisers and consultants of its own. The recruitment to the Board's senior headquarters staff of a biologist-environmental conservation specialist, from the outset of the Board's work in 1944, appears to have been a precedent for environmental study and research at the earliest planning stages of such industrial developments. That the same specialist who was appointed to the Board's staff in 1944 should still be retained as the Board's adviser in 1988 is also remarkable.

### **Water Diversions and Impoundments**

To study the effects of water diversions and impoundments and changes caused thereby in the natural flows of rivers, one must go back a long way in time. Dams to collect and retain water are among the oldest engineering structures known, dating back for almost 5,000 years. The oldest dam still in use may be one on the River Orontes in Syria; it is

more than 3,000 years old. And some dams built by the Romans are still functional (Ames, P.L. 1978). In spite of diversions of rivers and storage of water having been practised for such a very long time, it seems that until less than two centuries ago little serious thought was given to unintended and sometimes serious consequences. In particular, stocks of migratory fish could be extinguished.

In Northwest Europe weirs and dams to divert water for industrial use obstructed the movements of fish to such an extent that in some streams stocks of salmon, sturgeon and other species which must ascend rivers to breed, were threatened with extinction. In 1830, a mill-owner in Scotland devised a "salmon stair" or "fish-ladder". It consisted of a series of small pools with only a short rise between each, so that salmon and trout could surmount the weir by swimming from pool to pool requiring only a small flow of water to be lost to the mill for power (Berry, J. 1943). Thus a major conservation problem of water-use had been tackled and solved perhaps for the first time. Now, migratory fish can be enabled to pass even very high dams by "fish-ladders", "fish lifts", "fish locks" and other devices. This applies to such diverse species as Salmon on the Atlantic coasts of Europe, Sturgeon from the Black Sea, Mullet in Australia and Mahseer in India.

At 'Expo 71', the international exposition in Budapest, Hungary, the British Pavilion (the Director of which chanced to be the Scottish Hydro-Board's environmental conservation adviser) exhibited a working model of a type of 'fish lock' designed in Scotland and extensively installed at hydro-barrages. Operating on the same principle as a ship lock, this device can take fish over a dam of almost any height without any effort on the part of the fish and requires little loss of water from the power supply. At one high dam in the Scottish Highlands where the reservoir level fluctuations could be more than 21 metres, four such fish locks were installed, each catering for a different range of water levels.

The model fish lock in the Budapest exhibition was intended to draw attention to the message of the British Pavilion that conservation of the environment and of natural flora and fauna in the planning of industrial developments was now official policy in the United Kingdom; the model fish lock illustrated one of the practical efforts being made in Britain to combine conservation with development of natural resources in a small, highly populated industrialised country (Expo 1971). The "Conservation Message" was well received and was publicised in several countries. A Czechoslovakian Documentary Film Unit made a complete T.V. film of the British Pavilion's Conservation Section, including two complete

cycles of the model fish lock in operation. "The model fish-lock was considered of special note because it provided an impressive demonstration of practical conservation of a wildlife resource of great economic and recreational value—the Scottish salmon fishery—with development of an industrial resource—water power" (Expo 1971).

### **Loss and Replacement of Wetlands**

During recent decades, concern has been increasing in many countries at the loss of wetlands. The term "wetlands" includes some inshore coastal waters and all inland water areas,—lakes, rivers, bogs and marshes. At an I.U.C.N. meeting at the Hague, Netherlands, in 1951, attention was drawn to the loss of natural wetlands from 'over-zealous drainage projects', pollution and other causes. In compensation, it was suggested that the environmental value of many water areas, whether natural, or 'man-made lakes', might be greatly increased by ecological management.

The use of natural waters for primary purposes, for irrigation and for power, has been altering their extent and character for many centuries; but during the present century and with accelerating impetus at the present time, two unrelated factors have been changing the distribution and constitution of wetlands, particularly in the industrialised nations. These factors are first, the extraction of sand, clay and gravel for the building trade, and secondly surface excavation of coal and other minerals. Both of these developments may result in massive water pollution and in other less obvious impacts, such as alteration of springs, percolating water, water tables and drainage (Berry, J. 1979). Sand and gravel extraction often takes place from, or near to, a river. Large quantities of water may be required for washing and grading the extracted material and returned to a river densely turbid. The extraction of gravel from a river may be of more than local importance where such gravels are the essential and perhaps restricted spawning grounds of fish, notably of such migratory species as the salmonids. Changes in flow velocities, in scour, in turbidity and in other physical conditions may affect fish directly, but sometimes more importantly indirectly through reduction of flora and invertebrate fauna on which the vertebrates may depend. Some critical effects may not be easy to detect, for example, clay in suspension may pollute water almost invisibly; the colloidal suspension can become lethal to young fish with a change in the alkaline-acid balance,—the 'pH' (Berry, J. 1934).

In urban zones, especially near large cities, the pits left after mineral

extractions are likely to be used for dumping rubbish and sometimes toxic waste. Poisoning of ground water seeping to rivers and lakes can result, sometimes with disastrous limnological consequences. On the other hand, extraction pits can be used to create new wetlands of great scientific and recreational value. Two antipodal examples can be quoted to illustrate such use. Both have been dependent essentially upon ecological study, planning and management.

### A Gravel Pit Reserve in England

The first example is the Sevenoaks Gravel Pit Reserve in Kent, England. Extensive extraction of gravel for industrial building left large pits which were flooded. Use of the pits for wild life, instead of filling them in as a dump for disposal of urban and industrial rubbish, was negotiated with the Sand and Ballast Company who owned the site. The Company generously cooperated with the conservationists, using their earth-moving machines to make islands and in other ways to make the site more suitable as a reserve. A wonderful new man-made wetland area has been formed. Some indigenous water and marsh flora was planted, but a rich and remarkable colonisation by plant and animal species took place naturally when the habitat had been made attractive for them. More than thirty species of mammals have been recorded in or near the area now declared a Nature Reserve; it has an interesting population of fish, but outstandingly it has become a bird resort, both for migrants on passage and for species breeding and for others wintering. Perhaps most noteworthy is the reestablishment there in Kent County of breeding and wintering Greylag Geese (*Anser anser*), previously long extinct as residents in the southeast of England. Scientifically, the Gravel Pit Reserve is valuable for the opportunities it provides for study and research in environmental conservation (Harrison, J. G. 1974). But the particular significance of the Sevenoaks Reserve is its location in the populous conurbation of south London. People who profess no interest in birds, nor in Nature, may be entranced to watch Common Kingfishers (*Alcedo atthis*), Shoveller (*Anas clypeata*) and other handsome water birds amid the beauty of flowers and water plants which have replaced the desert of the former gravel pits. To have such an oasis of nature in such a place is cogent propaganda for wildlife conservation. Common Kingfishers, Shovellers and several of the other kinds of birds to be seen at Sevenoaks can be watched also in another urban wildlife oasis far distant from southeast England. It is the remarkable Mula-Mutha Sanctuary within the City of Pune, Maharashtra. The foreword to the 'Bird-Watchers Guide to

the Mula-Mutha Sanctuary' admirably sums up the way such places make their popular appeal: "The appreciation of the beautiful and the novel is a characteristic latent in the human species. There is none in whom the seed of this faculty is entirely wanting".

### **An Artificial Wetland in New Zealand**

An example of an impressively successful man-made wetland can be seen on the opposite side of the earth, in the South Island of New Zealand. In the great Otago power development of the Waitaki River system, the Benmore Dam, 110 metres high, flooded some 80 sq. km. of land. Downstream from the Benmore Dam is another great reservoir created by the Aviemore Dam, 56 metres high, and downstream is yet another big reservoir. The chain of man-made lakes has provided a wonderful extent of water for human aquatic recreation and vistas of scenic beauty, but the lakes, Lake Aviemore in particular, inundated an extent of marshes and swamps previously of scientific importance as the breeding grounds of many water birds. Among these was an isolated local population of the Pukeko (*Porphyrio melanotus*), a large purple Gallinule with singular nesting requirements. Before the Aviemore reservoir was filled, sections of the natural marsh, with clumps of a giant rush in which the Pukekos habitually nested, were removed with big earth-transporters to recreate similar marsh conditions in gravel pits some miles away. Pukekos were caught by night and transported in the dark, with their nests and eggs, to the artificially-made duplicate habitat. Some other species were transferred in a similar manner, and as the reservoir slowly filled, stilts, dotterels, herons, ducks, gulls, and other birds of inundated Aviemore marshes, transferred themselves. Revisiting the Waitaki valley five years later, one found that the man-made habitat had completely replaced the former Aviemore marshes. All the species which had characterised the original marshes and lagoons were now so well established in the transformed gravel pits area that one might think it had always been their natural habitat.

The Waitaki-Aviemore wetland transplantations demonstrated the engineering practicability of replacing completely an ecologically important wetland on a very large scale. Of course, the cost was considerable, but it was a comparatively small part of the great over-all cost of the Waitaki power development. Such replacements of important wetlands can be made a condition of approval for industrial development. Specialists in environmental ecology with the necessary expertise and experience for such translocations, are still few in number; however, keen

young ecologists are now getting trained for this work. They should be given every encouragement.

### **Changing Water Levels of Natural Lakes**

When large natural lakes are used for water storage without changing by more than some 5% their former water levels, or the periodicities of their level fluctuations, there is unlikely to be significant change in the wetland ecology. But when natural lakes are artificially deepened by a barrage, with prolonged inundation of adjacent ground, marshes or shallows, grave loss of indigenous flora and invertebrate fauna may result. And drawing down the surface level of a natural lake for longer than natural periods, or at unnatural seasons, may cause ecological destruction of the littoral, except where a former water-table can be maintained artificially. This has been achieved successfully by cutting off from the main lake some bays or inlets and ponding them with small dams; by this means the water level at that location remains in a natural condition and does not drop when the water level in the main lake-reservoir is drawn down. It has proved better to maintain some scarce sensitive species by safeguarding a restricted natural habitat in this way, than by attempting translocation. The fact that a sedentary species is rare, or locally restricted in distribution, implies that it is ecologically unadaptable, and must have precisely the right conditions of habitat to which it has become adapted over thousands of years.

Grave environmental harm has been caused by failure to appreciate that the effects of artificial changes in long-established lake levels may extend far from the lake margins. This is notably so when land adjacent to the lake is rather flat and with pervious soils. Such soils may become waterlogged, or desiccated at a critical season, or leached of nutrients. Many other effects of changing water levels artificially have to be considered: Will the thermocline be altered? Will flooded vegetation rot and pollute water discharged from a dam? or will the discharged water be so devoid of oxygen that fish below the dam will suffocate? Should aero-hydraulic guns be used to counteract stratification? Should rotary dispersers be employed to aerate discharged water and to reduce hydrogen sulphide if the discharged water is to be drawn from bottom layers of a deep reservoir? Such considerations may be of critical importance for wetlands dependent upon reservoir water. It is not only the actual reservoirs and associated wetlands which need careful and skilled planning. *Whether reservoirs are to be made by altering natural lakes, or by the creation of entirely new water bodies, ecological study and the*

*planning of comprehensive environmental management from the start is necessary if advantage is to be taken of their potential biological value as productive wetlands.*

Hitherto, the wetland importance of large new reservoirs has received less attention than this aspect deserves. A commendable exception is the Snowy Mountains Scheme in Australia. Created to retain, for electric power and for irrigation, snow-melt water in a catchment area of more than 5,000 sq.km., the reservoir-lakes have been planned and managed to provide wetlands of great beauty and with rich wild life in a zone which previously lacked any such amenities. Another example of exceptionally good environmental conservation in a major water impoundment development is to be found in the Koyna Catchment Area, in Maharashtra, India, an area of some 890 sq.km. In that development it was essential to clothe the very steep barren slopes of the valley in which the great Koyna Lake reservoir was made, to restrict erosion and siltation of the reservoir. The manner in which the afforestation and concomitant wildlife protection has been achieved is indeed noteworthy.

#### **Acceptance of Comprehensive Water-use Planning**

Comprehensive environmental planning of large water-use projects is becoming a more widely accepted practice; much credit for this should be given to Guyana. In 1976, the Government of Guyana decided to embark on a very large hydro-development of their Upper Mazaruni River. A dam 43 metres high and 435 metres long would flood a vast area of rainforest. "To provide up-to-date information on environmental aspects of hydropower with special reference to agricultural, archaeological, ethnographic, fishery, forestry, health and recreational aspects. . ." (to quote H.D. Hoyte, Now President of Guyana then Minister of Economic Development & Cooperatives), and to plan the creation of a unique equatorial wetland of great size and habitat diversity, the Government of Guyana, through their Science Research Council, called an International Seminar on "Hydropower and the Environment". Countries and international agencies which had practical experience of the conservation problems of large water storage schemes were invited to send a leading specialist on some aspect, apart from engineering and construction. The Guyana Seminar was "... the first-ever such to be held", and as Prime Minister Forbes Burnham "... remarked in his address when he formally declared the Seminar open, it might well be that the major historical significance of the Seminar was that it made it possible for. . . Guyana to 'light a candle in the path of other developing

countries who seek to develop their resources and to advance into the technological age of the last quarter of the 20th century' ". (Guyana 1978).

The I.U.C.N.'s International Commission on Ecology, from its creation in 1954, pressed the clamant need for maintaining aquatic habitats and for comprehensive assessment, at the planning stage, of large water-use projects to that end. But it may be claimed that it was the Guyana Seminar which did indeed "light a candle" for wetland conservation in a way which was unique and unprecedented.

In Guyana, a small team of participants in the Seminar was selected from those deemed to have had exceptional experience and to have specialist expertise in some aspect of wetland planning and operation. The team was taken in an airplane to the remote hinterland above the great escarpment where the area to be flooded was surveyed, with jungle landings by helicopter. This was a daunting exercise, but it provided for us, as ecologists, an exceptional opportunity to discuss with engineers and surveyors, in a largely unexplored terrain, the practicability of creating there a unique wetland and wild life reserve, and how to minimise risks of health hazards such as schistosomiasis and vectors for other tropical diseases.

It is to be hoped that in most countries the importance is now appreciated of maintaining or creating wetlands, with realisation of their potential benefits, but also possible dangers, for human population ecology, hence the need for specialist guidance in wetland planning and operation. Yet in many countries, whether already industrialised or developing, politicians and administrators may be helped by reminders and encouragement from men and women versed in ecological science.

Dr. John Berry  
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Fife, Scotland, U.K.

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## **Return of the Great Indian Bustard in Maharashtra**

*Asad R. Rahmani & Ranjit Manakadan*

### **The Setting**

Solapur and Ahmednagar districts of Maharashtra are semi-arid and drought-prone, with average annual precipitation of 724 mm in Solapur and 550 mm in Ahmednagar district. The rainfall moreover is erratic and poorly distributed with wide fluctuations from year to year. In Ahmednagar the number of rainy days is only about 35-40 in a year (Mahabale and Chaudhari 1987). The maximum temperature varies from 25.2°C in winter to 42.5°C in summer.

The terrain is gently undulating, a characteristic of the Deccan plateau, with isolated hillocks 450 to 500 meters high above sea level. The soil is derived from basic igneous rock, namely basalt, commonly known as the Deccan trap. The soil colour varies from reddish brown to dark grey and the soil pH varies between 7.5 to 8.5 making it somewhat alkaline. It is poor in organic matter (Patil et al 1981) and is generally known as Black Cotton or Regar.

The vegetation in these regions is classified as Southern Tropical Thorn Forest (Champion & Seth 1968). But the natural vegetation has more or less disappeared and in the non-cropped areas only scrub and grass are seen. Open grasslands occur in areas of poor soil (Mahabale & Chaudhari 1987).

### **The Rediscovery**

It is this region that has now become the home of the Great Indian

Bustard (*Ardeotis nigriceps* (Vigors)) in Maharashtra. It was not that the GIB was unknown in the drier parts of Maharashtra. In the former days it was in fact quite common. A certain Lover of All Sports wrote in the now defunct Oriental Sporting Magazine that he had shot 961 bustards between 1809 and 1829 in the neighbourhood of Ahmednagar. The GIB however, declined rapidly in later years and it was only in the early seventies when the late Dharmakumarsinhji carried out surveys to locate it, that it was rediscovered in very small numbers in these tracts. Dharmakumarsinhji recommended reservation of certain areas of this region as sanctuary for the GIB. But it was only in 1979 that the Government of Maharashtra declared an area of 7818.47 sq. km as the sanctuary for the GIB under section 18 of the Wildlife (Protection) Act 1972. The sanctuary area then included 3 talukas (Newasa, Srigonda & Karjat) of Ahmednagar district and 3 talukas (Mohol, Karmala & Madha) of Solapur district (Rego 1980). Later in 1985 on the recommendations of Bombay Natural History Society, Nanaj area of north Solapur was included in the sanctuary increasing the total sanctuary area to 8496 sq. km.

Between 1981 and 1984 we studied the GIB in the Nanaj area. A few monitoring visits were also made to Nanaj in 1985, 1986 and 1988.

### The Study

When we began the study in 1981 we found that the whole sanctuary area was heavily populated with 101.29 human beings per sq.km. The cattle population at 100.12 cattle per sq.km. was also quite high (Rego 1980). In addition to cattle, sheep and goats also constituted the livestock of the area, especially in villages, where more than 75% of the population lived. Wheat, maize, sorghum, sunflower, groundnut and Bengal gram formed the major crops of the area. Most of the land was under dry farming, except some tracts in Newasa where canal irrigation was available. Over 90% of the land of the sanctuary was under human habitation and agriculture. Consequently the natural vegetation of the sanctuary was under tremendous pressure.

In 1975 the World Bank-financed Drought Prone Areas Programme (DPAP) had been initiated in Solapur district (Gabale 1980). It was essentially an area development programme aimed at integrating development efforts to fight the drought. It sought to develop land, water, vegetation, livestock and manpower with the hope that the ecological balance would thereby be restored.

Under the DPAP scheme the state Forest Department began establish-

ing pastures and woodlots in Solapur and Ahmednagar districts. It was in one of these DPAP plots at Nanaj that the GIB was first sighted in 1978 (Gabale 1980). In 1980 Rego listed 8 DPAP plots in Ahmednagar where the Bustard was sighted. Since then bustards have been seen in 7 more plots such as Boramani, Koregaon, Gangiawadi, Dahiwadi and Kati in Solapur district and Arangaon and Chapedgaon in Ahmednagar district (see map 1) (Ali & Rahmani 1982-84).

### **The Bustard at Nanaj**

The bustards at Nanaj are mainly seen during the rains when they come to breed in the grassland plots. As soon as the rains start in June, the birds are seen in Nanaj and other DPAP plots like Karmala, Mirajgaon, Chapedgaon, etc. The cock bustards generally arrive before the hens, and within a few days, adult cocks start displaying in the traditional display spots. Hens arrive in small droves and adult hens soon separate for nesting. Eggs are mostly found between August to October and the mothers leave the area when the chicks have fledged by late November or early December. Sometimes late nesters are seen till the end of December. An occasional bird may be seen in January and February. Such sightings are generally during cloudy or drizzling periods (Rahmani & Manakadan 1986). Arrival of bustards, courtship display, nesting and departure from the grassland plots, all depend upon the rainfall pattern and local weather conditions. According to Ekbote (pers. comm.) since 1986-87, one or two birds are seen throughout the year in Nanaj and Gangiawadi plots.

### **The Number of Bustards**

When we began the study at Nanaj a maximum of 8 to 10 GIBs were seen in 1981. In 1983 on a rainy day we counted 20-22 bustards in the area. In 1985 the Forest Department personnel counted 24 bustards in the same area and in their census of 1987-88, in the part of the sanctuary that falls in the Solapur district 70 bustards were counted.

This increase in population must be due to success in breeding as well as temporary immigration from nearby areas. As individual birds were not marked, we do not know whether the same birds were seen in different plots or they were different populations. Though it is difficult to count the number of bustards in the entire sanctuary, it appears that 70 to 100 bustards colonise different parts of the sanctuary. The birds have reacted positively to protection that the creation of the sanctuary has provided to them and their habitat.

### The Other Fauna of the Sanctuary

It is not only the GIB but also Blackbuck (*Antelope cervicapra*), Chinkara (*Gazella bennetti*) and Wolf (*Canis lupus*) have reacted positively to the protection that the sanctuary provides.

Habitat protection introduced under the DPAP programme has benefited the blackbuck which is now found in all the major DPAP plots such as Nanaj, Vadala, Karmala, Gangiawadi, Deulgaon, Chapedgaon, Mirajgaon, Kamuni and Boramani. Its population has been increasing and the animal is occupying new areas. For example, on 24 October 1984, 17 kms. from Solapur on the Solapur-Pune highway, we saw 7 blackbuck. It is now seen in all the 11 talukas of Solapur district. The highest blackbuck population (nearly 1600 heads) is seen in north Solapur taluka. In the sanctuary the total blackbuck population is estimated between 2000 to 3000.

**Table 1 Blackbuck population in important DPAP plots**

Name of the plot	Area (in ha.)	Numbers seen	Year	Source
1. Nanaj-Vadala area	c. 5000 *	600-800	1988	Pers. observation
2. Gangiawadi (Kasegaon)	200	180-200	1988	Pers. observation
3. Karmala	100	60-70	1984	Pers. observation
4. Boramani	75	40-50	1984	Pers. observation
5. Rehekuri	217	300-400	1986	Forest Department
6. Kowdani	c. 200	200-250	1984	Forest Department

\* including grazing lands and crop fields.

The chinkara (*Gazella bennetti*) is mainly seen in the Ahmednagar part of the Bustard Sanctuary. During our four year study period we did not see any chinkara at Nanaj. However, a pair was seen in 1981 at Karmala and seven individuals in 1984. Chinkara is also reported to be present in the following DPAP plots: Thergaon, Koregaon, Teju-Belvundi and Mirajgaon. Scattered populations are found in other parts of the sanctuary. No systematic census has been done.

**Table 2 Chinkara population in the DPAP plots**

Name of the plot	Area (in ha.)	Numbers seen	Year	Source
1. Karmala	100	7	1984	Pers. observation
2. Mirajgaon	78	1	1981	Pers. observation
3. Thergaon	—	25	1981-82	Forest Department
4. Koregaon	115	10	1981-82	Forest Department
5. Taju-Belvundi	310	10	1981-82	Forest Department
6. Kowdani	200	100-150 (?)	1984	Forest Department

The wolf (*Canis lupus*) also appears to have increased in the sanctuary though no comparative population data are available. It is now quite frequently seen in Nanaj area, Gangiawadi, Dahiwadi and Rehekuri. On 11 July 1988, we saw 6 wolves in the Gangiawadi plot. According to the watchman, 11 wolves were seen in the noon and they had killed a goat. A den with two cubs was located in this plot in February 1988. During our surveys in Solapur, Ahmednagar and other districts, wherever we went, we got reports of wolf. Locally it is known as 'Landga'.

### Conservation Problems

Theoretically the Bustard Sanctuary of Maharashtra is the largest sanctuary in India! However, more than 90% of the land is under human occupation, with numerous villages, towns and crop fields. Only about 400 sq. kms. of the sanctuary area is under Forest Department, not as a compact block but in various fragmented plots.

During the last eight years, except for the excellent protection to the bustard and other wildlife at Nanaj, Karmala, Rehekuri, Kamuni, etc., not much work has been done to manage the huge Bustard Sanctuary. The Sanctuary falls under two districts which creates administrative problems. Till now, even the crop protection guns, which can be used for poaching have not been withdrawn from the sanctuary area. There is no control on grazing (nor is it possible), except in the Forest Department plots. These plots are scattered and the staff has not been given proper vehicles to go regularly. There is no long-term planning of habitat protection in the sanctuary area, except in a place like Nanaj which has come to lime light. Lesser known bustard areas like Gangiawadi, Dahiwadi, Mirajgaon, Kamuni, Chapedgaon, etc., also need administrative attention because they are as important as Nanaj. With the increase and expansion of the bustard population, the above-mentioned areas will have to play an increasing role in bustard conservation. For instance, Gangiawadi, earlier known as Kasegaon, and consisting of 200 hectares, has since 1987 been occupied by one territorial cock and a few hens.

### Socio-economic Consequences of the Sanctuary

*Canal* : During the last eight years, practically no major developmental activity has been stopped in the Bustard Sanctuary area. For example, there is a plan to construct a feeder canal to Hipparga tank near Solapur town. This canal will flow from Mohol to Karamba. Fortunately, this feeder canal will not affect the main bustard area near Nanaj village.

*Grazing* : Except for the plots of the Forest Department (F.D.), grazing

has not been stopped anywhere else. Out of the 15,00,000 hectares constituting Solapur district, only 24,000 hectares which are under F.D. are closed to grazing (Ekbote, pers. comm.) Similarly, in the area constituting the Bustard Sanctuary, not more than 5% is closed for grazing; thus graziers are not much affected.

*Grass-cutting*: As grass-cutting from the F.D. plots was in conflict with bustard conservation, it has been banned in all the four talukas of Solapur which come under the Bustard Sanctuary. The breeding season of the bustard in Maharashtra starts with the onset of monsoon in June, and the peak display and egg-laying period is between July and September-October. In early days grass was auctioned in August, and by September the area was handed over to the bidder. Grass was cut by the end of September or early October. Thus the whole grass cutting season coincided with the peak breeding season of the bustard. This conflict of interest can be resolved by (i) having large plots and auctioning only one third or half of the grassland for grass-cutting, (ii) by delaying grass-cutting till November so that the peak bustard breeding season is over, and (iii) by close supervision of the grass-cutting operations to avoid any disturbance to the bustard. It must be added here, that cutting of grass for commercial purposes should never be allowed in important plots like Nanaj, Vadala, Gangiawadi, Kamuni, Mirajgaon, etc, which are regularly used by the bustard. If necessary, grass-cutting should be allowed only from the subsidiary plots, with due consideration to the three suggestions mentioned earlier.

*Crop damage*: Since the Bustard Sanctuary was declared in 1979, the population of blackbuck has increased. For example, in 1982-83, we estimated a population of 250 to 300 blackbuck in Nanaj-Vadala areas but in 1987-88, upto 600 were estimated (the F.D. estimate is higher). Similarly, in 1984, we counted 80-100 blackbuck in Gangiawadi (Kasegaon) plot of 200 hectares. In a visit on 11 July 1988, we saw nearly 180 heads. There might be between 2000 to 3000 blackbucks in the sanctuary i.e. one animal per three square kilometre—certainly not a very high density. However, as the blackbucks are locally concentrated, the problem of crop damage assumes importance in certain areas like Nanaj where atleast half of the blackbuck population of the Bustard Sanctuary is found.

According to the preliminary data gathered by us from various sources (including agriculturists), crop damage by blackbuck is selective with sorghum, millet, Bengal gram, groundnut and young wheat being the preferred species. Around F.D. plots at Nanaj, the damage is so much

that many agriculturists have shifted to non-palatable crops like sunflower and safflower. Economic returns from these crops are as much as from sorghum or millet but after selling the product, farmers have to buy sorghum-millet for their own consumption. Moreover, from sunflower-safflower, crop residual is not available for domestic animals. A plus point of sunflower-safflower is that they are drought-resistant and thus give the same yield every year, unlike sorghum-millet-wheat which need more water and their yield fluctuates yearly depending upon the vagaries of the monsoon.

To minimize crop damage by blackbuck and consequent resentment among villagers, there are four options: (1) The F.D. should grow crops preferred by the blackbuck to restrict the animals within the plots. This option is highly dubious because, firstly, the F.D. does not have enough land to grow crops, and secondly, the free ranging wild blackbucks cannot be prevented to go out of a small plot (unless it is effectively fenced). (2) To grow unpalatable crops around the F.D. plots. As said earlier, many farmers have already shifted to grow sunflower/safflower around Nanaj. This may not be the best step as far as the bustard conservation is concerned because bustards eat crops like sorghum, millets, groundnut, Bengal gram and wheat so the bird will be affected if such crops are not present in the area. Alternative crops like sunflower/safflower are not eaten by the bustard so they will lose important food items if the traditional crop pattern is changed. (3) Compensation to farmers for crop damage. This option has many administrative difficulties like correct assessment of the crop damage, delays in giving compensation, and chances of money not reaching the correct person. (4) Translocation: This appears to be the most obvious choice and much-liked by the farmers. However, before this is undertaken on a large scale, the F.D. has to improvise the technique of catching blackbuck (without injury and shock), and secondly they have to find areas where captured animals can be released without being poached subsequently.

Crop damage by blackbuck is a growing concern, not only at Nanaj but in other parts of India. It should be studied in more detail before any long-term action is taken.

### **Habitat Management**

Instead of having an unmanageable area as a sanctuary, it is better to have 100-300 ha protected grasslands dotted all over the important bustard areas in Maharashtra. On the basis of habitat requirements, the wandering habit and wide distribution of the bustards, as well as the

cattle and human population, it is now not possible to have large (100-300 sq.km.) undisturbed grassland sanctuaries where a few hundred bustards can live. We simply do not have that much land to 'block' from rational/traditional human use. Most of the bustard areas are already occupied by man and it will be impossible to evict the local people. Bustard and man have to co-exist. Habitat-preference studies of the bustard indicate that with proper protection during the breeding season, the bustard can survive in marginally cultivated areas. Moreover, limited or traditional cultivation is even beneficial to the bustard by providing food during certain months.

Taking into consideration the above factors, we recommend that a typical bustard sanctuary should have two equally important components: (1) a large buffer zone of a few hundred sq.km. where traditional agriculture and grazing should be allowed, and (2) small core areas of 100-300 hectares, totally protected from all human interference during the breeding season of the bustard. These core areas should be intensively managed to keep them suitable for the bustard.

The bustard sanctuary of Maharashtra has both these components i.e. a large buffer zone of 8496 sq.km. and small core areas in the form of forest (DPAP) plots. The sanctuary however, has not been developed properly and there are no long-term plans to protect the grassland plots, which were earlier developed under the DPAP or other schemes like Employment Guarantee Scheme (EGS) and District Rural Development Agency (DRDA). Only the Nanaj area has been looked after well, and recently the F.D. has even given a proposal to double the size of the Nanaj bustard area (see Map). The number and size of the grassland plots are too small and need improvement.

We suggest the following measures for the conservation of bustards in the sanctuary and in the whole of Maharashtra:

1. The DPAP grassland plots of 50 ha. & more should be taken over by the Wildlife Wing of the Forest Department. Additional grassland plots of more than 100 ha. should be developed as core areas.
2. Livestock grazing and unnecessary movement of people should not be allowed inside these plots.
3. Special protection should be accorded to the plots during the breeding season i.e. June-November.
4. All plots should be encircled by trench-cum-mound fencing.
5. The plots should be maintained as grasslands and tree-planting should be avoided.
6. The plots should preferably form a catchment area for the percola-

tion tank. This fact will give additional incentive to protect the vegetation of the plot. Presence of a percolation tank will provide water facilities to the fauna.

7. Each plot should have a watchman, preferably from the local area.
8. A daily record of the sighting of bustards in each plot should be maintained. An annual census should be undertaken to know the trend of the bustard population. An annual assessment of each plot should be made and necessary conservation and administrative changes should be carried out.
9. Tourist activity should be strictly controlled during the breeding season.
10. Proper staff, headed by a Conservator of Forest, should be appointed in the sanctuary.
11. Fresh assessment of the boundary of the sanctuary should be undertaken. Heavily populated areas should be excluded and some excellent bustard areas in Beed, Aurangabad and Osmanabad should be included.
12. Research staff should be appointed and bustard movement should be studied by colour-banding and radio-telemetry.

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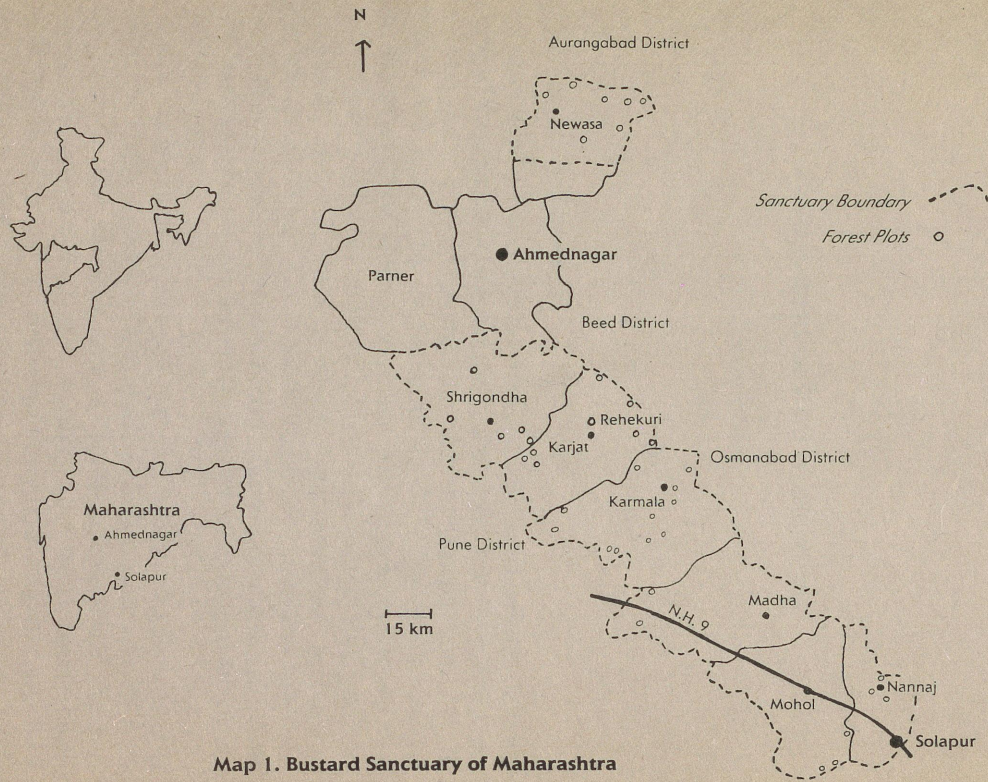
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## **Management of Bird Sanctuaries**

*Prakash Gole*

### **The Need for Management**

Of late a spate of demands for creation of bird sanctuaries in India has surfaced from groups and associations of bird-watchers. In Maharashtra the movement gathered momentum after the inauguration of Mula-Mutha Bird Reserve by Dr. Salim Ali in 1977. The All-Maharashtra Bird-watchers' Meet which is an annual event, has recommended creation of bird sanctuaries at Mayani, about 70 kms. north of Sangli, at Jayakwadi, about 50 kms. south of Aurangabad and at Nandur-Madhmeshwar 60 kms east of Nasik. These three proposals have been accepted in principle by the government and areas around all these three wetlands (irrigation reservoirs and their environs) have been declared as protected areas.

Once the decision to 'develop' a particular area as a Sanctuary is taken, the Forest Department goes ahead with planting trees in the area. For example, the foreshore area of the Mayani reservoir, the area between the road and the lake, was planted up by the Department with such trees as *Mango*, *Sissoo*, *Erythrina*, *Bombax*, *Eucalyptus*, *Leucaena* etc. Another activity on which the Department starts work immediately is to allocate space for building tourist accommodation of various sorts and begin construction as soon as funds become available.

Such activities may or may not adversely affect wild birds that are found at a particular place. On the whole, however, the composition of

bird species found at such places, undergoes a change as a result of such actions. For example, in 1977 in the presence of Dr. Salim Ali, a stretch of about 2 kms on the banks of the Mula-Mutha in Yerawada, a suburb of Pune, was declared a protected area by the Forest Department of Maharashtra. Shallow water habitats used by a number of migratory birds such as Blackwinged Stilts, other waders and Garganeys together with resident birds, were thus protected. On the north bank of the river a stony upland with grass and thorn scrub attracted hordes of Yellow Wagtails that rose as Dr. Salim Ali followed by a throng of bird-watchers, arrived on the north bank. However, in subsequent years there was a marked decline in the number of Yellow Wagtails as the Department planted a variety of trees on this plateau. A few wagtails now, use fringes of this plateau, while the deciduous forest that occupies most of the flat land attracts arboreal birds such as Koel, Golden Oriole, Coppersmith, Flowerpeckers, and even Green Pigeons that were not found in this 'reserve' before.

Thus by bringing about a change in the habitat structure at a particular place, the composition of bird-species was also changed. This is neither 'conscious management' nor does it have any scientific basis. But it may not be proper to blame the Department alone for lack of scientific considerations. Many times, voluntary organisations who put up proposals for creation of bird sanctuaries are also tantalizingly vague in their objectives. In most such proposals there is no mention of target species that the proposers want to protect. Instead the proposers usually desire protection to a particular place with all the species that use the gamut of habitats existing at that place. Such place may be a wetland or woodland or a combination of the two. No conscious management, except maintenance of the status quo, may be desired also. However, the maintenance of the status quo does involve management as the balance of existing habitats is likely to change by the very act of declaration of the reserve and also by extraneous forces beyond the control of the manager.

To take the example of the Mula-Mutha bird reserve again : the level of water is crucial to the maintenance of shallow-water habitats used by numerous waders. However, as demand for water for irrigation in the downstream areas increased, more water is now released from the Khadakwasla reservoir upstream. This action flooded and drowned many of the 'wet meadows' used by Snipes. These birds have progressively become rare in the reserve. Also as Pune city expanded, the underground sewage system became overburdened and the quantity of sewage enter-

ing the river increased markedly. This changed the water quality, attracting more scavenging birds such as Blackwinged Stilts and Gull-billed Terns that picked up organisms thriving in the fertilised water and driven away such birds as Bronze-winged and Pheasant-tailed Jacana (Gole P. 1984). Moreover, the spread of water hyacinth is increasing year after year, reducing the open water areas used by migratory ducks such as Garganey and Pintail for foraging and resting. The composition of birds and habitats is no longer what it was in 1977 when the reserve was created.

As bird-watching becomes more popular, the demand for protection to particular bird-species and to places used by birds, is going to increase and without conscious management it is going to be difficult to translate these objectives into actual practice. What happens if such management actions are not backed up by scientific considerations and research may be illustrated by the example of Keoladeo Ghana National Park near Bharatpur. There the complete ban on grazing was no doubt prompted by the most worthy consideration of affording total protection to the habitat of birds in the Park. But as it was not backed by any detailed scientific study, it produced certain results that were wholly unpredicted.

It is therefore, evident that in order to produce desired results management actions should be backed by adequate scientific investigation and research. This paper offers certain suggestions to the managers of bird sanctuaries to enable them to carry out studies and organize data that such studies will produce, in such a way as to facilitate decision-making.

### **The Basic Data**

1. The first requirement will be to know what birds are found at a particular place through the seasons. If the proposal for creation of a bird sanctuary is drawn up by a group of bird-watchers or a voluntary agency of bird and nature enthusiasts, a list of birds will usually be found to be attached. Some lists will also show status of bird-species, whether they are rare, common, abundant, vagrant etc. and which of them are breeding and which are local or long-distance migrants. If such a list is not enclosed, it is advisable to ask for one or start collecting this information.
2. The next important requirement is to chart the landuse pattern and the character of habitats available. Vegetational details such as dominant plant communities and their successional stages, distribution of

vegetation in the area and ecotones should be added to the land-use map of the area.

3. The next step would be to study the habitat-use of different bird-species. The U.S. Dept. of Agriculture, Forest Service, classifies habitat use on the basis of the two most important activities of any animal, viz. feeding and reproduction (USDA 1979). It is not difficult to adapt this system of classification to Indian conditions. In Table 1 a system of classification that may prove suitable to Indian conditions is suggested.

Once information on these three basic requirements is at hand, it can be organised in such a way as to pin-point what effects a particular action will produce. How many species of plants and birds will be affected, how they will be affected and where. If a target species is designated, a particular measure designed to afford it more protection may affect other species. Through the above arrangement of the data, the manager can gauge which other species will be affected and how. A versatility rating is assigned to each species. The most versatile or the least specialised species are generally less affected as they can use other habitats if a particular one becomes unavailable through a specific management action. The least versatile species are more vulnerable and require careful treatment if they are to be preserved.

#### **Example of a Woodland Bird Sanctuary**

A concrete example will show how the data in a particular case can be organised. The example that will be considered is of a woodland area in Western Ghats. The proposal to create a wild-life sanctuary in the extreme west of the catchment area of Panshet dam, 45 kms south-west of Pune is contained in an ecological survey report submitted by Ecological Society to the Department of Environment, Govt. of India, in August 1985.

The accompanying map will show the location of this 2387 ha. (5896 acres) proposed sanctuary. The area includes the crest-line of Western Ghats where rainfall annually averages 800 to 900 cms. With such an average of rainfall the vegetational climax should be evergreen forest. At one time this indeed was the case as can be deduced from a number of Sacred Groves scattered in this area. Due to religious sentiments vegetation in these groves was not cut down and these therefore, exhibit specimens of relict vegetation, the type of forest that once dominated this high rainfall area.

Outside the groves however, the original vegetation is now replaced

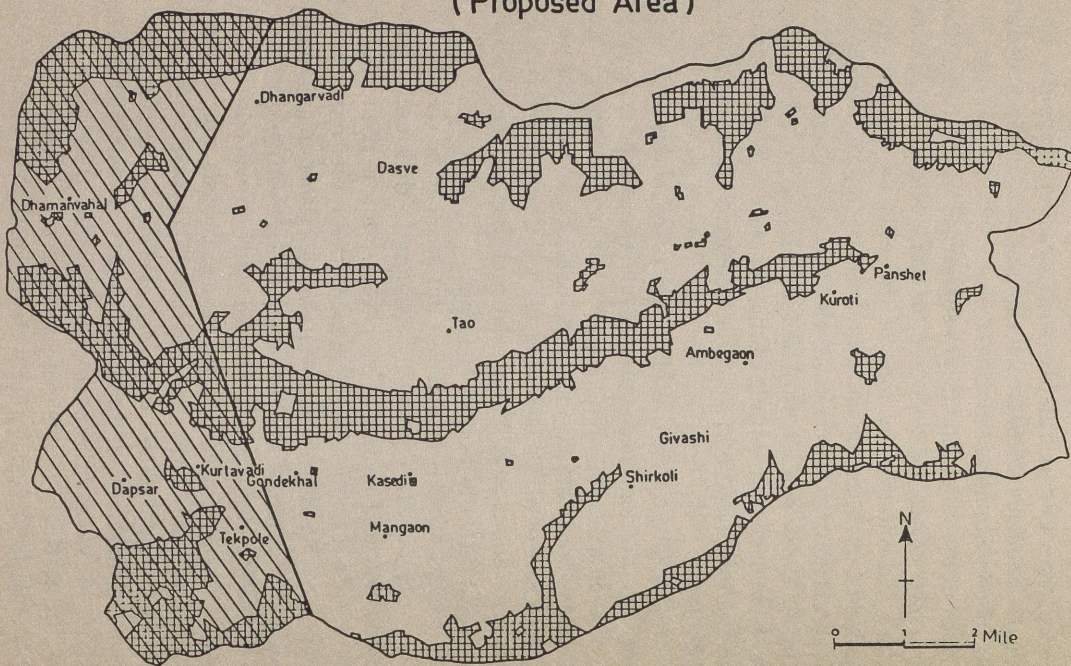
by secondary types as shifting cultivation, making of charcoal, cutting of wood for fuel and house timber and grazing have taken their toll. Most of this area is now occupied by grasses or shrubs or by heavily pollarded or coppiced trees. Certain fruit trees such as Jamun (*Syzygium cumini*) and Mango (*Mangifera indica*) are left standing and heavily eroded areas can only support *Euphorbia nerrifolia*.


Much of the valley land is now submerged under the Panshet reservoir. Lower slopes are cultivated for paddy and the middle are under shifting cultivation. The tops of the hills are reserve forest areas encroached upon, cut up and burnt at many places. The population in this area is however, low, around 600 souls, giving a ratio of one human being for 10 ha. or 25 acres. The survey report prepared by Ecological Society recommends shifting of this population to govt. land near the dam and their resettlement through co-operative dairying and animal husbandry.

The aim of creating a wildlife sanctuary in this area is to afford protection to certain species of plants and animals, birds and insects that are fast disappearing from Western Ghats as evergreen and semi-evergreen forests are cut down. 83 species of birds have so far been recorded here of which 11 species use the semi-evergreen or evergreen biotope in various ways. Mammals include Barking Deer, Jackal, Porcupine, Wild Boar and Bonnet Macaque.

83 species of birds recorded in this area can be classified into Life Forms categorised in Table 1, according to their use of habitats for reproduction and feeding. This classification is given in Table 2. A majority of bird species (62%) are seen to be covered by life forms 6 and 7 i.e. they use trees for reproduction and feed either on ground, in bushes or trees. Good management of tree cover and more open habitats such as open glades, and shrubs interspersed with trees will prove beneficial to a majority of the species. But the manager needs more information to decide how he should manage these areas—what trees to be maintained, what to be removed and when etc. He should therefore, know what activities birds carry out through different seasons, which habitat-types they use to carry out these activities and when. It is therefore, necessary that the manager of a Sanctuary should be assisted by competent ornithologists who can gather such information by actual field observation, by netting and ringing birds etc. In this example ornithologists of Ecological Society were able, in the two-year survey period, to gather information on the occurrence of birds through the seasons and the types of habitat different species use for different activities.

# WESTERN GHATS WILDLIFE SANCTUARY (Proposed Area)



 Proposed Area


 Area under Forest.

Table No. 3 gives information about the frequency of occurrence of birds in the reserve area. While 32 species both reproduce and feed in the area, the rest use the available habitats for feeding only and reproduce outside the reserve area. Among the birds that breed, 18 species use trees for nesting, 7 use bushes or ground and 6 other nest in varied habitats such as mud-banks, cliffs, holes in trees, ledges etc. While only 8 species breed in the period June to December, 24 species nest during the first 6 months of the year. With this basic information at hand, the manager can plan his actions in such a way as to cause the least disturbance to breeding birds during the prime breeding season.

However, for intelligent planning of management, more data are obviously required. It is essential to know which habitats, out of the available habitat-pattern, are used by birds for feeding only, for reproduction only and for both feeding and reproduction. Table No. 4 lists the available habitats in the reserve and classifies birds according to how they use them. The highest number of bird species are seen to use riverine vegetation for reproduction as well as feeding. 20 species reproduce in this habitat out of which 18 species use it for reproduction as well as feeding. Another 31 species use this habitat only for feeding. As such in the reserve riverine vegetation demonstrates prime bird use and any action that will disturb this habitat should be avoided and measures should be taken to protect and enrich this vegetation.

Next in importance comes the habitat represented by the tree cover consisting mainly of *Syzygium cumini*, *Mangifera indica*, *Macaranga peltata* and *Actionodaphne hookeri*. In this example, this tree cover represents Sacred Groves scattered in this area. Protection to these groves will provide protection to 16 breeding birds out of which 13 both reproduce and feed in this habitat; and to 27 other species that only feed there. Third in importance appears to be village environs where fruit trees and bamboo are planted by villagers. Among the more open habitats those represented by *Strobilanthus* and *Dendrocalamus* stand out.

To arrive at the Versatility Rating of each bird species, it will be necessary to know the successional stages of vegetation used by different bird species. Vegetational stages that are more or less common to woodland areas are: 1. Grass and forb, 2. Sapling, 3. Pole, 4. Young forest, 5. Mature forest and 6. Aged, declining trees. Though no specific information was collected on the use of successional stages by birds in different habitats, it is possible to give rough indication of such use from work done by other ornithologists. Thus the number of species using

different successional stages of the plant communities in our example, is as follows :

Successional stage	No. of bird species using it for	
	Reproduction	Feeding
Grass and forb	4	36
Shrub-seedling	0	10
Pole-Sapling	11	22
Young trees	7	42
Mature trees	24	34
Aged, declining trees	5	9

(Species feeding in open water & breeding outside the reserve are excluded)

Species from each life form can be thus classified according to the dominant plant communities and their successional stages that they use. Now the Versatility Rating will be :

VR = No. of plant communities + No. of successional stages used for  
Reproduction  
Plus  
No. of plant communities + No. of successional stages used for  
feeding.

Different species can now be classified into species with Low, Medium and High VR. In this example the number of species, in these three grades are :

Species with Low VR (total score 1 to 5)	34
Species with Medium VR (total score 6 to 10)	39
Species with High VR (total score above 10)	10
Total	83

### Steps to reach Management Goals

In this example, there are 10 versatile species which can utilise a variety of habitats (plant communities and successional stages) and therefore, are likely to be least affected by various management actions. These species include Redwhiskered and Redvented Bulbul, Scimitar and Jungle Babbler, Magpie Robin, Shikra, Crow-pheasant, Jungle Crow, Quaker Babbler and Small Green Barbet. These are common species belonging to a variety of habitats including woodland in various stages of growth and decay. The 11 species from semi-evergreen and ever-green

forest which need protection in this reserve include : Blue Chat (5), Grey Jungle Fowl (10), Scarlet Minivet (7), Rufous Turtle Dove (3), Emerald Dove (6), Yellowbrowed Bulbul (5), Brown Wood Owl (10), Small Sunbird (5) and Chest-nut-bellied Nuthatch (4). The brackets show their VR Score. Most of these use mature and old trees for reproduction and feeding. In this reserve Sacred Groves signify such a forest. Protection and maintenance of these groves will no doubt benefit these species. But the expansion of this habitat cannot be the sole aim of the management. Many other species depend on more open habitats. All of them cannot be wished away. But intelligent management may also try edging out certain unwanted species and attracting others which have vanished due to continued destruction of their habitat. In the present example, species like Little Brown Dove, Indian Robin and Green Bee-eater have no place in a high-rainfall area. These species were able to invade the reserve with the creation of xerophytic conditions. The data presented should be able to tell the manager how he can keep controlling their numbers. Likewise the complete absence of Woodpeckers is striking in this example. The manager would do well to keep a certain number of dead and dying trees to attract woodpeckers.

The task of the manager does not end with the conservation of target species. His goal should be the improvement of the overall quality of the reserve in terms of biological diversity. This implies change in the status quo. Indeed the very act of declaration of a reserve tends to change the status quo for it restricts human use of the area. Presentation of the data in the form described so far has equipped the manager with the knowledge of the basic requirements of the birds with whom he would be dealing. This should enable him to be selective—bring about conscious elimination of certain species in preference to certain other species. To judiciously plan his actions he will need more information about the niches occupied by different species, their behavioural traits, their habits—learned or inherited, their food preferences, the size of their territories or home ranges and specific requirements if any, of each species. As such importance of continuous collection of data and research cannot be overemphasised. Management of bird sanctuaries to be effective, will have to be backed by a competent team of ornithologists and ecologists.

#### **Example of a Wetland Bird Sanctuary**

The second example considers management of a proposed wetland reserve. The Mula-Mutha Bird Reserve has already been alluded to.

Though over 120 bird-species have been recorded in this reserve so far, 96 species that more commonly occur here are taken for consideration. The reserve area consists of a one and half kilometer stretch of the Mula-Mutha river in the suburb of Yerawada of Pune city. Birds start congregating there every September and remain there in numbers till the river-water rises during the rainy season and the usual shallow water habitats are no longer available. The normal water-level is regained in September. The following broad habitats are available to birds in this reserve :

No. Name of habitat	Dominant Plant Community
1. Open Water	Hydrilla verticillata, Lemna gibba, Ceratophyllum demersum, Vallisneria spirallis, Potamogeton crispus and P. indicus
2. Water Edges	Cryptocoryne retrospirallis, Cyperus pangorei, Polygonum glabrum and Typha angustata
3. Midstream rocks & Islands	Ipomoea sp., Portulaca oleracea, Marselia sp., Rorripa indica
4. Backwaters and pools in rocks	Rotulla tenui
5. Meadow, wet & dry	Polygonum glabrum, Cynodon dactylon, Alternanthera sessilis
6. Grass & Scrub	Lantana camera, Acacia arabica
7. Woodland	Erythrina sp. Cassia sp. Dalbergia sissoo, Leucaena leucocephala.

No target species have been specified by the proposers. However, the reserve is well-known for the numbers of migrants it attracts in winter. These include ducks (Garganey, Pintail and Common Teal), Waders (Blackwinged stilts, Sandpipers & Stints, Greenshank, Ruff & reeve etc.), birds of prey, terns, wagtails etc. Ducks and waders throng the reserve from October to March. A number of resident birds also use the above habitats for feeding and resting or roosting. Species that breed here are however, few viz. Little Brown Dove, Indian Robin, Streaked Fantail and Indian Wren Warbler, Rock Bush Quail, Rain Quail and Little Grebe. This situation may be considered as typical of all the wetland reserves that have been proposed in recent years.

In the original proposal a list of birds occurring at this place was

attached. There have been some changes in the status of certain species over the years and Table Nos. 5 & 6 list 96 species that commonly occur at present. A look at the list and the types of habitats available, will make obvious two broad management objectives. These are :

1. To improve the quality of habitats so as to attract greater numbers of migrant birds, and
2. To induce more resident birds to stay and breed in the reserve.

However, the reserve being very close to the city, certain factors, which are beyond the control of the manager impinge and have to be considered. These are :

1. Human use: The stretch of the river is used by people for bathing, washing clothes and utensils and for fishing as a non-commercial activity. Birds appear to be used to the presence of the people. Though hunting and trapping are no major threats, a certain amount of grazing by cattle, horses and sheep and goats, is also carried on. However, this has not materially altered the character of any habitat.
2. Quality of the river water and the water level: The quality of water depends on the quantity of sewage let out in the river by the city. A sewage treatment plant is coming up in the upstream stretches of the river. Once it becomes operational the quality is likely to improve. The water level depends on the quantity of water released from the Khadakwasla reservoir upstream.
3. In recent years *Eicchornia crassipes* or water hyacinth spreads rapidly over the entire river course through the city as soon as floods recede after the monsoons and the river flow becomes sluggish. The municipal corporation tries to remove it but the efforts to remove it from the Sanctuary area have not been persistent.

It may now be worthwhile to classify birds according to Life Forms. This will bring into focus species that use the same habitats for feeding and reproduction and indicate to the manager diverse species that will be affected if a particular habitat is interfered with. However, reproduction being not an important activity in the reserve at present, resting and/or roosting is considered in its place. A number of migrant birds spend the night in the reserve itself. These include some ducks, Black-winged Stilts, waders, terns etc. The number of species in different life forms is as follows :

Life Form	1	2	3	4	5	6	7	8	9	10	11	12	13	14
No. of Species	—	3	14	10	14	17	16	—	8	3	2	5	—	4

The frequency of occurrence of different species is given in Table

5 & 6. 26 species use the reserve for feeding for more than 9 months; 50 species feed here from 5 to 8 months and transients include 20 species that feed in the reserve for 1 to 4 months. Of the 50 species that roost in the reserve, 15 are found from 9 to 12 months, 24 roost from 5 to 8 months and 11 roost from 1 to 4 months. Next let us consider the different plant communities used by birds in different habitats. Information from Table 5 is condensed below :

Habitat No.	1		2		3		4		5		6		7	
	R	F	R	F	R	F	R	F	R	F	R	F	R	F
No. of Species	—	19	14	43	45	48	—	27	1	35	7	47	14	33

The most important resting and roosting habitat appears to be rocks and islands midstream followed by edges of water and woodland. The most important feeding habitats are rocks and islands, scrubland and edges of water, in that order. Midstream rocks and islands is the most important habitat from the point of resting/roosting and feeding.

#### Steps to meet Management Goals

The first objective that we have mentioned involves improvement in the quality of the habitat to attract greater numbers of migrant birds such as ducks and waders. Many of these use mid-stream rocks for resting and roosting, feed in the open water or shallows nearby and also along the edges of river banks. The shallow open water habitat is used by 19 species for feeding. These include a number of migratory ducks. The main threat to this habitat comes from the spread of water hyacinth which tends to cover open water areas from February onwards and practically occupies the whole of it by March end. Its timely removal will benefit ducks and other species that use this habitat. This weed also occupies nooks and crannies, bays and inlets of the river course where the water-flow is sluggish. Thus edges of water are also affected and 14 species that rest/roost here and 43 species that feed here are faced with problems. Timely removal of this weed will benefit all of them.

The use of the open water habitat by birds is also dependent on the quality of aquatic vegetation. The dominant aquatic plant communities found at present may be the result of increased fertility of water due to greater inflow of sewage. Their food value and use by birds need investigation. Once this information is available the manager can be selective in eliminating some vegetation in preference to some other species with better potential of bird use. Similarly vegetation at the edges of water also needs to be examined from the same point of view.

Besides ducks the other important group of migrants is waders. They feed in shallow water or in mud along the water's edge and some of them roost on rocks mid-stream. In the last few years due to the maintenance of a higher water level, such mud-filled shallow areas have contracted. The manager can examine the edges of water to see if at places such areas can be created.

The second objective mainly concerns resident birds. As already noted the activity of plantation on the north bank has on the whole benefitted the resident birds. Several new species have been attracted though the activity proved inimical to the large flocks of Yellow Wagtail that used the grass and scrub area before it was planted up. Some of the wagtails have now shifted to the eastern extremity of the reserve where this type of habitat is still available to them. The plantation on the north bank can be made more attractive to birds by planting more nectar-producing flower trees, more trees that produce berries and gradually eliminating exotic, quick-growing trees that were planted simply because they grow very quickly.

A look at the habitat-use of birds should convince the manager of the importance of meadows and shrubbery. 8 species use these habitats for roosting while 92 species seek food here. By studying the feeding habits of these birds the manager can enhance the habitats' usefulness to birds. Again certain plant species may have to be eliminated, while planting of certain species can be taken up. The need for a continuous study of birds should once again be emphasized.

The proper management of meadows and shrubland will help birds such as Partridges and Quails and may attract other ground-nesting birds as well as birds that nest in shrubs. However, solitude and absence of disturbance are necessary to ensure breeding success. The manager will do well to keep certain pockets away from human disturbance. Likewise near the water's edge pockets of dense *Typha* or other water-side thickets will provide shelter and breeding places for Coot, Indian and Purple Moorhen etc.

At present the number of breeding species is low and tree-nesters are even fewer. But as the forest on the north bank matures it may provide suitable places for some more species. However, between the sanctuary and the private estate further to the north, there is a buffer zone which provides the necessary solitude to nesting birds. This is not yet adequately planted up. If suitable nesting trees such as *Ficus*, *Acacia* etc. are planted here, they may eventually provide nesting space to such colonial nesters as Cormorants, Egrets, Herons and Storks. However,

these will not breed unless adequate food is made available to feed their nestlings. The manager should consult fisheries experts to enable him to augment fish in river waters.

The basic data that are presented here thus provide the manager a working base on which to build up his management practices. Continuous research on birds that are placed under his care will open up new vistas and suggest novel ideas that will enrich his experience and place newer tools in his hands to reach management goals. His task becomes immensely easier if he is backed by a team of competent ornithologists. For the development of the science of Bird Sanctuary Management, it is necessary to attract this unfeathered biped who alone can study 'feathered bipeds'.

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Table 1

## CLASSIFYING WILD FAUNA ACCORDING TO LIFE FORMS

## ACTIVITY

Life Form	Reproduction or Roosting	Feeding
1	In water	In water
2	On and around water	In water
3	In and around water	In and around water
4	In grass or bushes around water	In and around water
5	On ground among rocks, grass or in cultivation	Among rocks, grass, in cultivation or in water
6	In bushes or in medium high trees	On ground, in bushes or trees in water or in air
7	In tall deciduous or evergreen trees	On ground, in bushes or trees, in and around water or in air
8	In coniferous trees	On ground, in bushes or trees, around water or in air
9	In a burrow in mud-cliffs, rockfaces, and ledges along water courses	On ground, in water or in air
10	On rock cliffs, ledges or in caves	On the ground or in air
11	In an excavated hole in a tree	On the ground, in bushes or trees or in air
12	In a hole or nest in a tree made by another species	On ground, in bushes or trees or in air
13	In a hole or burrow underground	On ground, in water or in bushes or trees
14	In a hole or ledge in a man-made structure	On ground, in bushes or trees or in air

Table 2

## WESTERN GHATS WILDLIFE SANCTUARY (PROPOSED) : CLASSIFICATION OF BIRDS ACCORDING TO LIFE FORMS

## L I F E F O R M S

One	Three	Four	Five	Six	Seven	Nine	Ten	Eleven	Twelve
Black headed Gull	Grey Wag-tail	Spotbill Duck	Jungle Bush Quail	Pond Heron Cattle Egret	Shikra Sparrow-hawk	Honey Buzzard	Tawney Eagle	Small Green Barbet	Collared Scops Owl
	Large breasted	White-breasted	Red Quail	Blackwinged Kite	Crested Hawk-Eagle	Small Blue	Long-billed Vulture		Brown Fish
	Pied Wag-tail	Water-hen	Spur-fowl	Little Brown Dove	Whitebacked Vulture	King-fisher	Vulture Shaheen		Owl
		Blue Chat	Redwa-tled	Rufousbacked Shrike	Crested Serpent Eagle	White-breasted	Falcon		Spotted Owllet
			Lap-wing	Blackheaded Cuckoo-Shrike,	Rufous Turtle	King-fisher	Blue Rock Pigeon		Brown Wood Owl
			Indian Robin	Scarlet Minivet, Redwhiskered Bulbul	Dove, Emerald Dove	Green	Great Horned Owl		Grey-headed Myna
			Orange headed	Spotted Babbler, Scimitar Babbler	Crow-pheasant	Bee-eater	Alpine Swift		Jungle Myna
			Ground Thrush	Rufous Babbler	Jungle Nightjar	Wire-tailed Swallow	Malabar Crag		Brahminy Myna
				Jungle Babbler	Crested Tree Swift	Whistling Thrush	Martin		
				Verditer Flycatcher	Golden Oriole				
				Paradise Flycatcher	Grey Drongo				
					Jungle Crow				
					Yellowbrowed Bulbul				
					Black Bulbul				
					Quaker Babbler				

Blacknaped	Greyheaded
Flycatcher	Flycatcher
Chiffchaff	Yellowcheeked Tit
Leaf Warbler	Chestnutbellied
Magpie Robin	Nuthatch
Pied Bush Chat	Tree Pipit
Blueheaded Rock	Thickbilled
Thrush	Flowerpecker
Blackbird	Small Sunbird
Common Rosefinch	Yellowbacked sunbird

Table 3

## WESTERN GHATS WILDLIFE SANCTUARY (PROPOSED): FREQUENCY OF OCCURRENCE

R = Reproduction      F = Feeding

Life Form	Name of Bird	Month of the Year											
		1	2	3	4	5	6	7	8	9	10	11	12
1	Blackheaded Gull	—	—	—	—	—	—	—	—	—	F	F	F
2	Grey Wagtail	F	F	—	—	—	—	—	—	F	F	F	F
3	Spotbill Duck	—	—	—	—	—	—	—	—	—	F	F	F
	Whitebreasted Waterhen	F	F	F	F	F	—	—	—	RF	RF	F	F
	Blue Chat	F	F	F	F	F	—	—	—	—	—	F	F
5	Jungle Bush Quail	F	F	F	F	F	—	—	—	F	F	F	F
	Red Spurfowl	F	F	RF	RF	F	—	—	—	F	F	F	F
	Redwattled Lapwing	F	F	F	F	F	—	—	—	—	F	F	F
	Indian Robin	F	F	F	RF	RF	—	—	—	—	F	F	F
	Ground Thrush	F	F	F	RF	RF	F	—	—	—	F	F	F
6	Pond Heron	F	F	F	F	F	—	—	—	—	F	F	F
	Cattle Egret	F	F	F	F	F	—	—	—	—	F	F	F
	Blackwinged Kite	F	F	F	F	F	—	—	—	—	F	F	F
	Grey Jungle Fowl	F	F	F	RF	RF	RF	F	F	F	F	F	F
	Little Brown Dove	F	F	F	F	F	—	—	—	—	—	F	F
	Baybacked Shrike	F	F	F	F	F	—	—	—	—	F	F	F
	Rufousbacked Shrike	F	F	F	F	F	—	—	—	—	F	F	F

Blackheaded Cuckoo-Shrike	F	F	F	RF	RF	—	—	—	F	F	F	F
Scarlet Minivet	F	F	RF	RF	F	—	—	F	F	F	F	F
Redwhiskered Bulbul	F	F	RF	RF	F	—	—	RF	RF	F	F	
Redvented Bulbul	F	F	RF	RF	F	—	—	F	F	F	F	
Spotted Babbler	F	F	RF	RF	F	—	—	—	F	F	F	
Scimitar Babbler	F	F	RF	RF	RF	F	F	F	F	F	F	F
Rufous Babbler	F	F	F	F	F	—	—	—	—	F	F	F
Jungle Babbler	F	F	F	F	F	—	—	—	—	F	F	F
Verditer Flycatcher	F	F	F	—	—	—	—	—	—	—	F	F
Paradise Flycatcher	F	F	F	RF	RF	—	F	F	F	F	F	F
Blacknaped Flycatcher	F	F	F	F	F	—	—	—	—	F	F	F
Chiffchaff	F	F	F	—	—	—	—	—	—	—	F	F
Leaf Warbler	F	F	F	—	—	—	—	—	—	F	F	F
Magpie Robin	F	F	RF	RF	RF	—	—	—	F	F	F	F
Pied Bush Chat	F	F	RF	RF	RF	—	—	—	F	F	F	F
Blueheaded Rock Thrush	F	F	F	F	F	—	—	—	—	F	F	F
Blackbird	F	F	F	F	F	—	—	—	—	—	F	F
Common Rosefinch	F	F	F	F	F	—	—	—	—	—	F	F
Shikra	F	F	F	F	F	—	—	—	F	RF	RF	RF
Sparrowhawk	F	F	F	F	F	—	—	—	—	F	F	F
Crested Hawk-Eagle	F	F	F	F	F	—	—	—	—	—	F	F
Booted Hawk-Eagle	F	F	—	—	—	—	—	—	—	—	F	F
Whitebacked Vulture	F	F	F	F	F	—	—	—	—	F	F	F

Table 3 contd...

Crested Serpent Eagle	F	RF	RF	RF	F	—	—	—	F	F	F	F
Osprey	F	F	—	—	—	—	—	—	—	F	F	F
Kestrel	F	F	F	—	—	—	—	—	F	F	F	F
Rufous Turtle Dove	F	F	F	F	F	—	—	—	—	F	F	F
Emerald Dove	F	F	F	RF	RF	RF	—	—	F	F	F	F
Crow-pheasant	F	F	F	F	F	F	—	—	RF	RF	F	F
Jungle Nightjar	F	F	RF	RF	RF	—	—	—	F	F	F	F
Crested Tree Swift	F	F	F	RF	RF	—	—	—	F	F	F	F
Golden Oriole	F	F	F	F	F	—	—	—	—	F	F	F
Grey Drongo	F	F	RF	RF	RF	—	—	—	F	F	F	F
Jungle Crow	F	F	F	F	F	F	F	RF	RF	F	F	F
Yellowbrowed Bulbul	F	F	F	F	F	—	—	—	—	F	F	F
Black Bulbul	F	F	F	F	RF	RF	—	—	—	F	F	F
Quaker Babbler	F	F	F	F	RF	RF	—	—	F	F	F	F
Greyheaded Flycatcher	F	F	F	—	—	—	—	—	—	F	F	F
Yellowcheeked Tit	F	F	F	F	F	—	—	—	F	F	F	F
Chestnutbellied Nuthatch	F	F	F	—	—	—	—	—	—	—	F	F
Tree Pipit	F	F	F	—	—	—	—	—	—	F	F	F
Thickbilled Flowerpecker	F	F	F	—	—	—	—	—	F	F	F	F
Tickell's Flowerpecker	F	F	F	—	—	—	—	—	—	F	F	F
Small Sunbird	F	F	F	F	F	—	—	—	F	F	F	F
Yellowbacked Sunbird	F	F	F	F	F	—	—	—	F	F	F	F
Honey Buzzard	F	F	F	F	F	—	—	—	—	—	F	F

	Small Blue Kingfisher	F	F	F	F	F	F	—	—	—	RF	RF	F
	Whitebreasted Kingfisher	F	F	F	F	F	—	—	—	F	F	F	F
	Green Bee-eater	F	F	F	F	F	—	—	—	—	F	F	F
	Wiretailed Swallow	F	F	F	F	F	—	—	—	—	F	F	F
10	Tawny Eagle	F	F	F	F	F	—	—	—	—	—	F	F
	Longbilled Vulture	F	F	F	F	F	—	—	—	—	F	F	F
	Shaheen Falcon	F	F	F	F	F	—	—	—	—	F	F	F
	Blue Rock Pigeon	F	F	F	F	F	—	—	—	—	F	F	F
	Great Horned Owl	F	RF	RF	F	F	—	—	—	F	F	F	F
	Alpine Swift	F	F	F	F	F	—	—	—	F	F	F	F
	Crag Martin	F	F	F	—	—	—	—	—	—	F	F	F
11	Small Green Barbet	F	F	RF	RF	RF	—	—	—	F	F	F	F
12	Collared Scops Owl	F	F	F	F	—	—	—	—	—	F	F	F
	Brown Fish Owl	F	F	F	F	F	—	—	—	F	F	F	F
	Spotted Owlet	F	F	F	—	—	—	—	—	—	F	F	F
	Brown Wood Owl	F	F	F	F	F	F	—	—	F	RF	RF	RF
	Greyheaded Myna	—	—	—	F	F	—	—	—	—	—	—	—
	Jungle Myna	F	F	F	F	F	—	—	—	—	F	F	F
	Brahminy Myna	F	F	F	F	F	—	—	—	—	—	F	F

Table 4  
WESTERN GHATS WILDLIFE SANCTUARY (PROPOSED) : HABITAT-USE OF BIRDS

Life Form	Name of Bird	R = Reproduction					F = Feeding				
		Open Water	Water Edges	Riverine vegetation	Village Environs	Woodfordia Lasiosiphon Xeromphis	Strobilanthus Butea Emblica	Syzygium Mangifera Macaranga Actinodaphne	Erythrina Euphorbia Meme-cylon	Dendrocalamus Phoenix Glochiodion	
1	Blackheaded Gull	F	—	—	—	—	—	—	—	—	
3	Grey Wagtail	—	F	—	—	—	—	—	—	—	
4	Spotbill Duck	F	F	—	—	—	—	—	—	F	
	Whitebreasted Waterhen	—	RF	RF	F	—	—	F	—	—	
	Blue Chat	—	—	F	—	—	—	F	—	—	
5	Jungle Bush Quail	—	—	—	—	F	F	—	—	—	
	Red Spurfowl	—	—	—	—	F	RF	—	F	F	
	Redwattled Lapwing	—	F	—	F	—	—	F	RF	—	
	Indian Robin	—	—	—	RF	F	—	—	F	—	
	Ground Thrush	—	—	RF	F	—	—	RF	—	—	
6	Pond Heron	—	F	F	F	—	—	—	—	F	
	Cattle Egret	—	F	F	F	—	—	—	—	—	
	Blackwinged Kite	—	—	—	—	F	F	—	—	F	
	Grey Jungle Fowl	—	—	—	—	—	RF	F	—	F	

Little Brown Dove	—	—	—	F	F	—	—	—	—
Baybacked Shrike	—	—	—	F	F	—	—	F	—
Rufousbacked Shrike	—	—	—	F	F	F	—	F	—
Blackheaded Cuckoo-Shrike	—	—	RF	F	—	—	RF	F	—
Scarlet Minivet	—	—	—	—	—	—	RF	F	F
Redwhiskered Bulbul	—	—	RF	F	F	RF	F	F	F
Redvented Bulbul	—	—	F	RF	F	RF	—	F	F
Spotted Babbler	—	—	F	—	—	RF	R	F	RF
Scimitar Babbler	—	—	RF	F	—	F	RF	—	—
Rufous Babbler	—	—	—	—	F	F	—	—	F
Jungle Babbler	—	—	—	—	F	F	—	—	F
Verditer Flycatcher	—	—	F	F	—	—	F	F	—
Blacknaped Flycatcher	—	—	F	—	—	—	F	—	F
Chiffchaff	—	—	—	F	F	F	—	F	F
Leaf Warbler	—	—	—	F	F	F	—	F	F
Magpie Robin	—	—	RF	RF	—	—	F	F	F
Pied Bush Chat	—	—	—	RF	F	RF	—	F	F
Blueheaded Rock Thrush	—	—	F	—	—	F	F	—	—
Blackbird	—	—	F	F	—	—	F	F	—
Common Rosefinch	—	—	F	F	—	F	—	—	F
Shikra	—	—	RF	—	—	—	RF	F	F
Sparrowhawk	—	—	F	F	—	—	F	F	F
Crested Hawk-Eagle	—	—	—	—	F	F	F	—	F

Table 4 contd...

Booted Hawk-Eagle	—	—	—	—	F	F	—	—	F
Whitebacked Vulture	—	—	—	F	F	—	—	—	—
Crested Serpent Eagle	—	—	F	—	—	F	R	F	RF
Osprey	F	F	—	—	—	—	—	—	—
Kestrel	—	—	—	F	—	F	—	F	F
Rufous Turtle Dove	—	—	F	—	—	—	F	—	—
Emerald Dove	—	—	RF	—	—	—	RF	—	—
Crow-pheasant	—	—	RF	RF	—	F	F	F	F
Jungle Nightjar	—	—	RF	F	—	F	RF	F	—
Crested Tree Swift	—	—	RF	F	—	F	—	R	F
Golden Oriole	—	—	F	F	—	—	—	F	F
Grey Drongo	—	—	RF	—	—	—	RF	F	—
Jungle Crow	—	—	RF	RF	—	—	F	F	F
Yellowbrowed Bulbul	—	—	F	—	—	—	F	—	—
Black Bulbul	—	—	F	F	—	—	RF	F	—
Quaker Babbler	—	—	RF	F	—	F	RF	F	F
Greyheaded Flycatcher	—	—	F	—	—	—	F	—	—
Yellowcheeked Tit	—	—	F	F	—	—	F	—	—
Chestnutbellied									
Nuthatch	—	—	F	—	—	—	F	—	—
Tree Pipit	—	—	F	—	—	F	—	F	—
Thickbilled									
Flowerpecker	—	—	F	F	—	—	F	—	—

			F	F	—	—	F	—	—
			F	F	—	—	F	—	—
			F	F	—	—	F	—	—
9			—	—	F	F	—	F	F
			—	—	—	—	—	—	—
		RF	RF	—	—	—	—	—	—
								F	—
		F	F	F	—	—	F	F	F
		—	—	—	F	—	—	—	—
10		F	F	F	—	—	—	—	—
		—	—	—	F	F	—	F	F
		—	—	—	F	F	—	—	—
		—	F	—	—	F	—	—	—
		—	—	—	F	F	—	—	RF
		—	—	F	F	F	—	F	F
		—	—	—	—	F	—	—	F
		F	F	—	—	F	—	—	F
		F	F	—	—	F	RF	F	F
11		—	—	RF	F	—	—	—	—
12		—	—	F	—	—	—	—	—
		F	F	F	—	—	—	—	—
		—	—	—	F	—	—	—	—
		—	—	—	F	—	RF	F	—
		—	—	F	F	—	F	—	—
		—	—	—	—	—	—	F	—
		—	—	F	F	—	F	F	F
		—	—	—	—	—	—	—	—
		—	—	F	F	—	F	F	—
		—	—	—	—	F	—	—	—

Table 5

MULA-MUTHA RIVER BIRD SANCTUARY (PROPOSED)  
 CLASSIFICATION OF BIRDS ACCORDING TO LIFE FORM & FREQUENCY OF OCCURRENCE

56

Life Form	Name of Bird	R = Reproduction		F = Feeding									
		1	2	Months of the Year									
		1	2	3	4	5	6	7	8	9	10	11	12
7	Little Cormorant	F	F	F	F	—	—	—	F	F	F	F	F
7	Little Egret	F	F	F	F	F	F	F	—	—	F	F	F
7	Grey Heron	F	F	F	F	F	—	—	—	F	F	F	F
7	Pond Heron	F	F	F	F	F	—	—	—	F	F	F	F
7	Night Heron	F	F	F	F	F	F	—	—	F	F	F	F
7	Whitenecked Stork	F	F	F	F	F	—	—	—	—	F	F	F
6	Openbilled Stork	F	F	F	—	—	—	—	—	F	F	F	F
4	Spotbill Duck	F	F	F	—	—	—	—	—	—	—	—	F
2	Shoveller	F	F	F	—	—	—	—	—	F	—	—	F
2	Little Grebe	F	F	F	—	—	—	—	—	—	—	—	F
3	Pintail	F	RF	RF	F	F	F	—	—	—	—	—	F
3	Common Teal	F	F	F	—	—	—	—	—	—	F	F	F
3	Garganey	F	F	F	—	—	—	—	—	—	—	F	F
10	Scavenger Vulture	F	F	F	F	—	—	—	—	—	F	F	F
6	Blackwinged Kite	F	F	—	—	F	—	—	—	—	—	—	F
7	Pariah Kite	F	F	F	F	—	—	—	—	—	—	—	F
4	Marsh Harrier	F	F	F	F	F	F	—	—	F	F	F	F
		F	F	F	—	—	—	—	—	—	F	F	F

6	White-eyed Buzzard	F	F	F	—	—	—	—	—	—	F	F	F
10	Redheaded Merlin	F	F	F	—	—	—	—	—	F	F	F	F
7	Kestrel	F	F	F	—	—	—	—	—	F	—	—	—
5	Painted Partridge	—	—	—	—	—	—	F	F	F	—	—	F
5	Grey Partridge	F	F	—	—	—	—	—	—	—	F	—	—
4	Rain Quail	—	—	—	—	—	F	F	F	F	—	—	—
5	Jungle Bush Quail	—	—	—	—	—	F	F	F	F	F	—	—
5	Rock Bush Quail	F	F	F	F	F	—	—	—	—	F	F	F
4	Indian Moorhen	F	F	—	—	—	—	—	—	—	F	F	F
6	Whitebreasted Waterhen	F	F	—	—	—	—	—	—	F	F	F	F
4	Purple Moorhen	F	F	F	—	—	—	—	—	F	F	F	F
3	Coot	F	F	F	F	—	—	—	—	F	F	F	F
4	Painted Snipe	F	F	—	—	—	—	F	F	F	F	—	—
2	Pheasant-tailed Jacana	—	—	F	F	F	F	—	—	—	—	—	—
5	Redwattled Lapwing	F	F	F	F	F	F	F	F	F	F	F	F
3	Little Ringed Plover	F	F	F	F	F	—	—	—	—	—	F	F
3	Kentish Plover	F	F	F	F	—	—	—	—	—	—	F	F
3	Ruff & Reeve	F	F	F	F	—	—	—	—	—	F	F	F
3	Common Sandpiper	F	F	F	F	F	F	—	—	F	F	F	F
3	Green shank	F	F	F	F	—	—	—	—	F	F	F	F
3	Little Stint	F	F	F	—	—	—	—	—	—	F	F	F
3	Temminck's Stint	F	F	F	—	—	—	—	—	—	F	F	F
4	Common Snipe	F	F	F	—	—	—	—	—	—	—	F	F
3	River Tern	F	F	F	F	—	—	—	—	—	F	F	F
3	Gullbilled Tern	F	F	F	F	—	—	—	—	F	F	F	F

Table 5 contd. . .

7	Shikra	F	F	F	—	—	—	—	—	—	—	F	F
14	Blue Rock Pigeon	F	F	F	F	F	F	F	F	F	F	F	F
6	Little Brown Dove	F	F	F	F	RF	RF	F	F	F	F	F	F
6	Koel	F	F	F	F	F	F	—	—	F	F	F	F
7	Crow-pheasant	F	F	F	—	—	—	—	—	F	F	F	F
6	Hawk-cuckoo	—	—	—	—	—	F	F	F	F	F	F	F
11	Coppersmith	F	F	F	F	—	—	—	—	—	F	F	F
7	Plaintive Cuckoo	—	—	—	—	—	F	F	—	—	—	—	—
12	Spotted Owlet	F	F	—	—	—	—	—	—	—	—	—	F
14	House Swift	F	F	F	F	—	—	—	—F	F	F	F	F
14	Hoopoe	F	F	F	F	F	—	—	—	F	F	F	F
6	Indian Roller	F	F	F	—	—	—	—	—	—	—	—	F
3	Blackwinged Stilt	F	F	F	F	—	—	—	—	F	F	F	F
9	Small Green Bee-eater	F	F	F	F	F	F	—	—	—	F	F	F
9	Pied Kingfisher	F	F	F	—	—	—	—	—	F	F	F	F
9	Small Blue Kingfisher	F	F	F	F	—	—	—	—	F	F	F	F
9	White-breasted Kigfisher	F	F	F	F	F	—	—	—	—	F	F	F
11	Grey Hornbill	F	F	F	—	—	—	—	—	—	F	F	F
6	Wryneck	F	F	—	—	—	—	—	—	—	—	—	F
4	Yellow Wagtail	F	F	F	F	—	—	—	—	F	F	F	F
5	Indian Pipit	F	F	—	—	—	—	—	—	—	—	F	F
9	Redrumped Swallow	F	F	F	F	—	—	—	—	F	F	F	F
9	Wiretailed Swallow	F	F	F	F	—	—	—	—	F	F	F	F

9	Common Swallow	F	F	F	F	—	—	—	—	—	F	F	F
6	Baybacked Shrike	F	F	F	—	—	—	—	—	—	—	F	F
7	King Crow	F	F	F	F	F	F	—	—	—	F	F	F
7	Golden Oriole	F	F	F	—	—	—	—	—	—	—	F	F
12	Common Myna	F	F	F	F	F	F	F	F	F	F	F	F
12	Brahminy Myna	F	F	F	F	F	—	—	F	F	F	F	F
7	Jungle Crow	F	F	F	F	F	RF	RF	RF	F	F	F	F
7	House Crow	F	F	F	F	F	F	F	F	F	F	F	F
12	Grey Tit	F	F	—	—	—	—	F	F	F	—	—	—
6	Redvented Bulbul	F	F	F	F	F	F	RF	RF	RF	F	F	F
12	Jungle Myna	F	F	F	F	F	—	—	—	—	—	—	F
6	Large Grey Babbler	F	F	F	F	F	—	—	—	—	F	F	F
4	Bluethroat	F	F	F	—	—	—	—	—	—	—	—	F
5	Streaked Fantail Warbler	—	—	—	—	—	F	RF	RF	F	F	—	—
5	Indian Wren Warbler	—	—	—	—	—	F	RF	RF	F	F	—	—
6	Ashy Wren Warbler	F	F	F	F	F	F	RF	RF	F	F	F	F
6	Tailor Bird	—	—	—	—	—	F	RF	RF	F	F	—	—
5	Indian Robin	F	F	F	F	RF	RF	F	F	F	F	F	F
10	Blue Rock Thrush	F	F	F	—	—	—	—	—	—	—	—	F
5	Stonechat	F	F	F	—	—	—	—	—	—	—	—	—
4	Yellowheaded Wagtail	F	F	F	—	—	—	—	—	—	—	—	—
5	White Wagtail	F	F	F	—	—	—	—	—	—	—	—	F
9	Large Pied Wagtail		F	F	F	F	F	F	F	F	F	F	F
5	Rufous-tailed Finch-lark	F	F	F	F	F	—	—	—	—	F	F	F
6	Weaver Bird	—	—	—	—	F	F	—	—	—	—	—	—

Table 5 contd. . .

6	White-throated Munia	—	F	F	F	F	—	—	—	—	—	—
5	Blackheaded Munia	—	—	—	—	F	F	—	—	—	—	—
5	Red Munia	—	F	F	F	F	—	—	—	—	—	—
14	House Sparrow	F	F	F	F	F	F	F	F	F	F	F

Table 6

MULA-MUTHA RIVER BIRD SANCTUARY (PROPOSED)  
 CLASSIFICATION OF BIRDS ACCORDING TO HABITAT-USE

R = Roosting/Resting      F = Feeding

Life Form	Name of Bird	NATURE OF HABITAT						
		Open Water Hydrilla Lemna Ceratophyllum Vallisneria Potamogeton	Water edges Cryptocoryne Cyperus Polygonum Typha	Rocks midstream Ipomoea Marselia Portulaca Rorripa	Back-Waters Rotulla Tennis	Meadows Polygonum Cynodon Alternanthera	Scrubland Acacia arabica Lantana camara	Woodland Erythrina Cassia Bauhinia Leucaena
7	Little Cormorant	F	—	R	R	—	—	—
7	Little Egret	—	F	RF	F	F	—	—
7	Grey Heron	—	F	RF	F	—	—	—
7	Cattle Egret	—	F	RF	F	F	F	—
7	Pond Heron	—	RF	RF	F	F	—	—
7	Night Heron	—	F	—	—	F	—	—
7	Whitnecked Stork	—	F	F	—	F	—	—
6	Openbilled Stork	—	F	F	—	—	—	—
4	Spotbill Duck	F	RF	RF	—	—	—	—

Table 6 contd. . .

2	Shoveller	F	RF	F	—	—	—	—
2	Little Grebe	F	RF	—	—	—	—	—
3	Pintail	F	RF	RF	—	—	—	—
3	Common Teal	F	RF	RF	—	—	—	—
3	Garganey	F	RF	RF	—	—	—	—
10	Scavenger Vulture	—	—	—	—	F	—	—
6	Blackwinged Kite	—	—	—	—	F	—	—
7	Kestrel	—	—	—	—	—	F	RF
5	Painted Partridge	—	—	—	—	—	RF	R
5	Grey Partridge	—	—	—	—	F	F	R
4	Rain Quail	—	F	—	—	F	RF	—
5	Jungle Bush Quail	—	—	—	—	F	F	RF
5	Rock Bush Quail	—	—	—	—	F	F	—
4	Indian Moorhen	F	F	RF	—	—	—	—
6	Whitebreasted Waterhen	—	F	RF	F	—	—	—
4	Purple Moorhen	—	F	RF	—	—	—	—
3	Coot	F	RF	RF	—	—	—	—
4	Painted Snipe	—	RF	RF	—	F	—	—
2	Pheasant-tailed Jacana	F	RF	RF	—	—	—	—
5	Redwattled Lapwing	—	RF	RF	F	F	F	—
3	Little Ringed Plover	—	F	RF	F	—	—	—
3	Kentish Plover	—	F	RF	F	—	—	—
3	Ruff & Reeve	—	F	RF	F	—	—	—

3	Common Sandpiper	—	F	RF	F	F	—	—
3	Green-shank	—	F	RF	F	—	—	—
3	Little Stint	—	F	RF	F	—	—	—
3	Temminck's Stint	—	F	RF	F	—	—	—
4	Common Snipe	—	F	RF	—	RF	—	—
3	River Tern	F	—	RF	—	—	—	—
3	Gullbilled Tern	F	—	RF	—	—	—	—
7	Shikra	—	—	—	—	—	F	RF
14	Blue Rock Pigeon	—	—	RF	—	F	F	—
6	Little Brown Dove	—	—	RF	—	—	F	RF
6	Koel	—	—	—	—	—	—	F
7	Crow-pheasant	—	—	—	—	—	F	F
6	Hawk-cuckoo	—	—	—	—	—	—	F
11	Coppersmith	—	—	—	—	—	—	F
7	Plaintive Cuckoo	—	—	—	—	—	—	F
12	Spotted Owlet	—	—	—	—	—	—	—
14	House Swift	F	—	F	—	F	F	—
14	Hoopoe	—	—	—	—	F	F	RF
6	Indian Roller	—	—	—	—	—	F	F
3	Blackwinged Stilt	F	F	RF	F	—	—	—
9	Small Green Bee-eater	—	—	—	—	—	F	F
9	Pied Kingfisher	F	RF	R	—	—	—	—
9	Small Blue Kingfisher	F	RF	RF	F	F	—	—
9	Whitebreasted Kingfisher	—	RF	RF	F	F	F	R
11	Grey Hornbill	—	—	—	—	—	—	F

Table 6 contd. ...

6	Wryneck	—	—	—	—	—	—	F
4	Yellow Wagtail	—	—	F	F	F	F	—
5	Indian Pipit	—	—	—	—	F	F	—
9	Redrumped Swallow	F	—	—	F	—	F	—
9	Wiretailed Swallow	F	F	F	—	—	—	—
9	Common Swallow	F	F	F	—	F	F	—
6	Baybacked Shrike	—	—	—	—	—	—	F
6	Rufousbacked Shrike	—	—	—	—	—	F	F
7	King Crow	—	—	—	—	F	F	RF
7	Golden Oriole	—	—	—	—	—	—	F
12	Common Myna	—	F	F	—	F	F	F
12	Brahminy Myna	—	—	F	—	—	F	RF
7	Jungle Crow	—	F	F	—	F	F	RF
7	House Crow	—	F	F	—	—	F	F
12	Grey Tit	—	—	—	—	—	—	F
6	Redvented Bulbul	—	—	F	—	—	RF	F
12	Jungle Myna	—	—	F	—	F	F	—
6	Large Grey Babbler	—	—	—	—	—	F	F
4	Bluethroat	—	F	—	F	F	—	—
5	Streaked Fantail Warbler	—	—	—	—	F	RF	—
5	Indian Wren Warbler	—	—	—	—	F	RF	—
6	Ashy Wren Warbler	—	—	—	—	—	RF	F
6	Tailor Bird	—	—	—	—	—	—	RF

5	Indian Robin	—	—	—	F	—	RF	F
10	Blue Rock Thrush	—	—	—	F	—	F	—
5	Stonechat	—	—	—	—	—	F	—
4	Yellowheaded Wagtail	—	F	F	F	F	—	—
5	White Wagtail	—	—	—	F	F	F	—
9	Large Pied Wagtail	—	F	F	—	—	—	—
5	Rufoustailed Finch-lark	—	—	—	F	—	F	—
6	Weaver Bird	—	—	—	F	F	F	—
6	Whitethroated Munia	—	—	—	—	F	F	—
5	Blackheaded Munia	—	F	—	—	F	—	—
5	Red Munia	—	—	—	—	F	F	—
14	House Sparrow	—	F	F	—	—	F	F

Table 7

CLASSIFICATION OF BIRDS ACCORDING TO LIFE FORM, SEASONAL OCCURRENCE,  
REPRODUCTIVE CAPACITY & HOME RANGE

Letter Code	Life Form	Name of Bird	Scientific Name	Seasonal Occurrence (Months of Year)												Reproductive capacity	Home Range
				1	2	3	4	5	6	7	8	9	10	11	12		
PHNI	7	Little Cormorant	Phalacrocorax niger														

Table 8

CLASSIFICATION OF BIRDS ACCORDING TO HABITAT-TYPES AND/OR PLANT COMMUNITIES

Life Form	Name of Bird	Minimum Habitat Required for individual, pair, colony or population	Habitat-types/Plant Communities					Special Habitats					Unique Habitats						
			1	2	3	4	5	etc.	1	2	3	4	etc.	1	2	3	4	etc.	

Table 9

WILDLIFE ORIENTATION TO PLANT COMMUNITIES BY LIFE FORM

R = Reproduction

F = Feeding

Code	Life Form	Name of Bird	Plant Communities						Total R	Total F
			1	2	3	4	5	6		

1

Total No. of R

Species for F

(Each Life Form will have its own table for the species covered by it.)

Table 10  
WILDLIFE ORIENTATION TO SUCCESSIONAL STAGES BY LIFE FORM

Code	Life Form	Name of Bird	Successional Stages							TR	TF	
			Grass-Forb	Shrub-Seedling	Pole-Sapling	Young Trees	Mature Trees	Old Trees				
			R	F	R	F	R	F	R	F		
		1										
		2										
		4										
		5										
		Total No. of										
		Species for										

TR = Total Reproduction      TF = Total Feeding  
(Each life Form will have its own table for the species covered by it)

Table 9

WILDLIFE ORIENTATION TO PLANT COMMUNITIES BY LIFE FORM

R = Reproduction

F = Feeding

Code	Life Form	Name of Bird	Plant Communities						Total R	Total F
			1	2	3	4	5	6		
1										

Total No. of R

Species for F

(Each Life Form will have its own table for the species covered by it.)

Table 10

WILDLIFE ORIENTATION TO SUCCESSIONAL STAGES BY LIFE FORM

Code	Life Form	Name of Bird	Successional Stages												TR	TF
			Grass-Forb		Shrub-Seedling		Pole-Sapling		Young Trees		Mature Trees		Old Trees			
			R	F	R	F	R	F	R	F	R	F	R	F		
		1														
		2														
		4														
		5														
		Total No. of	R													
		Species for	F													

TR = Total Reproduction      TF = Total Feeding  
 (Each life Form will have its own table for the species covered by it)

Table 11

RELATIVE DEGREE OF USE BY THE LIFE FORM OF INDICATED PLANT COMMUNITIES &  
 SUCCESSIONAL STAGES

Plant Community	Function	Successional Stages					
		1	2	3	4	5	6
1	R						
	F						
2	R						
	F						
3	R						
	F						
4	R						
	F						

R = Reproduction      F = Feeding  
 (There will be one table for species from each Life Form)

Table 12

## VERSATILITY RATINGS OF BIRDS ACCORDING TO LIFE FORMS

Life Form	Code	Name of Bird	No. of Plant Communities Used		No. of Successional Stages Used		Total	
			for Reproduction	For Feeding	for Reproduction	For Feeding	R + F	VR
7	PHNI	Little Cormorant	2	—	1	—	3 + 0	3
	CESI	Crow-Pheasant	2	6	1	5	3 + 7	10

There will be one table for every Life Form.  
VR score can also be shown graphically as Low, Medium & High.

## कॅलिफोर्निया से इथीओपिया की ओर

करुणा

गर्मी का मौसम समाप्त पर है। बीच में दो दिन सबदूर थोड़ी वर्षा भी हुई है इसलिए हवा कुछ ठंडी है। नहीं तो इस साल की गर्मी? तोबा, तोबा कूलर की ठंडी हवा में, फ्रीज का पानी पीनेवाले नगर निवासी भी बारीश की राह देखने लगे हैं, छोटा-सा बादल आकाश में दिखते ही अखबारवाले उसका फोटो छापने लगे हैं, और आकाशवाणी मानसून कहां तक पहुंचा इसकी खबरे बड़े उत्साह से दे रही है। हमेशा तो शहरवालोंका बारीश से—क्या ये बारीश, सब कपड़े खराब कर देती है, लोकल-बस रुकवा देती है, परेशान हुए भाई इससे—इतना ही ताल्लुक रहा करता है। इसीलिए गर्मी को धन्यवाद की उसने इस साल पत्थर भी पिघलाये हैं।

### तहसिल वरुड

लेकिन कहानी मुझे गर्मी की नहीं कहनी है वह तो कहनी है इस भू-भाग की, जो कभी कॅलिफोर्निया कहलाता था। कहनेवाले तो आज भी इसे कॅलिफोर्निया ही कहते हैं, तो कॅलिफोर्निया टाईम्स भी निकालते हैं। लेकिन हाल तो यहां का इथीओपिया जैसा होने जा रहा है। (यह भाग नागपूर से १२५ कि.मी. दूर, मध्य प्रदेश की सीमा से लगकर अमरावती जिले की एक तहसील वरुड है।)

### नागपुरी संतरा

करीब चालीस-पचास साल पहले यहां संतरे का प्रवेश हुआ। (वही नागपुरी संतरा, जो देशभर के एअरकंडीशन्ड कमरोंमें बैठे लोगोंका स्वास्थ्य-वर्धन करता है। बेचारे आम आदमी की पहुंच से तो वह बहुत दूर है। लेकिन उसने यहां के आम आदमी की जो हालत

बना रखी है उसका यह वाक्य है। मेरी सास बताती हैं—“मेरे पिताजी उन दो-चार कृषकों में से एक थे जिन्होंने प्रथम संतरा लगाया। कोई भी नई चीज अपनाने में लोग हिचकिचाते थे तब। लेकिन मेरे पिताजी को बड़ी दूर की सूझ थी। उन्होंने पहचाना था की ये फसल यहां क्रांति ला देगी। और सचमुच, दो-चार एकर जमीन के स्वामी भी संतरे के बलपर लखपति बन गये। अब देखो वो. . ., कभी अपने यहां मजदूर था, लेकिन उसने संतरे कलम बनाने का हुनर सीख लिया, आज उसका पक्का मकान है, मोटरसायकल पर घूमता है और सत्तर एकर जमीन है उसके पास।”

इसीलिए संतरा तो ऐसा फैला, ऐसा फैला की बाकी सब वृक्षों का वह काल बन गया। बबूल जैसे जंगली पेड़ तो क्या, आम जैसे फलदार वृक्ष तक को उसने नहीं छोड़ा। संतरे का पैकिंग करने में उनकी लकड़ी काम आने लगी। पहाड़ भी नंगे हो गये, (यह भाग सातपुड़ा घाटी में बसा है और पहले सघन वनक्षेत्र माना जाता था।) और बारहो माह बहनेवाली नदियों में बारीश के चार माह भी पानी रहना मुश्किल हो गया। लेकिन संतरावालों की नींद नहीं खुली। क्योंकि जब अच्छी फसल आती है संतरे की तो प्रति एकर पंद्रह हजार रुपये तक मिल जाते हैं उससे। (फिर चाहे साल दो साल संतरा न आता हो, और अकाल के समय उसे बचाने हजारों रुपये लग जाते हों।) खेती आसान है उसकी पेड़ जम गये तो २५-३० साल फसल मिलते रहेगी। हरसाल बोओ-काटो की झंझट नहीं, खूब अच्छी जमीन चाहिए ऐसा भी नहीं। फिर यह हमारे गर्व का भी तो विषय है। यहां के सत्रे की खेती देखकर ही तो हमारे किसी मुख्यमंत्री ने इस इलाके को कॅलिफोर्निया घोषित कर दिया था।

### तीन साल अकाल

आज यहां की चालीस प्रतिशत जमीनपर संतरा खड़ा है। पिछले तीन साल से अकाल सदृश परिस्थिति है। बारीश इतनी हुई की मुश्किल से एक फसल ली जा सकी। लेकिन कूओं में पानी भरा नहीं। बचपन से खेतों में काम करनेवाले एक वृद्ध मजदूर से जब मैंने पूछा—“क्या पहले बारिश कम नहीं होती थी कभी? कैसे सामना किया जाता था ऐसी परिस्थिति का तब?” तो उन्होंने बताया—“बारीश तो पहले भी कईबार शुरू के एक-देढ़ माह बरसती और फिर महिना-महिना भर गायब हो जाती। लेकिन तब जमीन में पानी काफी ऊपर था, (संतरा कम था न?) दस पंद्रह फीट नीचे ही पानी मिल जाता था। अधिकांश फसले जमीन से पानी पा लेती थी। गर्मी में पशुओं और मनुष्य को पानी के लिए दरदर भटकना पड़ रहा है, यह दृष्य शायद ही कभी देखने मिलता।”

### सूखे कृएं

सात साल पहले जब मैं यहां बहू बन कर आयी तब भी ऐसी हालत नहीं थी जैसी आज है। तब भी कूओं में पीने भर तो पानी था ही। लेकिन इन तीन सालों में भू-जल स्तर बेहद नीचे पहुंच गया है। पचास-साठ फीट गहरे कृएं भी सूखे पड़े हैं। सामान्य मनुष्य और पशु पानी के अभाव से त्रस्त हैं। इसका कारण है टचूबवेल। पहले भी इस इलाके में टचूबवेल थी, लेकिन इक्का-दुक्का थीं। क्योंकि उनमें खर्च बहुत लगता है। फिर पानी नहीं मिला तो सारा पैसा बरबाद। इधर लोगों ने रास्ता खोज लिया है। दो-दो, चार-चार लोग मिल कर

खुदवाते हैं ट्यूबवेल, खर्चा भी बांट लेते है और पानी भी। ज्यादा पानी हो तो बेचते भी हैं प्रतिघंटा बीस रुपये के हिसाब से।

### ट्यूबवेल

ट्यूबवेल की बढ़ती संख्या के बारे में जब हमने यहां के एक प्रथितयश किसान से बात की तो उन्होंने बताया—“पिछले साल इस इलाके में १९२ ट्यूबवेल खुदीं। उनमें करीब १०० सफल रही। इससाल करीब ३०० खुदीं और १२५ सफल रहीं। (ये आकड़ें शेंदुरजनाघाट क्षेत्र के हैं जहां सबसे ज्यादा ट्यूबवेल है। बचे हुए वरुड तहसील के क्षेत्र में करीब इतनी ही ट्यूबवेल और होंगी।) ये २०० से ४०० फीट गहराई से पानी खींच रही हैं। वैज्ञानिकों का कहना है कि एक वर्गमील में एक ही ट्यूबवेल होनी चाहिए। जब कि यहां तो किसी-किसी भाग में पचास तक हैं। जिस गती से आज हम पानी खींच रहे हैं, हमें और गहरे, और अधिक गहरे, ऐसे नीचे-नीचे जाते रहना पड़ेगा। लोग मजाक में कहते हैं, इतना गहरे जानेपर तो शायद हमें पेट्रोल ही मिल जाये! (हरियाना में ट्यूबवेल खुदाई के समय जहरीली गॅस मिलने के समाचार हैं। गैरसरकारी सूत्रों के अनुसार कुछ मजदूरों की मृत्यु भी उसमें हुई है।) चाहे पेट्रोल न भी मिले, लेकिन जितना नीचे पानी आयेगा उतना क्षार और खनिज लिये रहेगा, जिससे जमीन खराब होगी, और उसमें पैदा हुआ अनाज स्वास्थ्य पर विपरीत असर करेगा।

संतरा बचाने के लिए, ट्यूबवेल खुदवाने लोग कैसे पागल हुए जा रहे हैं इसका किस्सा एक किसान ने सुनाया। धनोडी/मालखेड गांव के निकट (ये गांव वरुड तहसील के ही हैं।) एक आदमी के खेत में जब ट्यूबवेल खुदी तो वहां खूब पानी है ऐसा पता चला। तो दूसरेनेभी पासमेंही जमीन का एक टुकड़ा खरीदा और वहां ट्यूबवेल खुदवायी। उसे भी खूब पानी मिला। फिर क्या था, एक-एक कर पांच लोगो ने वहां जमीन के छोटे-छोटे टुकड़े खरीद कर ट्यूबवेल बनवायी, नसीब की बात, पांचों में भरपूर पानी था। उनपर पंप लगे और सींचाई होने लगी। कुल जमा बीस दिन सींचाई हो सकी। आखीर नीचे समुद्र तो था नहीं, सभी ट्यूबवेल सूख गये!”

एक ट्यूबवेल खुदती है तो आसपास के करीब सो-देढसौ एकर में जो भी कूप हो उन्हें सुखा देती है। पास-पड़ोस की ट्यूबवेल का भी आधा पानी तो खींच ही लेती है। कई ऐसी ट्यूबवेल जो पिछले साल खूब पानी देती थी, इस साल निकम्मी हो गयी है, क्योंकि उनके नीचे के हिस्से में दूसरी ट्यूबवेल खुद गयी हैं। फिर भी लोगों ने हिम्मत नहीं छोड़ी है। दो-दो किलो मीटर दूर से पाईपलाईन द्वारा वे पानी ला रहे हैं। तिस पर भी इस क्षेत्र के पच्चीस प्रतिशत संतरावृक्ष बारीश आने तक सूख जायेंगे। कितु तो भी किसान अधिक संतरे के पेड लगाने की सोच ही रहा है। लगता है उसे, शायद इस साल अच्छी बारीश आ जाये, तब मेरे कूप में पानी हों जायेगा और मेरे पेड बच जायेंगे। यह उस मृग की तरह है जो पीछे से आनेवाले शेर को देख बालू में सिर घुसाकर खड़ा हो जाता है और सोचता है की मृत्यु मुझसे दूर है।

वस्तुस्थिति यह है कि अब यहां ७० इंच वर्षा हो (औसत २५-३० इंच हुआ करती है।) तब भी कूप पहले जैसे भरेंगे नहीं। क्योंकि प्रतिवर्ष जमीन में जितना पानी रिसता है उससे

कहीं अधिक हम खींच रहे हैं।

### भूजल बढ़ानेका तरीका

भूजलस्तर उंचा उठाने का एक तरीका है, नालो (झरनों) पर छोटे-छोटे बांध बनाने का। लेकिन उस ओर यहां किसी का ध्यान नहीं है। महाराष्ट्र के अ.नगर, नासीक-जलगांव आदि जिलों के कुछ गांवों में लोगों ने ऐसे प्रयोग किये हैं और वहां जमीन पुनश्च हरी-भरी हो सकी है। ऐसे नाले हर जगह होते हैं, उनपर बांध बनाने में ज्यादा खर्च नहीं आता, बड़े बांधों की तरह वे पर्यावरण को नुकसान नहीं पहुंचाते, उन्हे बनाने की तकनीक आसान होने के कारण गांव के लोग ही उन्हे बना सकते हैं। यहाँ ट्यूबवेल के लिए जितना पैसा खर्च हुआ, उतने पैसे से करीब तीन हजार ऐसे बांध बन सकते थे। (मोटा हिसाब इस तरह—५०० ट्यूबवेल की खुदाई में प्रति ट्यूबवेल बीस हजार रुपये के हिसाब से एक करोड़ रुपये खर्च हुए। उनमें २२५ सफल हैं। उनपर मोटर पंप बिठाने का खर्च प्रति ट्यूबवेल पच्चीस हजार रुपये के हिसाब से साढेबासठ लाख रुपये लगा। अपने खेत तक पानी ले जाने के लिए पाईप लाइन पर औसतन पचास हजार रुपये खर्च करनेवाले करीब सौ किसान हैं। तो उसमें पैसा लगा पचास लाख। कुल दो करोड़ रुपया लगा ऐसा भी माने तो पांच से दस हजार लागत खर्च से बने करीब तीन हजार बांध बन सकते थे।) लेकिन सवाल है मनुष्य की हवस का। एक किसान ने हमसे कहा ही—“आप कितना भी भूजल स्तर बढ़ाइये, हमारी जरूरत इतनी अधिक है की वह कभी पूरी नहीं होगी क्योंकि हमें अनाज नहीं संतरा उगाना है।” उस किसान के कथन का जीता-जागता उदाहरण है करीब सात साल पहले बना मध्यम क्षमता का सातनूर बांध। बांध पूरा हुआ उसके दूसरे साल ही खूब बारीश हुई। बांध पूरा भर गया। जलस्तर इतना बढ़ गया (तब इतने बांध नहीं थे।) की कूप में पांच फीट नीचे ही पानी था। यह देख लोगों की तृष्णा बढी और उन्होंने खूब संत्रा लगाया। दो-तीन साल ठीक चला, अब पिछले तीन साल से बारीश कम ही रही है, बांध में पानी भरता ही नहीं। तो संतरा बचाने लोगोंने उसके पास की जमीन खरीद ली है, वहा कूप बनते जा रहे हैं, पाईप लाईन से खेतों में पानी लाया जा रहा है। इस समय बांध में एक गढे में केवल आठ-दस इंच पानी बचा है। ऐसी स्थिति में भूजल-स्तर कैसे स्थिर रह सकेगा?

यह स्थिति केवल इसी भाग की है ऐसा नहीं। कहीं अंगूर कहीं गन्ना, कहीं केला या अन्य ऐसी ही किसी पैसा देनेवाली फसल के कारण उस-उस क्षेत्रकी कमोबेश ऐसी ही हालत हुई है और हो रही है। क्योंकि किसानों की दृष्टि से खेती अब व्यवसाय है। धरती को मां माननेवाला किसान अब कथा-कहानीयों या पिक्चर में ही देखने मिलता है।

### नहीं तो शहर चलो!

किसानों की जरूरते बढी हैं, वे भी चाहते है कि सुख-सुविधा के साधन उनके पास भी हो। साथ-साथ खेती का आधुनिक तंत्र बेहद खर्चीला है। कीटनाशक-रासायनिक खाद आदि के भाव आसमान छू रहे हैं। इसलिए आज जब किसान संगठित हो कर कृषि-उत्पादों के लिए योग्य भाव की मांग करता है तब सरकार कृषि-केंद्रों, पत्र-पत्रिकाओं, रेडियो-टी.व्ही. द्वारा प्रचार करती है की आर्थिक दृष्टी से पुसाने वाली पैसा देनेवाली फसलें

ही, मसलन् तेलबीज, फल और जल्दी लकड़ी देनेवाले वृक्ष ही उगायें। किसान भी सोचता है, ठीक तो है, खींचो जमीन से उसकी उत्पादकता, और खींच लो सारा पानी! जब जमीन पूरी तरह बंजर बन जाये, उसे छोड़ अन्य कहीं चलते बनो। वैसे हमारी जिंदगी तो किसी तरह गुजर ही जायेगी, अगली पीढी अपना खुद देखते बैठे।

नयी पीढी सोचती है बेकार है यहां टिकना। बेहतर है शहर में जायें, कोई उद्योग चाहे वह ऑटोरिक्षा चलाना हो या पान ठेला लगाना हो करें और चैन की बंसी बजाये। देखो न शहर वालों को कभी जाना पडता है दो-दो-चार-चार मील पानी की खोज में? कृषि-विकास के नाम पर बड़े बड़े बांधो का निर्माण होता है, लेकिन ऐसे जल दुर्भिक्ष के समय शहरवालों के ही तो काम आते हैं वे!

यह परिस्थिति कैसे बदलेगी? मुझे गांधीजी का एक वाक्य याद आता है—'यह धरा हर किसी की जरूरते पूरी करने में समर्थ है, लेकिन किसी एक के भी लोभ को नहीं।' लगता है इसका भान जबतक हम सभी (राज्यकर्ता और प्रजा, दोनों) को नहीं हो जाता तब तक निसर्ग हमें जबरदस्ती उसका भान कराते रहेगा।

इसलिए इससाल जब इतनी गर्मी पडी की शहरवालो को बारीश की राह देखनी पडी, हरभरे पेड़ों से आनेवाली ठंडी बयार की याद आयी तो मेरे मन में कहीं आस बंधी की शायद अब अपना देश इथीओपिया बनने से बच जाय!

करुणा

म. खाला, पो. सातनूर  
त. वरुड जि. अमरावती  
महाराष्ट्र ४४४ ९०७

### From 'California' to 'Ethiopia'

*Karuna*

This is a story of a region about 125 km. south of Nagpur near the border of Madhya Pradesh and Maharashtra. This region became famous for the crop of tangerines that was introduced here 50 years ago. These 'oranges' became so famous all over India that the region came to be called another 'California'. With the continued increase in the acreage under tangerines and with the vagaries of the monsoon, the growers soon found that they could get assured irrigation only if they dug up 'bore-wells' reaching the underground reservoirs in the deeper strata. The initial efforts of boring deep wells were highly successful and soon the practice became so widespread that the region became saturated with bore-wells. A time then came when additional boring drew no water. The deeper reservoirs began to dry up. The monsoon continued to play truant and soon the tangerine trees began to perish for lack of water.

From 'California' the region was well set to become another 'Ethiopia', a famished land.

The economics of bore-well irrigation is then discussed and it is pointed out that construction of small bunds and check-dams will only alter this picture by making water available to the wells. Otherwise with the spread of modern living and the trend of increasing material wants, the cultivator is tempted to abandon his land and run to the cities where only assured water and other necessities are available. It is by conserving the natural resources of the countryside that we can make the land smile once again.

Karuna  
Post Satnur  
Tal. Varud  
Dist. Amravati  
Maharashtra 444 907

## मागे वळून पाहताना

डॉ. वा. द. वर्तक

माझे लहानपण पूर्वीच्या भोर संस्थानच्या परिसरात गेले. या छोट्या संस्थानाच्या राजधानीचे गावही तीन चार हजार वस्तीचे होते. स्वच्छ आणि टुमदार असलेल्या भोर गावात सर्वत्र आंबे, फणस, जांभूळ, नारळ यांची झाडी होती. परिकथेप्रमाणे असलेल्या ह्या पिटुकल्या राज्यात एकूण १५० जवानांचे पोलिसी पायदळ व चाळीस-पन्नास जणांचे घोडदळ होते. शिवाय हत्तीखान्यात दोन हत्ती झुलत असत. समारंभ प्रसंगी राजाला मानवंदना देण्यासाठी १२ शिपायांचा एक ब्रास बॅन्ड होता. तो "यश हे सचिवांना" ही धून वाजवत असे. सलामीच्या दोन मोठ्या पितळी तोफातून फुसके बार काढण्याची संख्या फक्त ९ होती. गावाच्या मानाने राजवाडा फारच भव्य आणि डौलदार होता. मोठ्या प्रवेशद्वाराचे दोन्ही बाजूला खास इटालीहून आणलेले शरीर सौष्ठवाचे यथार्थ दर्शन घडवणारे संगमरवरी पूर्णाकृती स्त्री आणि पुरुषाचे अर्धनग्न रेखीव पुतळे होते. राजवाड्याचे पुढील भव्य चौकात मारुतीचे देवळाजवळ एक थुईथुई उडणारे कारंजे होते. गावातील रस्ते स्वच्छ होते. पाटीचे संडास असले तरी घाण फारशी नव्हती. त्या काळात नीरा नदीचा प्रवाह चिरेबंद आणि स्वच्छ होता. भोर जवळून वाहणाऱ्या राम ओढ्यावर बांध घालून अडविलेले पाणी गावात अनेक हौद घालून खेळविले होते. मातब्बर व्यक्तींकडे तर बंद नळातून पाणी जात होते. भोरचे परिसरात राजेसाहेबांची तीन उद्याने होती. भागोडीचे बागेत कलमी आंब्याची भरपूर झाडे होती व काही बागायती आणि धान्य पिके काढली जावयाची. रामबाग ही राम ओढ्याला अगदी लागून असलेली बाग. तेथे मोठे दाट झाडीने भरलेले वनोद्यान असून कोणी इंग्रज सरकारचा बडा अधिकारी आला तर त्याचे आदरातिथ्य करण्यासाठी अत्याधुनिक ऐषारामी बंगला होता. राजवाड्याशेजारील उद्यानामध्ये अनेक त-हेची विलायती फुलझाडे होती. गुलाबाच्या निरनिराळ्या जाती

तसेच अगदी आपल्या हाताचा पंजा उघडल्यानंतर होणाऱ्या आकाराएवढ्या परिघाच्या डेलियाच्या विविध रंगांच्या जातींची पद्धतशीरपणे लागवड केली जात होती. उद्यानातील विस्तीर्ण विहीरीवर ६ बैलांची मोट सतत सुरू असे. बागेच्या मध्यभागी असलेले छोटेसे जलमंदीर प्रेक्षणीय होते. तर पर्णकृटीसारखी अद्यावत सुखसोईनी युक्त असलेली बंगली होती. आता या बागातून कचरा, कोंबड्यांची खुराडी, सगळीकडे उकिरडा आणि घोटीव दगडाच्या एके काळच्या प्रेक्षणीय भितींवर शोण्या लावल्या जात आहेत!

बालपणी अनुभविलेले शांत, लोभस, सुख-समृद्धीचे वातावरण अजूनही आठविले की जुन्या स्मृतींमध्ये मन रंगून जाते. भोर संस्थानच्या आखत्यारीमध्ये रोहिडा अथवा विचित्रगड, राजगड, तोरणा, सुधागड सारखे इतिहास प्रसिद्ध किल्ले, आंबवडे, बनेश्वर सारख्या देवराया, रायेश्वर सारखे महाबलेश्वर पेक्षाही मोठे असे ४५०० फूट उंचीवर पसरलेले विस्तीर्ण पठार यांचा समावेश होता.

हिडोशी-वरंधा-रायरी भागामध्ये लहानपणी अनेकदा मी फिरलो आहे. निरा नदीच्या उगमाचे ठिकाण, हिडोशीचा परिसर आणि वरंधा घाटामधील डोंगर पूर्वी दाट झाडीने भरले होते, हे आता सांगून देखील खरे वाटणार नाही. या निबिड अरण्यात अनेक जातीच्या वन्य पशु-पक्ष्यांची वर्दळ होती. ससा, भेकर, सायाळ, घोरपड, कोल्ही तर नेहमीचेच प्राणी, या शिवाय मध खाण्याच्या मागावर असलेली अस्वले, बिबळ्याचा वाघ आणि क्वचित प्रसंगी ढाण्या पट्टेदार वाघाचे आगमन होऊन गुरांचा फडशा पडण्यास सुरवात झाली की कडेपठारावरील ठाश्याची बंदूक असलेल्या धनगराला सांगावा जावयाचा आणि अगदीच नाईलाज झाला तर संस्थानी पोलीस अधिकाऱ्याकडे तक्रार व्हावयाची. क्वचित प्रसंगी माणसावरही हल्ला झाल्याच्या बातम्या यावयाच्या. शिकार केलेले भले मोठे पट्टेदार वाघ बांबूवर उलटे टांगून राजेसाहेबांना दाखविण्यासाठी राजवाड्यासमोर एक प्रदर्शनीय वस्तू म्हणून आणावयाचे. हा प्रसंग बघण्यासाठी पंचक्रोशीतील लोक मोठी गर्दी करावयाचे.

डोंगरमाळावरील निबिड अरण्यात दिवसाढवळ्या फिरण्यास भीती वाटे. हिडोशी गावाचे नाव घेतले की त्या काळात या परिसरात वाढणाऱ्या हजारो, डौलदार हिरव्यागार हिरडा (*Terminalia chebula*) वृक्षांची आठवण येते. दिपवाळीनंतर फळे पिकण्याची वेळ आली म्हणजे प्रत्येक झाडाभोवती वाढलेले तण, काटेरी रान स्वच्छ करण्यात येत असे म्हणजे जमिनीवर पडणारी हिरडाफळे चटकन गोळा करता येत. त्या सुबत्तेच्या काळात प्रत्येक पायलीमागे २०-२५ पैसे मिळत व प्रत्येक झाडामागे १५-२० रुपयांचे उत्पन्न मिळे. संस्थानी काळात नोकरदारास सुरुवातीचे पगार ५०-६० रुपये असावयाचे. त्या मानाने ही रक्कम चांगलीच होती. झाडतोडीबद्दल संस्थानी कायदेही फार कडक रीतीने अंमलात आणले जात असत. आंबा, फणस, साग, आवळा, हिरडा इ. वृक्षतोडीवर संपूर्ण बंदी होती. विशेषतः हिरडा वृक्षाला फार मोठे महत्व दिले गेले होते. हिरडा विक्री ही एक संस्थान महसुलाची मोठी बाब होती. डोंगरी भागातील जमिनीत राब करताना जरी हिरडाचाचा मोहोर जळाला तरी सरकारी चौकशी व्हावयाची. मग लाकूडफाटा तोडणे तर दूरच. हिरडा गोळा केल्यानंतर तो बाहेर विक्रीसाठी पाठविताना दर पोत्यामागे एक रुपया संस्थानी रॉयल्टी आकारली जात असे. हिडोशीच्या परिसरातून अशा रकमेचा महसूल

लाख दीड लाखाचा दर वर्षी होत असे. स्वातंत्र्य प्राप्तीनंतर १९४८ मध्ये संस्थाने खालसा झाली तेव्हा लोकांची वृत्तीच पालटली. पूर्वीचं मिळेल त्याच्यात सुख समाधान मानून त्यातून काही बचत करावयाची हे धोरण संपले. संस्थानी आणि पर्यायाने ब्रिटीश कारकीर्दीचा आदरयुक्त कायदा पाळण्याचा वचक संपला. लोभी वृत्तीने उचल खाल्ली. सूड, द्वेष या नावाखाली निसर्ग संपत्तीचीही आडदांडपणे लूट होऊ लागली.

हिरड्याचे लाकूड वजनात जास्त, संध, धूर न होता जळणारे, उष्णता अधिक देणारे म्हणून त्याला मागणी जास्त. संस्थानी राजवट संपल्यानंतर व्यापाऱ्यांची लोभी दृष्टी या चांगल्या राखल्या गेलेल्या जंगलावर गेली. राजकारणी लोकांना पैशाचे प्रलोभन दाखवून, गरीब, अडाणी शेतकऱ्याला दर झाडामागे ७०-८० रुपये रोख देण्याचे आमिष दाखवून हजारो झाडे तोडण्यात आली. त्याबरोबर इतर झाडोरा देखील तोडला गेला. काही वर्षांतच हिर्दोशीला हिरडा वृक्ष दुर्मिळ झाला. गावच्या परिसरातील डोंगर उघडे पडले. निरा नदीला एकदम पूर येऊ लागला. ज्या नाक्यावरून लाखाचे वर हिरड्याची पोती निर्यात व्हावयाची तेथे आता काही हजार पोत्यांचीच नोंद होऊ लागली. सर्व डोंगर साफ केल्यामुळे पहिली ३-४ वर्षे पिके उत्तम आली. नंतर भारी पाऊस पडल्याने जमिन वाहून गेली व खडक उघडे पडले. आता हिरड्याचे उत्पन्नही तुटले. शेतकरी भिकारी झाले. शेतकरी आता सोन्याची अंडी देणारी हिरडा वृक्षरूपी कोंबडी कापली असा पश्चाताप करत आहेत. माणसांच्या लोभी प्रवृत्तीने अगदी हिर्दोशीच्या हिरड्याचा कोळसा हेच नाव आता रूढ झाले आहे. पूर्वी ज्या घनदाट झाडीमुळे स्थानिक जनतेला रोजगार, अन्न आणि निवारा तसेच बाराही महिने स्वच्छ पाणी मिळत असे तेथे उन्हाळ्यात पाण्याचे हाल होऊन अन्नान्न दशा असलेले गावकरी दुष्काळी कामाचे शोधात हिडत आहेत.

नाही म्हणावयाला अजूनही वरंधा घाटातील अती दुर्गम दऱ्याखोऱ्यातून बाराही महिने हिरवागार झाडोरा दिसतो. त्यावरून पूर्वी येथे सर्वत्र असलेल्या दाट जंगलाची कल्पना येते. वरंधा घाट ते रायरीचा डोंगर तर पूर्वी विविध जातीच्या वृक्ष वेलींनी समृद्ध होता. दुर्गादेवी डोंगर परिसरातील धूपरहाटात तर देवीचे वाहन महाभयंकर पट्टेदार ढाण्या वाघाची गस्त असते असा समज होता. घाटातून जाणाऱ्या कोणत्याही प्रवाशाचे लक्ष या देवराईकडे जाण्याचे कारण म्हणजे वृक्षांच्या गर्द राईतून एकदम आकाशाकडे झेप घेणारे विशाल पण डौलदार छत्रीदार आकार असलेले राळधूपाचे वृक्ष. (त्या वेळेच्या ६-७ वृक्षांचा समूह पाहिला की हिरव्यागार जंगलात निसर्गदेवतेचे हे राखणदार आहेत की काय असा भास होत असे.)

आता तेथे फक्त दोनच भयभीत झालेले राळधूपाचे वृक्ष दिसतात. पश्चिम भारतामधील जुन्या वनस्पतींची माहिती प्रा. कुकने सुमारे १०० वर्षापूर्वी लिहिली. त्या प्रसिद्ध ग्रंथामध्ये महाराष्ट्रात हा वृक्ष दुर्मिळ असून त्याचे फक्त एक झाड माथेरान परिसरात आढळल्याचे वर्णन आहे. महाराष्ट्रामध्ये एकमेव ठिकाणी असलेल्या या वृक्षांना खास संरक्षण देऊन एका स्मारकाप्रमाणे त्याची राज्य सरकारने देखभाल ठेवावयास पाहिजे. सुदैवाने या राळधूपाची बीजे जमिनीवर पडून त्याची झालेली अनेक रोपे या देवराईत इतस्ततः दिसतात. त्यांना संरक्षण मिळाले पाहिजे व काहींचे इतर योग्य ठिकाणी पुनर्वसन, लागवड झाली पाहिजे. या परिसरात सर्वत्र कोठेही न दिसणाऱ्या वनस्पतींच्या

अनेक जाती देवरायांमध्ये आढळून येतात. त्या सर्वांची नोंद व्हावयास पाहिजे.

देवराईच्या बाहेरील रान मात्र अगदी न्हाव्याने पूर्ण हजामत केल्यासारखे दिसते. शेजारील उघडा बोडका प्रदेश पाहून मन सुन्न होते. आता देवराईमध्येही घुसखोरी सुरू असून त्या मधील अनेक वृक्ष चोरून कापले जात आहेत. देवमहात्म्य आणि वनराई या संबंधी अनेक लोककथा या भागातील वृद्ध गिरीजन यांच्या मध्ये प्रचलित असून देवीचे उत्सव, नैवेद्य, दैवतांचे स्वभावविशेष, भक्तीला पावण्याचे प्रकार आणि मांडलेल्या देवमंडळासभोवती असलेली उपदैवते, इतस्ततः विखुरलेल्या प्राचीन ऐतिहासिक जिनसा यांचा जर कोणी सखोल अभ्यास केला तर शिवपूर्वकालीन महाराष्ट्रातील आदिवासी प्राचीन संस्कृतीचा मागोवा घेता येणे शक्य आहे. या देवराईचे नुकतेच वनस्पतीसंकलन करण्यात आले आहे. पहाणीत पूर्ण वाढ झालेल्या विविध जातीच्या वनस्पती जोमाने वाढताना दिसतात. अनेक रानवृक्षांची रोपटी जंगलातील भरपूर कुजलेला पाचोळा असलेल्या जमिनीत एकमेकाशी स्पर्धा करताना दिसतात. राज्यसरकारच्या रोप वाटिकांमध्ये तर फक्त काही मोजक्या सुबाभळ, निलगीरी, साग, इत्यादि ४०-५० वृक्षजातींची रोपटी मिळतात. इतर वन्य वृक्षांची रोपटी, बिया मिळवायच्या असतील तर देवराई खेरीज दुसरे योग्य ठिकाण सापडणार नाही. कडक उन्हाळाचामध्ये गुराढोरांना निवारा आणि पाणी फक्त देवरायांमध्येच मिळू शकते हे आता गावकऱ्यांनाही पटल्या-कारणाने अशा देवराया जर कोणी तोड करण्यास निघाला तर त्याला सक्त विरोध होईल यात शंका नाही. पंचक्रोशीत जर कोणी माणूस आजारी पडला तर तेथील स्थानिक वैदू किंवा भगत हमखास औषधी वनस्पती मिळविण्यासाठी देवराईकडेच धाव घेईल आणि जरूर तेवढीच वनस्पती काळजीपूर्वक काढेल. स्थानिक आदिवासी जनता देवराईला औषधी दवाखाना मानतात हे खोटे नाही.

हिडोशी जवळील धूपरहाटाची मालकी खाजगी वतनदार घराण्याकडे आहे. वतनदारीमध्ये देवस्थान म्हणून अजूनतरी हिस्से पडले नाहीत. या घराण्यामध्ये बरीच कुटुंबे आहेत. प्रत्येकाला असे मनोमन वाटते की जर आपण देवराई संबंधी वाटण्या केल्या, झाडे कापली तर वनदेवीचा कोप होईल म्हणून तो स्वतः देवराई तोडत नाही व दुसऱ्याला तोडू देत नाही. याचा दृष्य परिणाम म्हणजे ही देवराई अजूनही बऱ्या स्थितीमध्ये टिकून आहे. या भागातील दुर्मिळ वनस्पतींचे हे अखेरचे आश्रयस्थान असल्याने कोठल्याही परिस्थितीमध्ये ही देवराई टिकून राहिली पाहिजे. महाराष्ट्रात सह्याद्रीचे दऱ्याखोऱ्यातून अशा अनेक देवराया अजूनही अस्तित्वात आहेत. त्यांचे सर्वेक्षण करून योग्य देखभाल केली तर पुढील सह्याद्री पर्वतावरील वनराजीचे पुनर्वसन प्रकल्पात त्याचा फार मोठा उपयोग होईल. राज्य वनविभागाने यात लक्ष घालण्याची खास जरूरी आहे.

भोर परिसरात पूर्वी एके काळी निसर्गरम्य वनराजीने नटलेली आंबवडे गावाजवळील नागेश्वरीची देवराई, प्राचीन कालचे ऋषीमुनींचा इथे आश्रम असावा याची साक्ष देणारी होती. पण तीच देवराई माणसाच्या आपआपासातील भांडणे, लोभामुळे सर्व नाशापूर्वीचे आचके देत मृत्यूची वाट बघत आहे असे खेदाने म्हणावे लागते. संस्थानी काळात खुद्द पंतसचिवांची या देवराईवर खास नजर व योग्य देखभाल होत होती. देवराई सभोवती अजिबात वस्ती नव्हती. भोर संस्थानचे मूळ पुरुष शंकराजी नारायण यांची समाधी या

परिसराजवळच असल्याने तेथे चांगला बंदोबस्त आणि अधिकारी लोकांचा सारखा राबता असे. समाधीचे आवारामध्ये बरेच वृक्ष, जवळच फरसबंद जमीन आणि शांत वातावरण असे. नागेश्वर मंदिरामध्ये लांबून येणाऱ्या श्रद्धालू भाविक, वाटसरू यांचे साठी साध्या जेवण्याची सोय आणि अन्नछत्रही होते. जवळच असलेल्या डोंगराच्या कुशीत वसलेले इतिहास प्रसिद्ध जेधे वतनदारांचे आंबवडे गावातील ग्रामस्थ खाऊन पिऊन सुखी, सालस, सरळमार्गाने जाणारे, कायद्याला भिणारे असे होते. संस्थानच्या राजाबद्दल देखील आदरयुक्त दरारा होता. या सर्व तऱ्हेच्या संरक्षक व्यवस्थेमुळे ही देवराई फारच चांगली राखली होती. भोर संस्थानच्या प्रेक्षणीय स्थळांमध्ये आंबवडे गावाजवळील नागेश्वर मंदिर आणि देवराई प्रसिद्ध होती आणि दूरदूरहून अनेक पर्यटक या निसर्गरम्य ठिकाणाला आवर्जून भेट देत. सभोवती दाट झाडी असलेले नागेश्वरांचे मंदिर दुरून अजिबात दिसत नव्हते.

शंकराजी नारायण यांचे समाधीपासून नागेश्वर मंदिराकडे जाण्यासाठी जेव्हा २५-३० पायऱ्या उतरून प्रवासी खाली जात असे तेव्हा देवभेटीच्या आधीच निसर्गाच्या विराट आणि मनोहर आविष्काराचे दर्शन त्याला घडत असे. आकाशाला भिडणाऱ्या वृक्षांमध्ये ६-७ माणसांच्या कवेत न मावणारे असे सरळ वाढणारे आम्र वृक्ष अनेक होते. त्यामध्ये गोटी, शेंदरी, खोबऱ्या, शोपू असे बरेच प्रकार होते. वृद्ध गावकऱ्यांच्या माहितीप्रमाणे अशा काही वृक्षांना तर चांगल्या बहरात दहाबारा हजार फळांलागावयाची. आंब्याप्रमाणेच जांभूळ, करंज, चांदडा, नीव वगैरे वृक्षांचे प्रकार अहमहमिकेने जास्त उंच होण्याचे शर्यतीमध्ये दिसत. सगळ्यामध्ये बेहडा अथवा येहळ्याचा वृक्ष एखाद्या सम्राटासारखा दिसावयाचा. विस्तीर्ण आणि जवळ जवळ ४०-५० फूट सरळ उंच वाढलेले राखी रंगाचे खोड व त्यावर वाढलेल्या अजस्त्र फांद्या यांचा मनोहर आविष्कार बघता मान अवघडून यावयाची. निरनिराळ्या जातींचे वृक्ष पुरुषोत्तम एकत्र बघण्याचे भाग्य फक्त, देवराईमध्येच मिळावयाचे. अशा वृक्षांवर लटकणाऱ्या सुवासिक फुलांच्या कुसर, माधवलता अथवा गारंबी, वाटोळी, कांगोणी, ओंबळ वगैरे अजस्त्र, प्रचंड वेली आपली वेटोळी या वृक्षांसभोवती आवळताना पाहून मन आश्चर्यचकित होत असे. झाडावरील फांद्यांवर असलेल्या शेवाळाच्या थरामधून अनेक तऱ्हेची दुरून बांडगुळासारख्या पण निरुपद्रवी आमरी जातीचे (ऑर्कीड) अनेक प्रकार दिसत. वनराईची जमीन तर विविध तऱ्हेच्या झुडुपांनी दाट भरलेली दिसावयाची. त्यामध्ये नेऱ्याचे प्रकार, रानहळद, शतावरी, काळीमुसळी अशा अनेक वनस्पती आढळावयाच्या.

उन्हाळ्यामध्ये करवंदी, तोरण, आंबळुकी, मेकी यांची भरपूर ताजी फळे मनमुराद खावीत. पावसाळ्याचे सुरवातीला तर जंगलाचे भरपूर पाचोळा असलेल्या जमिनीत आंबे-जांभळाचा खच पडलेला असावयाचा. जवळ जवळ सगळी कुजून जात असत. दिवाळीचे सुमाराला बेहडाच्या फळांचा ढीग पडावयाचा आणि त्यामधील बदाम तर फारच चविष्ट लागावयाचा. आमचे आजोबा लगेच रागावून सांगावयाचे की बाळांनो असले बदाम थोडेच खा नाहीतर टमरेल घेऊन सारखे धावावे लागेल. डोंगरी आवळेही भरपूर असावयाचे.

घनदाट अरण्यामध्ये असलेल्या नागेश्वर देवस्थानाचे परिसरात प्रवेश केल्याबरोबर

एका अनोख्या, गूढ, भारलेल्या वातावरणात शिरत आहोत असा प्रत्यय येत असे. देवळाच्या सभोवतीचा परिसर विस्तीर्ण, फरसबंद आणि स्वच्छ. एका बाजूला वाटसरू, देवदर्शनासाठी येणारे श्रद्धालू यांचेसाठी कमानीदार ओवऱ्या होत्या. त्याचे जवळच अगदी थेट श्री क्षेत्र महाबळेश्वरची छोटी प्रतीकृती असलेल्या पाच कोनाड्यातून वाहत असणारा आणि नंतर गायमुखातून हौदात पडणारा पाण्याचा स्वच्छ प्रवाह होता. या जलकुंडाच्या सभोवती असलेल्या ओवऱ्यातील वातावरण अगदी शीत वातानुकुलीत असल्याचा भास होत असे. बाजूला एक पत्र्याची, स्थानिक ग्रामदेवता जनीआईची चंद्रमौळी झोपडी होती. गोरगरिबांची देवता म्हणून की काय देवळीची अवस्था दरिद्री होती. छोट्या प्रवेशद्वारावरची कागदी तोरणे, हळद कुंकवाचा सडा, मिणमिणती पणती हे या देवतेचे वैभव. हिचा नवसाला पावणारी देवता असा फार मोठा लौकिक अजुनही मानला जातो. इतिहासकार अभ्यासकांचे मते ही देवता फार पूर्वी येथे असलेल्या नाग जमातीची असावी. कालाचे ओघात ही जमात नष्ट झाली तरी त्यांची देवता अजूनही या स्थानी आहे. नागेश्वराचे प्राचीन शिवमंदिर हेमाड पद्धतीचे असून सभामंडप-गाभारा प्रशस्त आहे. सिमेंटचा वापर न करता कापीव दगड एकमेकांवर कौशल्याने ठेवून बांधलेले देऊळ म्हणजे प्राचीन स्थापत्य कलेचा उत्कृष्ट नमुनाच मानावयास पाहिजे. देवळाचे परिसरात निरनिराळ्या शिल्पाचे, लढाईत वीरगती प्राप्त झालेल्या शूर वीर सैनिकांचे वीरगळ इतस्ततः विखुरलेले आहेत. क्वचित सतीचे हात असलेले काही त्यामध्ये सापडतात.

आंबवडे देवस्थान परिसरात सचिवांच्या मूळ पुरुषाची समाधी असल्याने तसेच या निसर्गरम्य जागेचे पर्यटकांना आकर्षण वाटावे म्हणून बऱ्याच काही गोष्टी त्यांनी केल्या होत्या. या जागेतील इमला इमारतीची दुरुस्ती नीट ठेवली जात होती. सर्वत्र झाडलोट, स्वच्छता होती. देखरेखीसाठी पगारी नोकर वर्ग तेथेच राहणारा होता. शेजारील ओढ्याला तर बारमाही पाणी होते. पावसाळ्यात तर देवस्थान परिसर आणि रायरेश्वरच्या पंचक्रोशीचा संपर्क तुटे. गावकरी लोकांना वाहतूक करता यावी म्हणून अगदी थेट हिमालयातील लक्ष्मण झुल्यासारखा लोखंडी दोरावर आधारलेला झुलता पूल सचिवांनी बांधला. या पुलाच्या मध्यभागी गेले की भूकंपासारखे धक्के जाणवायचे. त्या काळच्या भोर संस्थानमधील हा बांधकामाचा एक उत्कृष्ट नमुना प्रवाशांचे मोठे आकर्षण ठरत असे. ओढा ओलांडाला की एका प्रचंड अस्ताव्यस्त पसरलेल्या वटवृक्षाचे दर्शन घडावयाचे. त्याच्या बुंध्याचा घेरच २५-३० फूट असावा. त्यावर पिंपळ, कडुनिंब, हे वृक्ष तर कुसर, कडूकांगोणी काटेरी तराटी यांची वसाहत झालेली होती. खारी, वांदरे, वटवाघळे इ. वन्य पशुपक्षांचा हा वटवृक्ष म्हणजे जीवनाधारच होता. झुलत्या पुलाच्या खाली खडकाच्या कपारीतून फेसाल पाण्याचा झोत १५-२० फूट खाली कोसळत असे. हे दृष्य तर फारच विलोभनीय होते. उन्हाच्या तिरीपीत तर त्यावर अनेक इंद्रधनुष्य दिसावयाची.

स्वातंत्र्य मिळाल्यानंतर संस्थाने खालसा झाली. कायद्याचा वचक कमी झाला. जुन्या काळच्या संस्थानिक सचिवांचा द्वेष व्यक्त करण्यासाठी आणि कोण कित्ती लुटतो याकडे सर्वांचे लक्ष लागले. या स्पष्टतः एके काळच्या वनराजीच्या वैभवाने गाजणारी, शांत आणि अति-रम्य असलेली ही देवराई मानवरूपी लांडग्याच्या तडाख्यात सापडली. देवस्थान विश्वस्थच बेफिकीर राहिले आणि कुंपणच शेत खाऊ लागले. दीर्घायु वटवृक्षाच्या पारंब्या

कापत राहिल्याने जसा वृद्ध माणूस मुलाबाळांनी सोडल्यामुळे हाय खाऊन मरतो त्या प्रमाणे तो कुजून कोसळला. आता शिल्लक आहे तो फक्त, मोठा पार आणि त्यावर असलेले वीरगळ आणि नागदेवताच्या प्रतिमांचे शिलाखंड. देवराईमधील अनेक वृक्ष या ना त्या कारणाने तोडण्यात आले. ओढ्याकाठच्या साधारण सपाटीवर उंच वृक्ष असलेले दाट जंगल होते ते शाळेतल्या मुलांना क्रीडांगण म्हणून साफ करण्यात आले. आता तेथे काही निलगिरीची झाडे कोणातरी पुढाऱ्याचे हस्ते लावण्यात आली आहेत. देवराई भोवती वस्ती वाढली आहे. पुणे-मुंबईकडे आढळणारी खोकी पद्धतीची अनेक दुकाने निघाली आहेत. जळणासाठी भरपूर लाकूडफाटा देवराईतून काढतात. देवराईचा मनुष्यवस्तीजवळचा भाग अक्षरशः उकिरडा आणि प्रातर्विधी करण्याची जागा झाली आहे. आता मंदिराच्या परिसरातील ओवऱ्यामध्ये प्राथमिक शाळा भरते. पूर्वी एकेकाळी नीरव शांतता, असलेला परिसर कलबलाटाने भरून गेला आहे. सगळीकडं कागद-कचरा आणि कावळ्यांचे साम्राज्य स्थापन झाले आहे. पाच कोनाड्यातून वाहणाऱ्या पंचगंगेची वास्तू लहान विद्यार्थी हौदाकडे जाऊ नयेत म्हणून गंजलेली काटेरी तार आणि बांबू यांनी बंदिस्त केली आहे. एके काळाचा, स्वच्छ पाणी वाहत असलेला ह्य परिसर आता अतिशय ओंगळ वाटतो. पूर्वी नागेश्वराचे मंदिर गर्द झाडीत होते आणि या प्राचीन वास्तूची कल्पना अगदी मंदिराच्या जवळ जाईपर्यंत येत नव्हती. तेथे आता अगदी रस्त्यावरूनही भकास झालेले मंदिर दिसते. मंदिराच्या योग्य दुरुस्तीकडे कोणचेच फारसे लक्ष नसल्या कारणाने कळसावर वड पिंपळासारखी बांधकामास धोका निर्माण करणारी झुडपे उगविली आहेत.

ग्रामपंचायतीच्या अखत्यारीमध्ये विश्वस्तांच्या ताब्यात असलेल्या देवराईला रम्य स्वरूप पुन्हा यावे असे कोणाही वयोवृद्ध ग्रामस्थांना वाटत नाही या बदल फार आश्चर्य वाटते. "हम सब चोर है" ही जर प्रवृत्ती असेल तर सरकारी पर्यावरण विभाग, वनविभाग यांनी चौकशी करून या आजारी देवराईला ताब्यात घेऊन हा अनमोल ठेवा एक राष्ट्रीय स्मारक म्हणून पर्यटकांना आकर्षक होईल अशी व्यवस्था ठेवली पाहिजे.

भोर संस्थानचे पंतसचिवांच्या खास देखरेखीखाली असलेली दुसरी देवराई म्हणजे पुणे-सातारा रस्त्यावर नसरापुर गावाजवळ असलेली बनेश्वर येथील शिवशंकराची वनराई. जर कोणाला देवराईचे खरे स्वरूप, तेथील वाढणाऱ्या विविध जातीच्या आविष्कारांचे दर्शन घ्यावयाचे असेल तर हमरस्त्याच्या जवळ असलेले बनेश्वरचे अभयारण्य दाखविण्यासारखे आहे. सिंहगड परिसरातून वाहात येणारा शिवगंगा या छोट्या नदीचा प्रवाह देवराई जवळून वाहातो. बनेश्वर या प्राचीन हेमाडपंती देवळाचा जीर्णोद्धार श्रीमंत पेशवे सरकारने केल्याचा उल्लेख आहे. देवळा सभोवती प्रशस्त बंदिस्त आवार आहे. गाभ्यामध्ये जवळ जवळ ८-१० फूट खोल जागी शिर्वालगाची स्थापना असून शाळुंका स्फटिकाची आहे. पिंडीच्या सभोवती वाहते पाणी आहे. सभागृह हेमाडपंती धाटणीचे असून त्यावर काही नक्षीकाम आहे. प्रवेशद्वाराचे बाहेरील ओवरीत एक भली मोठी पितळी घंटा आहे. चिमाजी आप्पा पेशवे सरकार यांनी उत्तर कोकणात पोर्तुगीजांचे विरुद्ध मिळविलेल्या विजयाच्या प्रतिकापैकी ही एक घंटा आहे. या मंदिराचे खास वैशिष्ट्य म्हणजे स्वच्छ अगदी तळ दिसते असे निर्मळ पाणी भरलेले दोन विशाल हौद. एकामध्ये हात हात लांब जाडजूड मासे संचार करताना स्पष्ट दिसतात. दुसऱ्या मोठ्या हौदात स्नान

करण्यास मुभा आहे. आणि तिसऱ्या हौदाचे पाणी भांडी, कपडे धुण्यासाठी वापरले जाते. मंदिराच्या परिसराबाहेर वाड्याचे जोते आणि काही अर्धवट उभ्या भिंती दिसतात. हे पूर्वीच्या राजवाड्याचे भग्नावशेष मानले जातात. काही भिंतींचे अवशेष एका नांदकीच्या वृक्षमहर्षीने आपल्या मुळांचे संरक्षण उभे आडवे आधार देऊन राखण्याचे प्रयत्न चालू होते. दुर्दैवाने गेल्यावर्षी या वृक्षाचा काही भाग आगीमध्ये भस्म झाला. ती हकीगत देखील स्थानिक लोक मोठ्या गंभीरपणाने सांगतात. वृक्षाला लागलेली आग काही दोन दिवस विझत नव्हती. रात्री तर वृक्षाच्या पोकळ फांद्यातून धुराचे व आगीचे लोळ बाहेर पडत तेव्हा असे वाटे की प्रत्यक्ष इतिहास पुरुष या भग्न अवशेषांचे संरक्षण करतो आहे. आता उरला आहे जळलेला बुंधा आणि अजूनही जुन्या भिंतींना आधार देत असलेली मुळे.

मंदिरा भोवती गर्द झाडी आहे. करंज, जांभुळ, कळंब, वावळा, उंबर, हेद, ऐन, बेहेडा इत्यादी सरळसोट वाढणारे वृक्ष इतरत्र फार क्वचितच इतक्या मोठ्या प्रमाणात आढळतात. या वनराईमध्ये ७०-८० फूट उंचीचे अनेक वृक्षपुरुषोत्तम आढळतील. येथे आजोबा मानला गेलेला एक विशाल पिपणीचा वृक्ष शिवगंगा नदीच्या काठाला डौलाने उभा आहे. त्याची भव्यता आणि वैशिष्ट्य अगदी दुरूनही दिसते. शिवगंगा नदीच्या पलीकडचा भाग मात्र खडकाळ उघडाबोडका आहे. त्याचे जवळच करंजाई देवतेचे झोपडीवजा चंद्रमौली ठाणे आहे. या देवळाचे आसपास प्राचीन काळी करंजाचे अनेक वृक्ष असावयाचे म्हणून करंजाई हे नाव पडले. पंचक्रोशीतील ग्रामस्थ आणि विशेषतः आदिवासी समाजाची ही ग्रामदेवता. देवीचा नेवैद्य वशात म्हणजे कोंबडी-बकरी असा आहे. अजूनही येथे भगत येतात, नवस-सायास होतात. एकेकाळी घनदाट अरण्याने भरलेली अगदी बनेश्वराजवळची करंजाई देवीची राई उजाड झाली आहे.

शिवशंकराचे बनेश्वर हे ठिकाण पूर्वी पंतसचिवाचे खास देखरेखीखाली होते आणि नंतर ते वनविभागाकडे आल्याने त्याची चांगली काळजी घेतली जात आहे. वनविभाग अधिकाऱ्यांनी हे ठिकाण पर्यटकांसाठी जास्त प्रेक्षणीय करण्याकरिता जंगलातील वृक्षांखाली वाढणारा काटेरी झाड-झाडोरा पूर्ण साफ केला आहे. त्यामध्ये वन्य वृक्षांची मोठी होणारी रोपटी नष्ट पावली आहेत. साफसूफ केलेल्या जमिनीवर रुंद पानांच्या गवतांचे चांगले कुरण केले आहे. मोठमोठ्या वेलीही काढल्या आहेत. त्या ऐवजी बोगनवेलीया, अलामेंडाचे वेल लावले जात आहेत. बॉटल पामच्या दुतर्फा रांगा लावल्या जात आहेत. जास्वंदीचे शोभिवंत अनेक प्रकार लावले जात आहेत. लहान मुलांच्यासाठी झोपाळे, सी-सॉ, पायाडे यांची मांडणी करण्यात येत आहे. असलेला झाड झाडोरा कापून तेथे विलायती झाडे लावणे, नैसर्गिक वाढणाऱ्या वनोद्यानाचे एखाद्या परदेशी बागेत रूपांतर करण्यासारखे आहे. त्यामुळे आपण शहराच्या एका शोभिवंत बागेत आलो आहोत असाच भास होईल. जंगल अथवा अरण्यात आहोत ही कल्पनाच येणार नाही. अजूनही येथील वनराजीचे सर्वेक्षण करून वनराईची मूळ स्थिती परत आणून सर्व सामान्यांना देवराईची ओळख आणि निरागस आनंद द्यावयाचा असेल तर पूर्वी तेथे असलेले पर्यावरण पुनर्स्थापित करावयास पाहिजे.

स्थानिक परिस्थितीचा नीट अभ्यास केला असता, पर्यटकांना गुलाब, बोगनवेलीयाचे ताटवे आणि मोठी हिरवळ असणे असे रुढीबंध असलेल्या बागेची कल्पना सोडून

प्राचीनकाली ऋषीमुनी रहात असलेल्या वनोद्यानाच्या कल्पनेचा आराखडा तयार करावा. सध्या येथे वाढलेले अनेक उंच वृक्ष आहेत. त्यांची नंतर जागा घेण्यासाठी त्याच जातीचे मध्यम आकाराचे वृक्ष पूर्वी सर्व झाडोरा नष्ट करताना काढले गेले आहेत. वनराईमध्ये विशेषतः जेथे मोकळ्या जागा आहेत तेथे अशा वृक्षांचे पुनर्स्थापन करावे. अजूनही खालील उपाययोजना एक मुदतपूर्व कार्यक्रम आखून अंमलात आणली तर देवराईचे मूळ स्वरूप कायम ठेऊन पर्यटक, देवाचे श्रद्धालू यांना एक तऱ्हेचा आगळा आनंद देता येईल.

(१) शिवगंगा नदी पलिकडील करंजाई देवीच्या परिसरातील जमिन ताब्यात घेऊन तेथे स्थानिक वाढत असलेले वृक्ष लावणे. पावसाळ्यात पलीकडे जाण्यासाठी धबधब्याचे दृष्य चांगले दिसेल असा छोटा, टुमदार पूल बांधणे.

(२) शिवगंगा नदीचे बाजूने विविध जातीचे बांबू, बोरू आणि वाळा गवताची बेटे लावावीत.

(३) दलदलीचे ठिकाणी वेखंड, माका, ब्राम्ही वगैरे औषधी वनस्पती लावाव्यात.

(४) पर्यटकांवर नियंत्रण ठेवण्यासाठी शुल्क आकारावे. प्रौढास रु. २/- व लहानास रु. १/-.

(५) बनेश्वर देवराईमध्ये पर्यटकांच्या करमणुकीबरोबर निसर्गप्रेमी जनतेला एका नैसर्गिक सृष्टीसौंदर्याचा आगळा अविष्कार बघण्याचा आनंद मिळावा. तसेच वनस्पती अभ्यासकांना महाराष्ट्रात वाढणाऱ्या निरनिराळ्या जातीच्या वनस्पती येथे बघण्यास मिळतील याची सोय व्हावी.

(६) अभ्यासक लेखकाकडून बनेश्वर देवराईवर सर्वांगीण माहितीचे विशेषतः वनस्पती, प्राणी यांची माहिती असलेले सुबोध पुस्तक प्रकाशित करावे.

डॉ. वा. द. वर्तक  
वर्तक वाडा  
शनिवार पेठ  
पुणे-३०

**Looking Back. . .***Dr V. D. Vartak*

Looking back I remember the childhood days spent in the little principality of Bhor south of Pune in the twenties of this century. I remember the lovely, sylvan surroundings of Bhor, the little town hidden in groves of trees and with its many gardens. In spite of the rudimentary sanitary facilities, the town was kept immaculately clean. I then take you to a ramble in the nearby hills covered by dense greenery & inhabited by numerous wild birds and animals. I look at the balanced exploitation of forest resources by the people and their religious sentiments which protected the 'Sacred Groves' dedicated to various deities. The salient features of the vegetation of these groves are then described and how they preserved many a rare plant. The need of protecting the fast disappearing indigenous plants, many of them of medicinal value, is emphasized. The avarice and greed of the population that once protected these plants is decried. Measures to protect our natural heritage from the deprivations of modern commercialism and its offshoot modern tourism are then discussed.

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## Ecological Society

The Society was founded in 1982 to promote research and education in ecology. Through research, the Society endeavours to study the impact of developmental activities on ecology; through education, the Society tries to make people aware of the implication of the adverse effects on ecology; and through field projects the Society proposes to set up model units where developmental planning and ecological conservation complement each other to better the lot of the people.

Members of the public are cordially invited to participate in the work of the Society by becoming a Wellwisher (life contribution Rs. 100), a Benefactor (life contribution Rs. 1000), or a Patron (life contribution Rs. 10000). Contributions in cash or kind are accepted. All donations are exempt from income tax. All the three categories of participants receive Society's Journal and are invited to programmes organised by the Society such as talks, film and slide-shows, seminars and symposia, field trips and excursions etc.

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