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Editor
Prakash Gole

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Greater flamingoes of
the Ujni Reservoir

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Attention Contributors

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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.
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Editor
Journal of Ecological Society

Foreword

Our Journal is now entering the 5th year of its existence, making it incumbent upon us to review what is going wrong and where, so that corrective steps can be taken to rehabilitate and if possible to revitalise the ecosystems. Maximum damage occurs in the fringes of cities where construction projects are being implemented on behalf of housing societies, or where highway projects are entering different phases of completion, or where industrial schemes are being inaugurated to create employment in 'backward' areas. Very often, it is these backward areas which still have vestiges of 'naturalness' left around them, where animal and bird life is reasonably undisturbed.

What we need is leadership in all segments of society—leaders among men, women and even children with the necessary awareness of what ecosystems are and how they can best be preserved. We have recently lost a youthful Minister of Environment who had the requisite spark and plenty of mileage to go. Let us hope that the new Government will find it possible to utilize her services in some other capacity but in the same field.

L.G. Rajwade
Chairman, Ecological Society

Journal of Ecological Society, Vol. 5, 1992

Food Security, Environment and Equity Issues

Kamla Chowdhry

Paper presented at the World Food Day on October 16, 1990 at FAO, Bangkok.

Food Security, Human Environment and Equity Issues

The first World Food Day was celebrated — no, not celebrated, since there is not much to celebrate about the increasing number of hungry people in the Third World countries — on October 16 in 1981. I presume the FAO which started this annual event wished to focus world attention on the emerging crisis in global food situation and to influence events in the direction of greater food security.

It is now almost ten years, since the first World Food Day deliberations took place; I wish therefore, to discuss the future of food security, especially in the Third World countries; the declining productivity of the earth because of increasing land and environmental degradation; and the widening gap between the rich industrialized countries and the poor developing countries, as well as between the rich and the poor within a given developing country; and the impact of equity issues on food security, human environment and development.

Future of Food Security

By the year 2000, world population would be more than 6 billion — it is now around 5 billion — and will require food and agriculture output some 50 to 60% higher as compared to 1980. With population growth pushing ahead of potential food production, the future in terms of food security and poverty related issues is likely to be grim. FAO estimates that 64 developing countries, out of 117, would be unable to feed their population adequately, and that 38 of these countries would be able to support less than half of their projected population.[1] The international debts are frightening to contemplate for developing countries.

An increasing number of human lives are being lost to hunger and malnutrition. According to the World Food Council, in 1988, the number of hungry people had increased 5 times faster in the 80s than in the previous decade. There were also more malnourished people in the 80s than in the 70s. Although the largest increase in the number of hungry people is in Africa, the majority of undernourished people live in Asia.[2]

Estimates of severely malnourished people range from 450 million (FAO) to a billion (World Bank). Experts agree that the absolute number of hungry people has never been so high and that these numbers are increasing.

According to UNICEF about 15 million children die of hunger and hunger-related diseases. Asia has 83% of all malnourished children under 5 in the world. In South Asia two-thirds of all children under 5 are malnourished. How much food is required to save 15 million children? Calculations by Susan George indicate that 15 million children would need just 3-6 million tonnes of cereals, a bare 0.002% of global harvests (i.e. 1556 m tonnes).

The total amount of food required to end global hunger is also fairly small. Based on FAO and IFPRI (International Food and Policy Research Institute) calculations only 15 to 20 million tonnes of cereals would be sufficient to end world hunger. In terms of world food production this is a small figure. The world, if it so desired could easily end this hunger. The problem does not seem to lie merely in global food production, but in North-South relationships, and the power of the North in serving its

own interests. At the national level too governments of the South have not paid sufficient attention to issues related to equity, justice and basic human needs consequently affecting hunger and food security.

The Problems of Equity

The rich countries, not quite 25% of the world population, consume between two-thirds and three-quarters of the world's food production. Their animals alone eat almost a third of all cereal grains harvested[3]. These widening disparities between North and South as the South Commission Report has stated are not merely due to economic progress but also due to an enlargement of the North's power vis-a-vis the rest of the world. The leading countries of the North now more readily use that power in pursuit of their objectives. The fate of the South is increasingly dictated by the perceptions and policies of governments in the North, by the multilateral institutions which a few of these governments control. Domination has been reinforced where partnership was needed and hoped for by the South.[4]

In most countries with serious food problems, at least one third to one half the population is landless or near landless. Land reforms introduced have not been implemented, with the result that 5 to 10% of the land-lords control 70% or more of agriculture land. Prevailing land tenure systems too demand exobitant rents and threats of eviction. Tribals and others dependent on forests for their survival are kept outside forests so that forest produce could be used for state revenue and industrial purposes. Unemployment and under-employment is high in most developing countries, and therefore, access to food is difficult. The consumption patterns of the rich and the poor vary widely, with seasonal hunger as part of at least half the rural population of landless and near landless.

At the international level too, there are serious problems of equity that makes it difficult for the developing countries to be self-sufficient and self-reliant in food. The 1980's decade has been characterised as a lost decade for the Third World countries. In their grim struggle against hunger, poverty, malnutrition and disease they seem to be slipping backwards. President Miquel de la Madrid Hurtado of Mexico, voicing the concerns of the Third World leaders, said, "The 1980s not only represent lost

time in terms of growth but backward steps have unhappily been taken. The South has been virtually kept out of the economic decisions that most concern it. Our raw materials are bought at prices that are less and less remunerative while products with higher value added find their access to international markets blocked by artificial obstacles sometimes with political overtones."[4]

The Nineties

The decade of the 90s in terms of food security will be even more grim than the decade of the 80s. FAO has predicted that annual growth in cereal production in developing countries would fall from 3.8% in 1970-85 to 2.6% in 1984-2000. This will mean that import requirements of cereals for the developing countries will increase from 55 million tonnes in 1986 to an estimated 96 million tonnes in the year 2000. This will also mean more dependency, more international debt, more destruction of natural resources and of course more hunger and poverty. As the Prime Minister of Malaysia pointed out, "Fifteen years later after the call for a new international economic order, we continue to find ourselves enmeshed in external debts frustrated by extensive and growing protectionism, bedeviled by fluctuations of commodity prices in favour of the developed countries of the North."[4]

Equity issues between North & South are not likely to be solved merely by the good-will of the developed nations. As the South Commission has pointed out, "The countries of the South are unfavourably placed in the world economic systems and they are individually powerless to influence these processes and institutions.[5] The South will need to organize itself for moving towards a new economic order which promises greater equity and justice. The South must learn to work together, to act as a countervailing force, to resist the moves of the dominant countries of the North in redesigning the economic system to their own advantage. The leaders of the South believe that "the South as a whole has sufficient markets, technology, and financial resources to make South-South cooperation an effective means for widening the development options for its economies. Intensified South-South cooperation has to become an important part of southern strategies for autonomous, self-reliant development."[6] Only when the South learns to speak with a united voice are there any chances of food security, of banishing poverty, and moving towards sustained economic growth.

Environmental Degradation : Loss of Food Security

All forms of environmental degradation adversely affect agriculture and food production in one way or another. *The State of the World Report* (1990) mentions that soil erosion has slowly undermined the productivity of about one-third of the world's cropland. Deforestation has added to soil erosion because of increased rainfall run-off. Deforestation also results in more frequent floods and droughts causing immense damage to crops and cattle. Deforestation can also alter the local hydrological cycle diminishing water tables for agricultural use. A recent study in Nepal showed that increasing deforestation meant long distances for collecting fuel-wood thus reducing the time the women could pay to agriculture resulting in further decreases of agricultural output in already marginal lands. Deforestation in the Himalayan watershed has resulted in massive landslides, whole villages with their agricultural lands being wiped out. Deforestation also means that cow dung and crop residues are used as fuel depriving soil of nutrients and organic matter that help maintain healthy soil structure and productivity.

Through the building of large dams and canals for irrigation, water-logging and salinity has increased affecting at least a fourth of the world's irrigated cropland. In countries like India and Pakistan, in many parts, half of their irrigated land over time has turned saline because of bad drainage. When productivity decreases on these saline lands they are abandoned as degraded lands. Victor Kovda, a Soviet agronomist, has calculated that about 1.0 to 1.5 m. ha of irrigated lands are abandoned, resulting in a loss of 2.4 to 3.6 m. tonnes of food annually.

Air-pollution and acid rain especially in the industrialized countries have also destroyed forests and damaged crops. Experimental data regarding the influence of the ozone hole and the resulting increase of ultra-violet radiation have shown that productivity of certain crops decreases (e.g. soybeans). The effect of global climate change is likely to be the most serious. There is the danger of low-lying areas being submerged as a result of the rising of the oceans. There is a real threat to islands

like Mauritius and Sri Lanka, and countries like India and Bangladesh, and other such areas around the world. Global warming will mean famines, flash floods and droughts. The exact magnitude of productivity losses is hard to predict at this stage, although it is clear from accumulating evidence that the productive capacity of the world will be seriously impaired.

The world's farmers lose an estimated 24 billion tonnes of topsoil each year. Conservative calculations by World Watch indicate that this means a loss of 21 million tonnes of grain production each year. In Australia Prime Minister Hawke said that "none of Australia's environmental problems is more serious than its soil degradation — over two-thirds of Australia's arable land". The Soviet Union too reports about the catastrophic decline in its soil fertility. India is reported to be losing 6 billion tonnes of soil each year.

Land degradation in many countries has also taken place because of excessive use of fertilizers and pesticides changing the soil chemistry and resulting in lowered productivities.

In developing countries increase in environmental degradation means increasing poverty. These two are related in a vicious downward spiral. The poor are forced to overuse common resources for survival; the resulting degradation of common resources further increases their poverty and problems of survival.

Degradation of land resources increases landlessness, rural unemployment, indebtedness, and exploitation of the weak. Efficiency and productivity suffers with such inequality. Also the whole social and community fabric collapses leading to social and political violence and instability.

The prospect for expanding land for agriculture especially in Asia is now limited. World's agricultural output kept pace with its growing population until 1950. However, land per capita has been declining since then, especially in developing countries. In India, cultivable land per capita has declined from 0.48 ha in 1951 to 0.26 ha in 1981. By the year 2000 it is likely to be around 0.14 ha per capita. World-wide the decline in grain area per capita was from 0.16 ha in 1980, to 0.14 ha in 1990, and to an estimated 0.12 ha in the year 2000.

In general, a tough decade lies ahead, in terms of food

security unless corrective steps are taken to reverse the environmental damage. Appropriate policies, institutional mechanism, political will, all will be required to protect soil, conserve the diminishing water resources and water tables, and reverse the tide of deforestation if food security for the next decade is to be realised. Lester Brown believes that the population and environmental trends in the world may mean that food emergency is inevitable.

Equity : a Challenge to Development

Three-fourths of the world population is from developing countries and accounts for more than two-thirds of the earth's land. Yet these countries live on the fringes of the rich industrialized nations without the benefits of prosperity, forced into subservient role by the international economic order dominated by a few countries of the North. Whereas the people of the North are affluent, the majority of the people in the South are desperately poor. Close to a billion people in the South are too poor to buy food. Whereas by and large the rich countries control their own destinies, this is not true of the poor developing countries where their destinies are vulnerable to external factors and institutions controlled by the North. Take for instance, the international debt situation. Julius Nyerere, the Chairman of the South Commission, pointed out "Creditors are strongly organised in their own interests; they constantly meet for discussions on debt questions and when confronted with individual debtors they work together. Debtors are unorganized — all this leads to creditors taking political advantage of their ignorance". It is only through a reform of the international system governing flows of trade, capital and technology, based on equity and justice that the developing countries can improve the life of their people.

In the trade negotiations in GATT the developing countries continue to face many discriminatory barriers to their exports to the powerful industrialized countries. In the Uruguay Round of discussions the grievances of the developing countries for a more equitable system were pushed aside.[4]

Many of the developing countries gained their independence in 1950s or 60s. The economies of these newly independent countries were fragile and fragmented. Centuries of colonial rule

and exploitation left them weak with not much of an infrastructure for development. Added to these difficulties were the international arrangements for world markets and economy which were designed basically to serve the interests of the developed countries, leaving the developing countries defenceless.

In order to get greater equity and justice in the international economic order, the developing countries have begun to realise that they must organise themselves — the Group of 77, the Non-Aligned Movement, and the South Commission are all efforts to fight collectively for a more equitable system for the South in the global economic order.

There are other questions of equity in relation to the poor Third World countries. Drugs, medicines, pesticides no longer relevant in their own countries are often dumped in the Third World countries. John Madeley, the editor of the *International Agriculture Development* in an article entitled *Britain and the Third World* wrote, "Britain has continued to use the Third World as a dump for pesticides, with British firms setting formulations that contain active ingredients (such as disulfoton and terbulos) which are either banned or severely restricted on health or environmental grounds in Britain and other countries."[7]

The dumping of toxic waste in Third World countries is yet another problem to be reckoned with in the context of equity, justice and human rights. There is also the concern relating to relocating polluting industries in the Third World to escape 'controls' in their own countries, and/or accidents such as the Bhopal gas leak case of a multi-national in India. Of course, all industrialized countries are not the same. There are economic, social and cultural differences among these countries as is the case in developing countries. They also differ in their approach to environment, equity and development issues and in their attitudes towards developing countries of the Third World.

The current domination of the developed countries must be replaced by a more equitable management of global affairs which satisfies the interests of the developed and the developing countries and requires the interdependence of the world's people. It has opened the doors for a dialogue, for a political accommodation. A common environmental crisis is moving

nations towards greater collaborative effort. The Montreal Convention on reduction of CFCs, the recent London meet on global warming, the forthcoming U.N. Conference on Environment and Development in 1992 are steps towards global decision-making and collaboration on critical environment and development issues.

Equity and Development

The equity dimension in the development process of Third World countries has also been very disappointing. After independence, and in a concern for speedy growth, development models were borrowed from the West and strategies were adopted which brought in modernization and industrialization but without ensuring equity, employment, or minimum needs of food, shelter or clothing — all goals which the developing countries aimed at, but remained unfulfilled.

In the search for food security, modernization of agriculture was given great importance. The Green Revolution, requiring irrigation, fertilizers, pesticides, access to credit, increased wheat production, but the beneficiaries were largely the big farmers. Although land reforms and land tenure systems were introduced these were not effectively implemented, with the result the rich farmers became richer and the poor farmers landless and more impoverished. In spite of modernized agriculture and the Green Revolution there are in absolute numbers more poor and hungry people than ever before. Forty years of development experience in India and without empowering people is hollow and meaningless.

Although 80% of India's population lives in rural areas and more than half of them are landless, unemployed and oppressed, the development bias in terms of investment, education and training and infrastructure development, supports the urbanized population. It is the urban sector that contains the intelligentzia, the articulate and the organised sector, as well as access to power and influence. Inevitably resources get diverted. Whether it is the Pay Commission, the posting of senior civil servants in rural areas, the access to roads and electricity, the price of milk and other agricultural products, it is the urban bias that wins. Forty years after Independence, a large part of rural India is without drinking water, without electricity or other

energy resources, without schools and health facilities, roads etc. India like many other developing countries has been two Indias — the modern, industrialized, urbanised India with living and consumption standards close to the Western nations, and the poor rural India with its hunger, poverty, unemployment, exploitation, disease and malnutrition. Unless measures of greater equity, of human rights, of dignity and self-reliance are pursued with passion, development will elude the poor countries.

The economic indicators of growth are flawed in a fundamental way; they do not distinguish between resource uses that sustain progress and those that undermine it. The over-use of resources by a few at the expense of others, whether of water, forests, land etc. are reflected as increases in GNP even though it increases the misery of many who are left bereft. In India in spite of the increases in GNP, in the 1960s, there were 17000 villages in UP plagued with water shortages. In 1985 they had increased to 70000 villages. In Gujarat in 1979 there were 3840 villages with water shortages, in 1986 there were 12250 villages thirsting for water. Placing too much confidence in the theory that growth would trickle down, they took little direct action to improve the productivity and raise incomes of the poor, or to ensure a less unequal distribution of land, water and energy, or other benefits of growth such as infrastructure and services of health, education, etc. The consequences of such development are evident. Inequalities and oppression tended to widen, as the economy grew and became more modern.

In most developing countries there is now a deep awareness of the limitations of 'borrowed' development strategies from the industrialized nations. The development of our countries will have to be largely fueled by our own resources taking into account the social and cultural realities, with emphasis on equity and people-centred approaches. Depending on developed countries cannot be counted on for they are likely to take political-economic decisions in their own favour, unless there is a radical change in the international economic order and in the 'minds of men'.

Rethinking the Future

According to Lester Brown, world grain harvest increased 2.6 fold between 1950 and 1984. But between 1984 and 1989, overall production rose only by 1%. Lester Brown predicts that in the decade of the 90s, whereas, population growth is likely to increase by 2%, net increases in grain output are likely to be under 1%. This will mean world grain prices will rise, developing countries will need to import food at exorbitant prices, there will be further deterioration in the international debt situation, and in the resource base pushing developing countries further into hunger, poverty and malnutrition. Barring any dramatic technological breakthrough, or a new international economic order, or a change of value systems and life styles, the decade of the 90s presents a grim picture.

The Gandhian Way

There are enough studies, reports, accumulated data that seem to indicate that the world is moving in the wrong direction, and needs rethinking about its future. Mahatma Gandhi emphasized the moral principle in development. His priorities focused on the rural poor. He believed in denying oneself what could not be shared with the least. Mahatma Gandhi practised what he preached. He lived a life of austerity because as he said "He who has made the ideal of equal distribution a part of his being would reduce his wants to a minimum bearing in mind the poverty of India."[8]

Throughout the ages, philosophers and religious leaders have denounced the material way of life as a path to fulfillment. In the last two to three hundred years the use of science and technology has achieved materialism of a high order. Only now with growing awareness of the implications of industrialization and the global environmental crisis do we realize the price of such growth. As Lester Brown notes in his *State of the World Report, 1990* : "Because of the strain on resources it creates, materialism simply cannot survive the transition to a sustainable world. As public understanding of the need to adopt simpler and less consumptive life styles spreads, it will become unfashionable to own fancy new cars and clothes. This shift, however, will be the hardest to make. As the amassing of personal and national wealth becomes less of a goal, the gap between have and have-nots will gradually close, eliminating many societal tensions."

Mahatma Gandhi too believed in putting a voluntary curb on

material wants. Said Gandhi, "The mind is a restless bird, the more it gets the more it wants and still remains unsatisfied. Our forefathers knew that if we set our hearts on such things we would become slaves and lose our moral fibre."[8]

In a final sense sustainable development, removal of poverty hunger and inequalities, the improvement in quality of life are not merely the function of economic planning, nor of technological achievements, but stems from a moral force which does not accept hunger, the widening disparities between the rich and the poor, nor the over-exploitation of national resources. Sustainable global development will require more equitable sharing of resources, and voluntarily giving up consumptive life styles so that we can live within the planet's ecological resources.

The Green Party too advocates the reduction of consumption. In its manifesto it makes the following statement about the conflicting interests of the North and the South, "As long as our economy depends on increasing consumption it cannot create justice in international relationships. Control of the sources of raw materials and cutting the cost of transferring them to the rich world will always be the top priorities. Thus the poor will stay poor, children will continue to die of hunger, and Western governments will turn a blind eye on oppression, fraud and environmental destruction."

Petra Kelly, one of the leaders of the Green Movement said, "The actual danger as well as the potential solutions are not out there. Both lie within us". We can begin, she says, "by reducing our consumption of goods, take only our share of world resources and not take what belongs to someone else." She further stated, "a life style and method of production which rely on endless supply of raw materials, a lavish use of those raw materials, generates the motive for the violent appropriation of raw materials from other countries. In contrast a responsible use of those raw materials reduces the risk of violence."

Equity, non-violence, ecological living are based on simple life styles, and on a belief in *ahimsa*. These cannot be preached. They have to be practised and this is the great challenge before the environmentalists. Gandhi had said, "My life is my message". Can we do it? In a final sense taking responsibility for our personal behaviour is about the only thing on which we can have control.

The UNESCO Declaration that, "Since wars begin in the minds of men it is in the minds of men that defenses of peace are to be constructed" is equally relevant about poverty, environment and sustainable development issues. It is in the "minds of men" that radical changes will have to be made in order to ensure food security, equity and sustainable development. It is in the minds of men that issues of justice, human rights, 'apartheid' between the rich and poor, between North and South between men and women will have to be fought to ensure a better world.

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Comments

The writer is India's eminent management expert. When I read her article, the first thought that came to my mind was the failure of the theory and practice of management in promoting sustainable growth. The growth model that our management experts preach and profess probably accentuates inequitous growth.

In a starkly material world, it is not sufficient to appeal to the moral fibre of man, by preaching simplicity and abstinence in life styles. Even a moralist of the stature of Mahatma Gandhi

failed to bring about that change.

What we need is a rationally devised alternative model of growth. Devising such a model is not possible without a deep knowledge of ecology (biological and environmental inter-relationships) both in theory and practice. It is high time ecology is given its due share equal, if not more, to economics and statistics in national planning.

(Editor)

Ecological and Social Dynamics of an Irrigation Reservoir

Prakash Gole

Irrigation has changed the face of India's countryside. Dry riverbeds and stony uplands are replaced by sprawling reservoirs and farm greenery. Canals have brought water to parched lands and thirsty throats. Water is transported or lifted to drench soils in ravines and hill-tops. A large portion of the river basins and stream catchments now lies submerged.

When hundreds and thousands of hectares of land are transformed, it is bound to affect the ecology of innumerable life-forms that are or were the residents of the countryside. Also as the avowed aim of providing water is to bring about a change in peoples' lives, their activities bring about secondary and tertiary changes in the ecology of the countryside.

I was fortunate to get an opportunity to study these changes brought about by one of the largest irrigation reservoirs in Maharashtra. It is the irrigation reservoir created by a dam near Ujni village in Solapur district on the river Bheema. As a part of the centrally funded project, I am carrying out ecological and socio-economic surveys of non-human and human beings on the periphery of the Ujni reservoir. Here are the preliminary results of the work we carried out between June 1990 and March 1991.

The Project Site

The Project began in June 1990 on a site about 1 Km. to the east of the resettled Kumbhargaon village (Lat. 18°25 N Long. 72° E) on the peripheri of the Ujni reservoir (see map). To the east of the project site lies the resettled village Dalaj No. 2 (Nos. 1 & 3 are further east), to the north lie the resettled villages Khanota and Chincholi and to the south runs the road between Pune and Solapur (NH 9).

A major portion of the project site except a 25 metre x 100 metre strip to the south, falls in the submergence area of the reservoir and is under water for a varying period during the year.

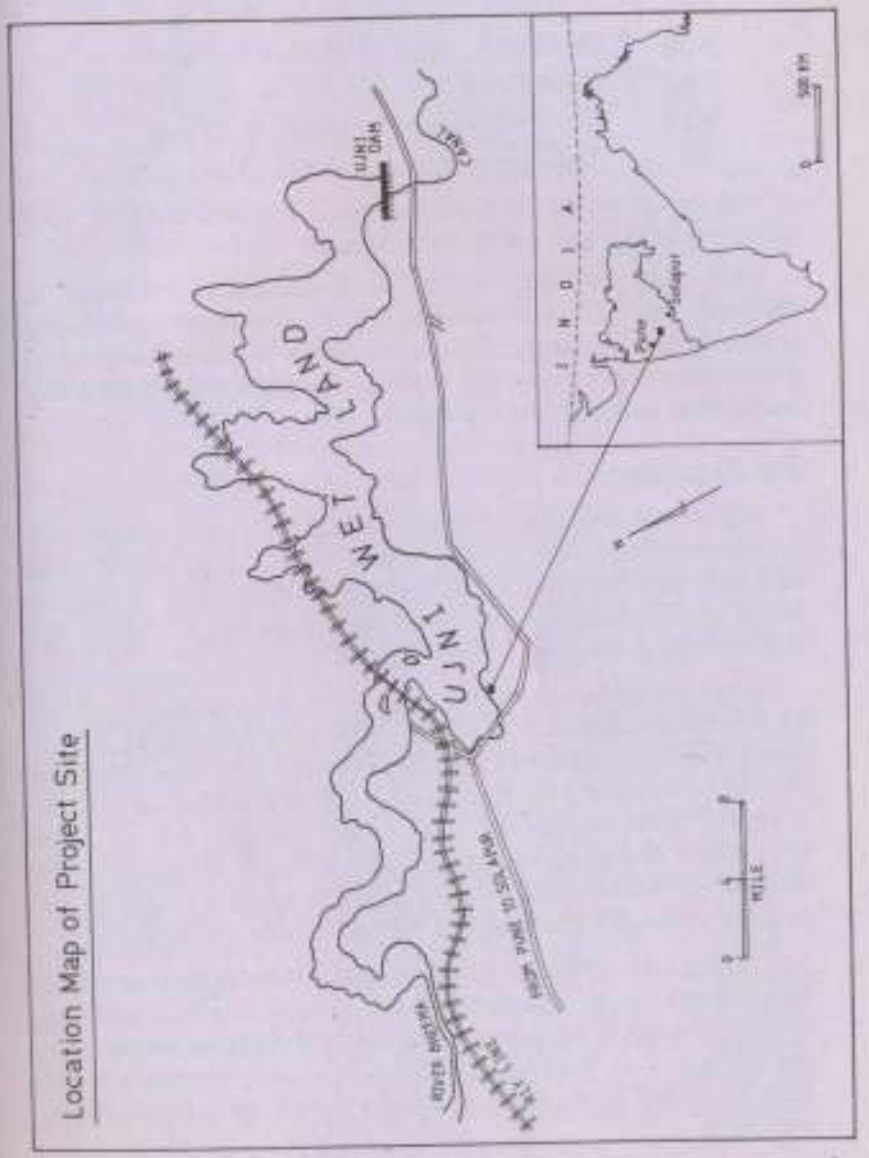
The site is on land that gently slopes in the direction of the river basin. The soil is gravelly, impregnated with *Murrum* overlying a more or less weathered basaltic base. To the south of the site a low hill jutting about hundred metres above the surrounding plain runs east-west towards Kumbhargaon where it is joined by another spur running south to north.

The rest of the land between the hill and the reservoir around the project site, is under cultivation.

The Reservoir

The reservoir was formed when a dam on the river Bheema (a major tributary of the Krishna river) was completed near the village Ujni (Lat. 18° 04" N, Long 75° 07" E) in June 1980 in the Solapur district of Maharashtra. The catchment area of the dam is 9766 sq km. with gross storage capacity of the reservoir being 3140 million cubic metre divided into 1440 mcm³ of live storage and 1700 mcm³ of dead storage. The inflow into the reservoir comes from the river Bheema and its tributaries. There are a number of dams on these rivers upstream of the Ujni dam and the level of the Ujni reservoir begins to rise when the flood waters are released from the dams upstream. There is a difference of only 5.80 metres between the full reservoir level and the maximum draw down level (496.83 m and 491.03 m) showing that much of the reservoir is not deep.

The average annual rainfall recorded at Bhigwan 10 kms west of the Project site is 500 mm. The major portion of the rainfall is derived from storms that burst in the pre-monsoon period



Location Map of Project Site

(April-May) and in Sept.-Oct. 28 mm of rain was recorded in May 1990.

The total rainfall between June and October 1990 at Bhigwan amounted to 437.50 mm, distributed as follows :

June : Total rainy days 7, rainfall 79.10 mm.
July : Total rainy days 10, rainfall 18.7 mm.
Aug. : Total rainy days 16, rainfall 156.7 mm.
Sept. : Total rainy days 7, rainfall 48.30 mm.
Oct. : Total rainy days 6, rainfall 134.50 mm.

The rainy season in 1990 extended till mid-October with storms bursting and enhancing the total.

The maximum and minimum temperatures recorded at Bhigwan are 35°C to 41°C and 12°C to 30°C in April and January respectively. The large difference between maximum and minimum temperatures coupled with low humidity make for a dry tropical climate most of the year.

The Vegetation

The dryness in the atmosphere coupled with sparse and erratic rainfall and the intense heat of the sun especially during summer tend to produce a xerophytic vegetation climax. A series of sub-climaxes dominated by shrubs and grasses is the result of the influence of biotic factors.

Before the dam was built the tree cover used to be dominated by *Acacia nilotica* and *Azadirachta indica* with *Tamarindus indicus* planted on road sides and *Vitex negundo* and *Pongamia pinnata* in moister places along the river and streams. *Ficus benghalensis* and a shorter local variety of *Ficus* could also be seen on field boundaries and along the roads and in villages. When a portion of the Pune-Solapur road was submerged under the reservoir, a number of large Tamarind and Neem trees had to be felled.

Grazing and cutting of wood for fuel, timber and other needs were identified as the main biotic factors. Dryland farming which reduces the total vegetation cover and exposes the soil to the elements all through the dry season, i.e. almost 9 to 10 months of the year, must also be counted as a major biotic influence.

Not all the area however, was under dry farming before the dam was built. Water was lifted from the river by means of electric pumps to irrigate sugarcane, wheat, gram. A number of lift sites and pipe lines carrying water had to be abandoned when the reservoir water engulfed them.

The shrub layer was formed principally of *Zizyphus* and *Capparis* species with heavily coppiced *Acacia* interspersed in between. Heavy grazing by cattle and goats and cutting for fuel have however, reduced the shrub layer at present to such non-browsable species as *Cassia auriculata, Tephrosia purpurea, Calotropis procera* and *Cryptolepis buchanani. Prosopis juliflora* has been introduced as alternative fuel-wood and has now invaded large areas. The residents now regularly coppice it for fuel.

With the advent of the moist conditions between June and September, a number of herbs and grass communities take shape dominated by *Indigofera linifolia, Tephrosia stigosa, Alysicarpus rugosus, Spermacos stricta,* and later in the season with winter setting in, *Leucas, Striga* and *Aerva* sp. come to dominate the scene. In tiny pockets where moisture is retained *Cynodon dactylon, Heteropogon contortus, Chrysophogon fulvus* and *Andropogon pumilus* take root on which cattle, goats and sheep graze. In land lying fallow can be seen *Opuntia dillenii, Xanthium Strumarium, Datura metal* and *Celosia argentea.* In the crevices of rocks and boulders sprout succulents consumed by cattle, goats and human beings too.

When the reservoir was formed fertile, deep soil lands along the river were submerged and cultivation shifted to light soils impregnated with *murrum* that lay away from the river basin and on hill slopes. These lands now formed the peripheri of the reservoir. Sugarcane which used to be grown on deep soils, was now introduced to light soils with wheat and groundnut as the rabbi (winter) crops. Dryland farming for cereals *Jowar* and *Bajra* continued in patches of poorer soils. Sunflower, pomegranate and roses also came to be cultivated. Water is even lifted to the hill-tops if soil cover is found to be adequate to grow sugarcane. Shevari or *Sesbania aegyptica,* was planted on farm boundaries for fuel and here and there *Azadirachta indica* and *Acacia nilotica* are left standing to be cut as timber. An occasional mango and *Leucaena leucocephala* planted around the new homesteads with

Ficus (local species) complete the vegetational scene at present.

Thus the vegetation cover today shows a paucity of woody species, high percentage of annuals and low of perennials showing less plant vigour and deficiency in diversity as the total number of plant species is low.

Outside the cultivated areas very little vegetation cover is apparent and utter desolation marks the landscape, as monsoon ephemerals wither and wilt in the intense heat.

Ipomoea carnii has invaded most of the shallow water areas and water edges. It is said to be propagated unintentionally by fishermen who tie its twigs to their nets as floats. These twigs are then discarded, take root and the reservoir and water edges are overwhelmed by this weed.

As the level of water in the reservoir begins to rise and areas free of water in summer begin to get inundated, aquatic and semi-aquatic flora begin to emerge. In deeper waters an aquatic community dominated by *Potamogeton crispus, Najas* and *Chara* takes shape. A semi-aquatic grass *Paspalum scrobiculatum* has invaded the reservoir since 1987 and is rapidly spreading. It grows tall and its stands and tussocks pop over the water surface where the depth of water is even 2.5 to 3 meters. This grass has also considerably reduced the occurrence of *Hydrilla verticillata* and *Vallisneria spiralis* which community dominated the waterspread till 1986.

Shallower waters are covered by an aquatic plant community whose principal components are *Ipomoea aquatica, Limnophyla indica, Phymbristylis sp., Eclipta alba* and *Baccopa monnieri*. Clumps of reeds such as *Cyperus triceps* and *Scirpus argenteus* remain rooted at places. Like the terrestrial realm, the aquatic realm at the project site exhibits low species diversity. The dominance of weeds such as *Paspalum* and *Ipomoea carnii* has proved inimical to the growth of a varied aquatic flora

Birds & the Habitat Pattern

The area of the water-spread seems to be the decisive factor in determining the habitat pattern.

1. When water reaches the full reservoir level (FRL) a narrow strip of shallow water is formed near the edge of cultivation. Emergent and floating vegetation comes to occupy various niches in this temporary marshland. Insects, especially water-skaters, invertebrates, beetles and even fish find food and shelter in the vegetation. Birds such as egrets, jacanas, storks and ibises are attracted and as winter begins hordes of Yellow wagtail forage among aquatic plants. In quieter time, especially during the noon, and in late evenings, ducks such as Common teal rest here and stilts, sandpipers, snipes and lapwings wade in the shallows searching for food.

   As certain tall trees are engulfed by the rising water level, temporary roosts become available to storks and ibises. Likewise *Ipomoea* clumps standing in water provide refuge to Great reed warblers, Purple moorhens and perches for Little cormorants.

   There is a great flush of aquatic insects such as Water skaters as water begins to inundate land.

2. Beyond this marshland lie shallow pools ranging in depth from 30 to 60 cms. As water stays at this depth this zone comes to be covered by emergents such as *Paspalum* and reed islands of *Cyperus* and *Scirpus*. Coots, Grey and Purple herons, moorhens, Cotton teals, Little cormorants, Spotbills, Brahminy ducks and Garganey teals frequent this zone. Besides aquatic insects such as *chironomous* larvae, seeds of grasses and sedges are consumed by birds. Herons and cormorants catch small fish which are found abundantly. From above, marsh harrier swoops down on unwary avians.

3. As water depth increases, away from land, stands of *Paspalum* become scattered and are replaced by mats of floating vegetation. These mats are formed in water 2 to 3 meters deep, the principal component of which being *Potamogeton* sp. and algae such as *Najas* and *Chara*. These attract coots and dabbling ducks such as Common teal, Garganey and Pintail with Spotbills and Brahminy ducks.

   Deeper waters are infested with fisherman's nets that sometimes trap coots and ducks. Here rafts of diving ducks such as Pochards and Tufted duck together with

Wigeons and Shoveller rest during the day and leave for their feeding grounds as dusk gathers. Gulls are attracted by debris from fishing boats and Ospreys and River and Gull-billed terns dive for the deep water fish. Sometimes a Laggar falcon and a Peregrine are found to be lurking on posts and structures such as inundated temple cupolas. Great stone plovers gather in small groups on little islands and other inundated structures looking for fish debris and insects, frogs etc.

4. Water level begins to recede as water begins to be drawn down for the rabbi crop season. As jowar and bajra ripen, munias, Baya weaver birds and Parakeets come to feed on the ripening grain. At the water's edge wagtails and Bluethroats flit through the semidry areas among stands of *Cyperus* and grasses. Jacanas probe in the spirals of *Ipomoea aquatica* and egrets and Pond herons jab for small fish, large insects and frogs.

   Another flush of insects heralds the beginning of winter and egrets, mynas, and babblers invade bushes and surround feeding cattle to grab mouthfuls of flies, midgets, grasshoppers etc. Wagtails do the same among grass tussocks and in low bushes.

   Flocks of Rosy pastors gather in acacia and neem trees to descend on ripening crops in nearby fields.

5. As water continues to retreat the emergent stands of *Paspalum/paspalidium* become the haunt of Purple moorhens. With much squabblings and mock fights territories are established and eggs laid in nests built inside dense growth of *Ipomoea carnii*. Some Spotbill pairs also nest in these clumps. As cattle enter the fast drying grasslands, Cattle and Little egrets, Glossy and Black ibis and Openbill and Whitenecked stroks search for food in the wet meadows.

6. As *Paspalum* and *Ipomoea* continue to invade, mud flats have shrunk. Where small areas of mud still exist Black-tailed godwit, sandpipers, Little stints and Little ringed plovers probe for food.

During the 1991 summer water continued to be high

inundating islands where River terns, Little pratincoles and Little ringed plovers nested in 1990. No nesting therefore, took place till late May. In early June unseasonal heavy rains flooded and washed away the nests of terns & pratincoles. *Ipomoea carnii* came to cover most of the islands too. There were no mud flats to attract Greater flamingoes who twice came in large flocks in February and March but went away for lack of suitable habitat. Even in May the water level was so high that flamingoes and other waders could not gather and we missed the spectacles of huge bird assemblages that made the site so attractive in May 1990.

This brief account highlights the salient features as well as the deficiencies in the available habitats. To begin from land, one is struck by the absence of large trees and other woody growth. This has deprived birds of roosting and nesting places. Likewise near the water's edge there is lack of cover of any sort except clumps of *Ipomoea*. These clumps though providing shelter and nesting sites for some species, do not provide food and insect life. They are also not much used as perches by birds. In the shallows the invading *Paspalum* has effectively curtailed the growth of other aquatic plants except *Cyperus* sp. The area of open water has also been reduced as *Paspalum* has spread even in waters as deep as 2 to 3 meters. Diving and dabbling ducks who used to rest near the project site in open waters have now retreated to open water areas in the middle of the lake. The growth of this grass and the high water-level in 1990-1991 excluded mud flats altogether. This has reduced the number and variety of waders on and around the project site. As marshy habitat is also restricted and is mostly occupied by weeds there is a restricted variety of marsh plants available in these habitats.

The Energy Transfers

When the reservoir was formed, the riverine biome began to be converted into a lacustrine biome. Formerly river was the main factor responsible for converting the sun's energy into biomass. The productivity was the highest during and immedi-

ately after the monsoon when the streams flowed with vigor and brought in silt, nutrients and seeds on which many life forms used to sustain. Water from the river was lifted to irrigate cash crops and the rich alluvium of the river was able to satisfy energy demands of a diverse biota.

In the post monsoon period the productivity declined gradually first and then rapidly as the dry season began. In summer the flow of the river itself became a trickle. A number of life forms either lay dormant or withered and died.

Before the reservoir was formed, the flow of water though limited in volume, promoted greater biological diversity. This was because irrigated agriculture could be practised on a limited area, the rest being under precarious rain-fed farming or allowed to lie fallow. The restricted human activity on these lands allowed scope for other life forms to thrive. Fallow and non-culturable waste lands promoted growth of grasses, herbs and shrubs which afforded food and shelter to diverse species such as the blackbuck and wolf among animals, bustard and sandgrouse among birds and a host of reptiles. Grazing by cattle and sheep was limited as their numbers were low. The practice of sheep and cattle migration as forage of one region was exhausted, permitted regeneration of flora and its exploitation by other creatures occupying other niches.

What happened when a substantial portion of the river basin and its surroundings was flooded, is shown in the accompanying figure. Nutrients released from the soil dissolved in water and a new food chain began. Each annual flood brought seeds, micro-organisms and detritus on which lacustrine life began to flourish. Fish, frogs, molluscs and crustaceans became the next trophic level. Macrophytes took shape in shallows and along the water's edge affording food and shelter to aquatic animals which in turn attracted waterfowl and animals like otter.

The outflow from the reservoir gave rise to another food chain. Water was lifted from the reservoir for irrigation and domestic needs. Irrigation crops began on light soil and even on upland as rich alluvial soils were submerged. Waste water from towns and villages flowed into streams and water channels and headed back towards the reservoir. The outflow from the canal distributed lacustrine life forms to lands further removed from the river basin.

When the reservoir was formed water became available in abundance and over an extended period of almost a year. 2 or 3 crops per year became routine. To that extent the habitats of other life forms vanished. Agriculture extended from tips of the water body to crests of the hills surrounding it. Even trees and bushes had to give way. The number of cattle increased but grazing lands shrunk. Stony uplands and lands under temporary submergence were left as the only areas available for grazing.

Though possibilities of fishing increased, the fish were not conducive to building up of food chains as they were imported from other river systems and even estuaries to be released annually and harvested as they grew. All the natural habitats necessary for spawning of riverine fish disappeared as bays and inlets and other shelter areas in the river basin came under the permanent sheet of water. Though shallow water areas attracted waterfowl, birds could not nest as nesting trees and bushes were scarce. Animals, reptiles and birds which were residents of barren and wastelands were driven away. Biological diversity declined and was replaced by a uniformity of habitat. Food chains became simplified and unidirectional. Much of the energy concentrated in cash crops and fish went out of the lacustrine eco-system as bulk of the produce was transported to the market to be consumed by outside agencies. Effluents from farms and villages and to a certain extent fishing practices became responsible for the spread of weeds that began to thrive in overfertilized waters. The weeds like *Ipomoea carnii* though providing nesting cover and shelter to certain birds, do not offer sustenance to other life forms and very little energy in the form of their detritus is put back into the eco-system.

Man and the Lacustrine Eco-system

How is man faring in the changed circumstances? A socio-economic survey of families from villages situated on the periphery of the reservoir brought out the following income distribution of the village families.

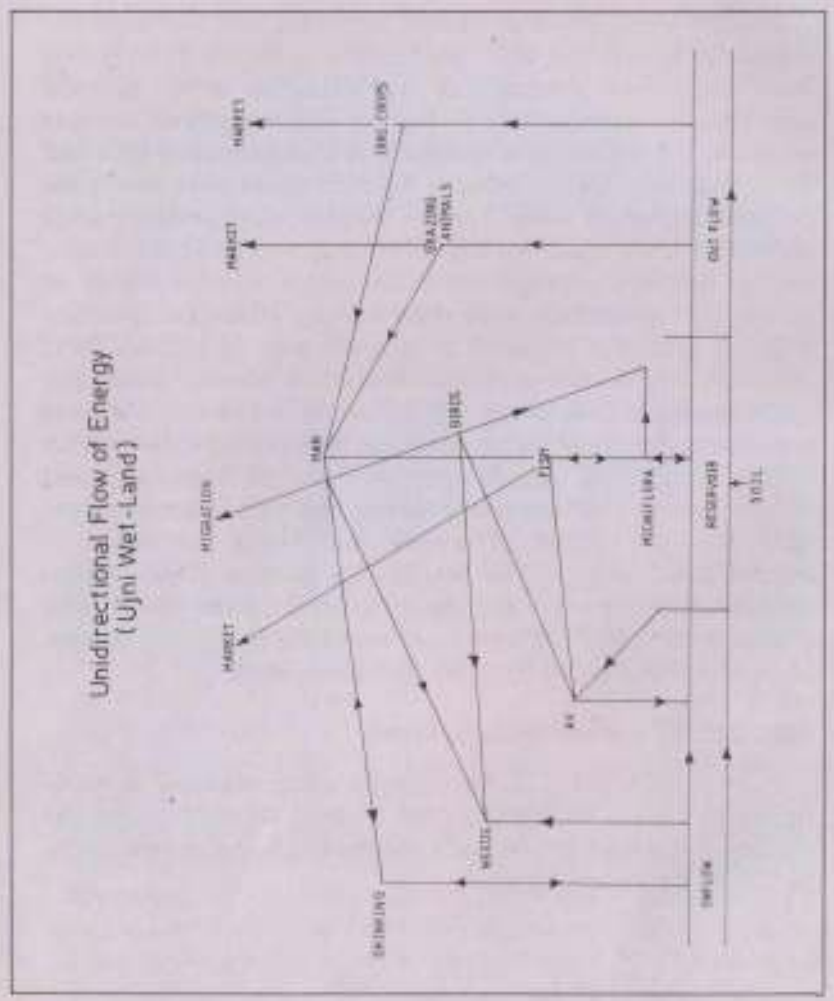


Table 1

Income Distribution of Families from Villages on the Periphery of the Ujni Reservoir

Income range (per month)	P.C. distribution of families from villages : Kumbhar-gaon	Bangar-wadi	Dalaj	Chincholi
0 to 1000	33.3	27.9	23.5	29.7
1001 to 2000	53.5	55.8	47.3	47.5
2001 to 3000	9.09	11.6	15.6	12.86
3001 to 4000	4.04	4.6	7.8	4.90
4000 & above	—	—	5.8	3.9
Total number of families	99	43	51	101

The table reflects the overall economic improvement of the village families as cash crops and fishing too have brought more cash in the pockets of the villagers. The number of families in the lowest income bracket is only about 25% of the total families interviewed in each village. All the villages have a substantial number of families in the middle income brackets. This prosperity is undoubtedly the result of the abundance of water available for cultivation and for satisfying other needs. But how far is this an increase in real terms? Are they in a better position to enjoy the fruits of modern civilization? If most common amenities that a modern civilization offers are : 1) independent piped water supply connection, 2) cooking gas, 3) electricity in the home and 4) possession of an auto-vehicle, how the village families fare in terms of these amenities? The next table shows the percentage of families from each village enjoying these amenities.

Table 2

Percentage of Village Families Enjoying Modern Amenities

Name of Village	P.C. of families enjoying				
	Piped water	Cooking Gas	Electricity	Auto-vehic.	No. Amenity
Kumbhargaon	Nil	Nil	26.2	7.0	67.0
Bangarwadi	Nil	Nil	20.9	2.3	76.7
Dalaj	Nil	Nil	50.9	19.6	29.4
Chincholi	Nil	Nil	49.5	7.9	43.5

The percentage of families that cannot enjoy any of these amenities is quite high in Kumbhargaon and Bangarwadi. None of the families in any of the villages can boast of an independent piped water supply connection. Piped water is available in Kumbhargaon and Dalaj but only through a few taps spread over the villages which are used in common by a number of families. People in Bangarwadi depend mainly on water supply from wells and all the residents of Chincholi had to haul water from the river.

Cooking gas remains a dream for the village families. For fuel, all families depend on Kerosene and biomass collected from farms, fallow lands, common pastures and wastelands. Families who cultivate sugarcane utilize waste material left in the field after the harvest as fuel. People who do not possess this source depend on collection of biomass from the wild to as much as 90% of their fuel needs. These families include those from the lowest income group as well as salaried people such as village school teachers, peons, policemen, forest guards, tractor drivers, petty shop-keepers, artisans and those who do not own any land. Their income does not allow them to depend wholly on kerosene. They have to collect biomass to satisfy 25 to 50% of their fuel needs.

On fallow lands, common pastures and wastelands, vegetation that can be used as fuel mainly consists of scattered stands of *Prosopis juliflora* which are extensively used by villagers as fuel. Social forestry plantations have been initiated recently near Bangarwadi and Kumbhargaon. They have yet to make any impact in satisfying the fuel needs of the local people.

Though fuel needs are satisfied to a certain extent by the locally available biomass, wood required as household timber or for making agricultural implements etc., is locally available to a much lesser extent. For these needs people have to depend on the market at Bhigwan 10 kms away. The high prices for any quality of wood in the market place this source beyond the reach of even the middle-income group families. Biomass in the form of usable wood (woody species) is therefore, an urgent necessity in the villages.

Scarcity of cattle forage also appears to be acute in the villages. More than a thousand domestic animals are owned by the families in the four villages surveyed so far. Their percentage distribution is given in the following table.

Table 3

Percentage Distribution of Domestic Animals in the Villages

Name of the Village	Total No.	Cow	Oxen	Buffalo	Sheep	Goat	Horse
Kumbhargaon	342	27.8	12.3	4.90	30.6	23.8	0.3
Bangarwadi	225	13.7	10.2	1.30	46.2	28.0	0.4
Dalaj	234	35.0	16.2	9.80	6.4	29.9	0.4
Chincholi	261	31.4	27.9	6.80	—	33.7	—

Cows, goats and sheep constitute the majority of animals in the villages. Not all the families however, own domestic animals. The next table shows the distribution of animal-owning families according to income per month.

Table 4

Name of Village	Income per month (Rs.)				
	0 to 1000	1001-2000	2001-3000	3001-4000	4000 +
Kumbhargaon	9	32	6	4	—
Bangarwadi	11	19	5	2	—
Dalaj	5	15	7	4	3
Chincholi	24	37	14	3	3
Total	49	83	32	13	6

Families owning animals belong to the low and middle-

income groups : those who have small land holdings and depend on animal produce for their livelihood. Many of these families own sheep and goats besides cows. But the number of animals per family rarely exceeds 5 in these groups. There are however, in each village a few families that own large animal herds numbering 30 to 70 animals in each herd. In Kumbhargaon the owners of such large herds come from the lowest and higher middle-income groups. In Bangarwadi also they are from the lowest and higher middle-income groups; in Dalaj they belong to the middle income group; while none of the families in Chincholi owns more than 10 animals.

For forage all animal-owning families report that they depend on the fodder from fields, meaning thereby common pasture, wasteland and area under partial submergence besides agriculture. Even the owners of large herds, though they posses large landholdings, pasture their animals on common sources. This is mainly because the main produce of their farms is cash crops such as sugarcane, sunflower, groundnut and wheat. Only a small portion of their land is devoted to production of cereals such as jowar and bajra, which produce cattle-feed after the harvest. Indeed the percentage area under cash crops in the total cropped area in each village is so large as to leave very little land for cultivation of fodder. The following table makes this point clear :

Table 5

Percentage of Area under Cash Crops in the Total Cropped Area in the Village

Name of Village	P. C. of land under cash crops
Kumbhargaon	75
Bangarwadi	82
Dalaj	70
Chincholi	90

The main source of forage for the cattle appears to be the post-monsoon flush of grass on common pastures, wastelands and fallow lands and *Paspalum* and other aquatic vegetation after the lowering of the reservoir level. In the dry season this latter source is the only forage available and animals tend to

concentrate on lands which have remained submerged in winter. Even in this area proliferation of weeds has severely restricted the quantity of forage. As the fodder available on agricultural lands is also limited, the pressure on common pastures can well be imagined. Development of grasslands, meadows, dry and wet, producing good fodder, is thus an urgent necessity.

Availability of electricity is better in villages situated near the main supply lines than in villages away from them. In Kumbhargaon and Bangarwadi, though rich farmers could afford to bring electric lines to run their lifts on the reservoir, they could not extend these to their homes located at some distance from the reservoir. Street light remains the main source of electric light to many families in these villages. Domestic electric supply still remains illusive for many a prosperous family from the villages.

High consumption of electric units or possession of gadgets run on electricity cannot yet become a mark of prosperity in these villages. The prestige symbol is then the possession of an auto-vehicle : a jeep, a motor-bike or even a moped. The greater availability of these vehicles in the market and loan facilities offered by banks and finance companies to buy vehicles have brought this amenity within reach of the prosperous rural families.

It appears therefore, that water though now available in plenty, has not led to greater production of biomass that will satisfy the basic needs of the people. Cultivation of cash crops has led to an increase in the cash income of rural families but without a parallel increase in real incomes. The market economy appears to be unable to meet the fuel, timber and fodder needs of the village families, neither is the social production of this biomass adequate for this purpose. The gap between the amenities available to the urban and rural middle and higher income classes, appears to be glaring.

It is therefore, urgently necessary to take steps that will lead to the generation of usable biomass for fuel, fodder and timber needs of the people. Obviously this can be achieved by enhancing the number and variety of primary producers. If a varied habitat pattern is established on the reservoir periphery not only

will it make usable biomass available within the village boundaries but it will also benefit the non-human creatures that are utilizing reservoir waters at present.

Usable biomass can be increased by restricting the hectarage under cash crops. Farmers however, may not immediately agree to do this. They will have to be convinced of the necessity of bringing about a varied landscape. Perhaps the experience in similar landscapes in other parts of Maharashtra may prove helpful. It indicates that persistent cultivation of sugarcane on light soils leads to salinity and water-logging. Horticulture, production of wood for timber and other needs, cultivation of better forage have to be propagated as alternatives as they facilitate better protection of soil and greater stability of income.

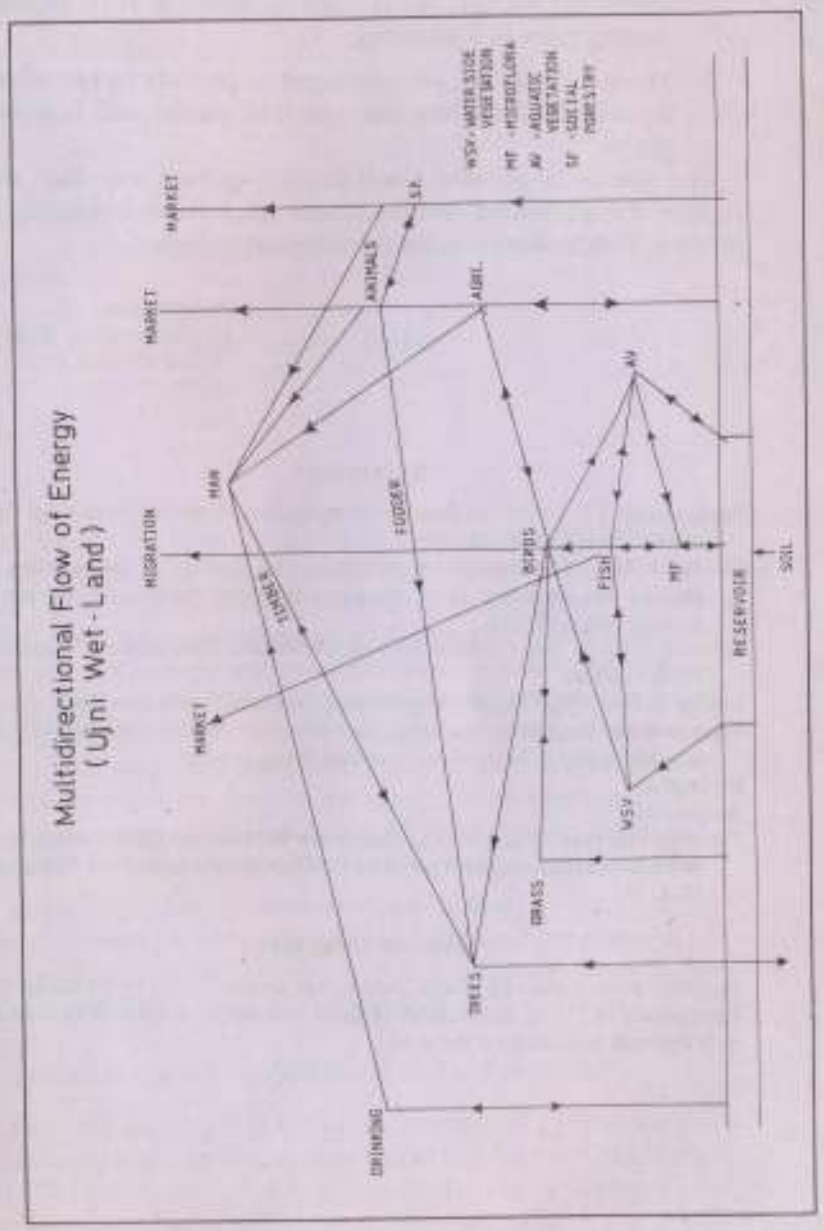
The water-edges at present lying without any vegetative cover or occupied by weeds need to be protected by suitable vegetation including aquatic and semi-aquatic plants, & grasses that will help reduce erosion at the lake periphery.

Likewise the area of partial submergence presently also occupied by weeds need to be made more productive by stabilizing the water-level at certain places, by improving the quality of vegetation and by offering shelter and breeding places to non-human creatures using the reservoir.

The Corrective Measures

With these objectives in view, the following activities are initiated as the project enters the second year of operation :

1. Farmers near the project site are being persuaded to plant horticultural and woody species instead of sugarcane or even jowar on light soils.
2. By Stabilizing water-level a wet meadow and an experimental marsh have been initiated on 1/2 ha of land. Beneficial aquatic vegetation such as *Acorus calamus* and *Pennisetum sp.* have been planted to improve the quality of aquatic vegetation.
3. Trees and shrubs that tolerate submergence are being planted on the water-edges. Such plants include *Salix tetraspermum, pandanus furcatus, Arundodonax sp.* and *Nerium odoratum.* Weeds are being physically removed.
4. Earthen mounds and islands are being provided in the



area of submergence for waterfowl use. They will be planted with *Acacia nilotica* trees and aquatic grasses as waterfowl shelter. As the acacia grows it may provide nesting trees to waterfowl.

5. These mounds are also expected to provide niches where aquatic life including fish can find shelter and breeding places.

The aim is to provide a self-sustaining food web that will replace the simplified unidirectional food chain operating at present. This is shown in the accompanying figure.

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Ron Sauey and the Siberian Cranes

Dr. George Archibald

On Christmas Day, 1986, while preparing a feast for his beloved family, Ron Sauey felt strange and confused. His parents lived nearby, and Ron called them and explained that he needed help. Soon after they arrived, Ron had collapsed into a coma. He never regained consciousness and he passed away January 7. He had suffered a cerebral haemorrhage, the consequence of the rupture of an arterial-venal mass that unknown to all, had been with Ron since birth. Such a mass is a time bomb that usually explodes between the ages of 35-40. Ron was 38. The loss of Ron leaves a void in the lives of the many who loved him, and it deprives our ravished earth of a gifted conservationist.

I write these details because many readers of this Journal knew Ron through his many visits to India and his research on Siberian Cranes at Bharatpur. Ron had a special place in his heart for India and his colourful circle of Indian friends.

The Beginning of the International Crane Foundation

Ron and I met in 1971 at the Laboratory of Ornithology at Cornell University in Ithaca, New York. Ron had just graduated with a Bachelor of Science from the University of Wisconsin in

north central USA. During his childhood at his home near Baraboo, Wisconsin, Ron had kept several species of pheasants, and at Cornell he hoped to pursue a doctoral degree through research on the biology of these colourful birds. That was, until he met me.

Cranes were my passion and my doctoral thesis is concerned with the evolutionary relationships of cranes as revealed by their remarkably loud calls. At Cornell, I had assembled 56 cranes of 9 species at a recently-vacated mink research farm that neighboured the Laboratory of Ornithology. The mink cages were sold. Small ponds were excavated and poultry netting fences erected to subdivide the compound into a series of enclosures for my valuable charges. The cranes arrived on loans from zoos. I lived in the vacated office building, a facility that provided winter shelter both for me, my Labrador retriever "Fuji", and the cold-sensitive African Crowned Cranes. I studied these captive cranes for three years.

During the autumn of 1971, I returned the cranes to zoos. I wrote my thesis, and prepared to depart for Japan to study the cranes in the wild. During those last few months at Cornell, I became friends with Ron Sauey and we volunteered to work together on a Sunday afternoon winter waterfowl census of Lake Cayuga.

Waves created by north winds hid many of the ducks and geese from our telescopes. That damp cold was so penetrating that we decided only to census from look-off spots readily observed from Ron's heated jeep. Finally, with a shrug we abandoned the census as an impossibillity and we resorted to a country pub.

By the time I had met Ron, all cranes except a pair of Wattled Cranes has been returned to the zoos. I had shown him these five-foot-tall giants from Africa. He was taken by the beauty of their white necks, red faces and long trailing gray and black wing feathers. That Sunday afternoon Ron expounded on the beauty of those two cranes and he added that considering the endangered status of seven of the world's 15 crane species, it was unfortunate that there was not a world centre for crane conservation. I agreed, but added that surely a branch of the United Nations was needed because cranes migrated across so many tense international borders.

In my make-shift facilities at Cornell, a pair of endangered White-naped Cranes reproduced, and in 1971 I hand-reared five chicks. I mentioned this success to Ron and he suggested that perhaps his parent's farm in Wisconsin could be used as a breeding centre for rare cranes. Within two weeks we were walking over the snow-covered fields of the Sauey's 65 acres along City View Road just north of Baraboo. I liked the farm and was attracted to the Sauey family. That Sunday afternoon chat in the pub in November, and our visit to Wisconsin in December 1971, precipitated our decision to establish a crane centre. In March 1973, the International Crane Foundation — the "World centre for the study and preservation of cranes" was incorporated as a nonprofit organization qualified to receive tax-deductible contributions from the general public. The generous Sauey family built 15 crane pens and rented ICF their farm for one dollar a year. Then the cranes began to arrive. A dream was becoming a reality.

Ron and I decided that ICF should have five major programs: research, public education, crane and habitat conservation, captive breeding and restocking. Over the past two decades since Ron and I met, ICF matured through a five-year volunteer stage (we had no money to pay staff), to a move to our own land, the growth of staff to 21 paid employees, a population of captive cranes including representatives of all 15 species, and field research and conservation programs with colleagues on five continents.

We were particularly interested in the Siberian Cranes—those great white cranes that breed on the Russian tundra and that once wintered from Iran to China. Little was known about the number and exact locations of the Siberian Cranes, few were held in captivity, and they had never successfully reproduced in captivity.

By importing several old Siberian Cranes, by artificially illuminating their enclosures to simulate the long spring days of their arctic nesting grounds, and by applying artificial insemination, in 1981, ICF achieved the world's first successful breeding of captive Siberian Cranes. As a safeguard against the possible extinction of Siberian Cranes in the wild, we helped setup a "species bank'" of these threatened Cranes at ICF headquarters

(6 pairs), Vogelpark Walsrode in Germany (2 pairs), and the Oka Nature Reserve in the USSR (8 Pairs).

Ron's Siberian Crane Research

Not long after we decided to found ICF, Ron abandoned his idea of studying pheasants and shifted his focus to the Siberian Cranes. Back in the early 1970s, the only known flock of Siberians was the group wintering at the bird sanctuary near Bharatpur in India's state of Rajasthan. Ron spent the winters of 1974-75 and 1976-77, and parts of other winters, with these cranes to document for science the details of the winter life of these elegant white cranes that traverse a 5000 mile migration between breeding grounds in the high arctic to winter on the Gangetic plain.

I especially remember Ron's account of the Siberian Crane's arrival at Bharatpur. Late one afternoon in November of 1977, Ron heard soft, flute-like calls floating down from the sky. White dots appeared, circling downward, dots that soon had black-tipped wings and long, salmon-coloured legs. On fixed wings, the great white cranes coasted rapidly earthward and, as if anxious to return to familiar turf, they plopped down in the centre of a large jheel. They looked exhausted and immediately began to drink. Some minutes later, after they regained their strength, they began to preen and then to probe in the mud in search of their favourite tubers.

For most of the next four months, Ron studied those 57 cranes from dawn to dusk. Ron was amazed at the Siberian Cranes dependence on shallow water, in contrast to Sandhill Cranes with which Ron was familiar in Wisconsin, and Sarus Cranes that were numerous in Rajasthan. During his two winters of observations, Ron seldom saw the Siberians walking on dry land, unlike the more adaptable Sandhill and Sarus that often forage on gleanings in upland agricultural fields. The Siberians' extraordinary long beak is used to probe in wet mud for the fleshy roots and nutritious tubers of aquatic plants. The Siberians were "tied" to wetlands, a bond that Ron concluded doomed Siberians over most of their former winter range in northern India where many wetlands have been drained for human use.

In winter the Siberian Cranes consist of unpaired birds, pairs

without chicks, and pairs with chicks. Ron was impressed by the strength of the bond between paired birds, and the care they lavished on their single cinnamon-brown chick. The chick was always near its parents and they frequently passed their youngster food items they excavated from the shallows. At night the flock roosted together on one of the larger jheels and at dawn, in small flocks and family groups, they dispersed to other wetlands in the sanctuary where they spent the entire day. Some pairs were highly territorial and would not allow other Siberian Cranes within their feeding area.

Ron was able to identify each family group by the variation in the brown plumage of the chicks. Upon arrival in autumn, the chicks were uniformly brown, except for their white wing feathers. However, during their four months in India, the brown feathers were gradually moulted, and by the time of migration in March, the chicks were predominantly white. However, the rate of moulting varied, and each chick was easily identified by its patterns of the brown and white feathers.

In mid-March, Ron witnessed the departure of the Siberian Cranes. They left in small groups over several days, and their departure came in mid-morning after they had fed and when wind thermals aided their ascent. Suspecting that the cranes migrated from Bharatpur to Afghanistan's Lake Ab-i-Estada, Ron flew to Afghanistan; with the kind assistance of US Ambassador Theodore Elliot, an expedition was launched to search for the Siberians. Ron was thrilled to find 56 Siberians, including the 8 families, probing in the shallows of Lake Ab-i-Estada. He was dismayed, however, that crane hunting was widespread in Afghanistan and nearby Pakistan, a practice that Ron suspected was the primary factor responsible for the steady decline in the size of the flock from 125 birds in 1965. When Ron passed away in 1987, 38 Siberian Cranes wintered at Bharatpur. During the winter of 1990-91, there were 10.

New Hope for the Western Siberians

The breeding grounds of Siberian Cranes in West Asia were discovered in 1981 by Russian ornithologist, Dr. Alexander (Sasha) Sorokin. He located several nesting pairs on wide wetlands on the basin of the Kunovat River, an eastern tributary of

the mighty Ob River that drains the lowlands immediately west of the Ural Mountains. During the 1980s, the numbers of pairs varied from 4 to 10, with more pairs present during years of high water.

In June of 1990, together with American ornithologist, Dr. David Ellis (of Patuxent Wildlife Research Center in Maryland), I had an opportunity to join Dr. Sorokin and his mentor, Professor Vladimir Flint, for a month with those Siberian Cranes. Life with close friends in that pristine wilderness, camped within a mile of the nest of a Siberian Crane, was one of the high experiences of my life. Our only regret was that Ron was not with us.

During those long subarctic days when the sun barely touched the northern horizon at midnight, and among a myriad of mosquitoes and occasional brown bears, we had plenty of time to strategize a plan to save the west Asian population of Siberians. There were two main problems to address: curbing the hunting, and increasing the number of cranes.

The Conservation Plan

Crane chicks migrate with their parents, and during that autumn flight they learn the migration route. Several years later, the young cranes return to their natal wetlands to breed. The remnants of the west Asian flock has the "knowledge" of a migration route unknown to other Siberians. Hunting along that route cannot be controlled until the migration path is known and public education programs targeted at problem areas. Satellite telemetry seemed the only feasible means of tracing the Siberian Cranes. Dave Ellis was the member of our wilderness team who had the required skills and equipment to implement such an ambitious program.

Dave's colleagues at the National Aeronautics and Space Administration (NASA) graciously provided three tiny radio transmitters capable of sending signals to a satellite. First, the technique would be tested using Common Cranes that also nested in the Kunovat Basin. With the help of Dr. Yuri Markin, three of these non-endangered cranes were captured and fitted with the battery-powered radio backpacks. NASA immediately began receiving messages from the cranes and throughout the

summer and early autumn, the movement of these birds was followed south along the Ob River and into the agriculture zone that borders the northern forest. Unfortunately, signals from two radios discontinued in early October, suggesting battery failure. However, the female Common Crane, Katya, was monitored to her wintering grounds along the Iran-Afghan border.

During the spring of 1991, Yuri Markin hopes to recapture the three marked Common Cranes to inspect the radio equipment and the effect of the backpack on the cranes. If all is well, improved radios may be saddled to several Siberian Cranes, thus revealing the mystery of their migration.

The second problem concerned the numbers of cranes. A way had to be found to increase the number of the dwindling flock before the "knowledge" of the migration route was lost for all time. Captive breeding of Siberian Cranes provided a hope.

In 1985, working at ICF, an ethologist, Dr. Robert Horwich developed an ingenious method for rearing Sandhill Cranes in captivity and releasing such birds with wild cranes. His chicks were reared in visual and vocal isolation from humans. Soon after we placed the chicks in a rearing pen, a hand puppet, resembling the neck and head of a crane, was extended through a hole in the wall, and the beak of the puppet manipulated food items while a tape recording of the feeding calls of Sandhills was played. A heat lamp over a stuffed Sandhill in brooding posture provided warmth and learning for the chick. As the chick developed and required more exercise, crane-costumed keepers led the birds through the fields and wetlands to strengthen their fast-growing legs and to teach them to feed on natural food items. After the chicks fledged, the costumed-parent disappeared and the chicks joined the wild Sandhills and successfully migrated with them to Florida. The following spring, five of the six cranes were back in Wisconsin. This historic experiment was subsequently repeated three times by Dr. Richard Urbanek, and the results have been consistently encouraging.

In 1989, Sasha came to the USA and observed Richard Urbanek's simple crane rearing setup on a field in Michigan's Seney National Wildlife Refuge. Why couldn't a similar facility be constructed within the territory of one of the pairs of Siberian Cranes? Hatching eggs could be imported from the three captive

flocks, the chicks costume-reared on the wetlands, and in late summer, with radio backpacks intact, the juvenile Siberians could be encouraged to join their wild relatives.

This is the very program underway in 1991. Mini Nagendran, an Indian ornithologist who developed costume-rearing for Siberian Cranes at ICF, is responsible for the crane rearing in the Russian wilderness. (See page 55.) In August, David Ellis and Yuri Markin will join her to attach satellite radios to her Siberian Cranes before they are released. If they join and follow the wild Siberian Cranes, the migration route will be followed by satellite, and the numbers of cranes in the dwindling flock will be increased.

Although the west Asian flock of Siberian Cranes is on the edge of oblivion, we have hope that the 1990s will witness the gradual recovery of the population as science opens new doors. Ron Sauey would be pleased that there is hope for the Siberian Cranes he knew so well.

Epilogue

As a tribute to their son and the values dear to him, Ron's parents, Norman and Claire Sauey, together with Ron's twin brother Don, have supported the construction at ICF of the Ron Sauey Memorial Library for Bird Conservation. Eventually, it will contain a growing collection of the world's literature on cranes and their habitats. Scientists will be invited to bring their data to ICF and write their reports. As well as raising cranes, ICF will be helping to create literature to guide future generations in helping these sensitive creatures survive the gauntlet of challenges to survival. Although Ron will always be remembered at ICF, I like to think of his spirit soaring with those white dots in the blue, wild and free, in an Asian sky with the blue waters of Bharatpur on the horizon.

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On Probable Sympatric Distribution of *Presbytis Geei* and *Presbytis pileata* in Bhutan

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Golden Langur (*Presbytis geei* Khajuria) has a limited distribution zone confined to a small area of Assam and Bhutan (Gee 1964). In Assam it is found in Kokrajhar, Bongaigaon (Choudhury, 1989) and Dhubri (Saikia *et al.* 1990) districts, where its east-west limits are the Manas and Sankosh rivers. Not a single record is there from north Bengal (west of the Sankosh River) or from areas in Barpeta district, east of the Manas river. Bulk of its range is covered by the core area and the buffer zone of the Manas Tiger Reserve. Inside Bhutan, near Assam border, it is also restricted to the west bank of the Manas river.

The Capped Langur (*Presbytis pileata* Blyth) on the other hand has a wide distribution in north-eastern India as well as Bangladesh and Burma. In Bhutan, it was an unrecorded species (Eudey, 1987). However, on 20 October, 1985 I observed a group on the high banks of the Manas Wildlife Sanctuary of Bhutan (Choudhury, 1990). This sanctuary is contiguous with Assam's Manas Tiger Reserve.

Inside Assam, especially in the Manas Tiger Reserve both the species are strictly allopatric, being divided by the Manas river (width at Mathanguri, c. 150). It is only from two small areas of

Bhairab Pahar and Kabaitari Tilla of Bongaigaon district that both the species have been reported to be sympatric (Mohd. Moosa, *pers. comm.*). Both these localities are towards west of the Manas and north of the Brahmaputra rivers, but are much south of the known main range of *P. geei*.

Inside Bhutan, in the upper reaches where the width of the rivers is less, *P. geei* is found on both the banks of the Manas river (Saha, 1980.) It is however, not known how far inside Bhutan the Capped langur occurs, but there is definite probability of overlapping distribution somewhere in the east-central Bhutan (Fig.1). Throughout its known range, the Golden langur is the only colobine monkey, whereas the Capped langur is partly sympatric in its southern range with the Phayre's Leaf monkey (*P. phyrei*), in southern Assam, Tripura, Mizoram and also perhaps eastern Bangladesh.

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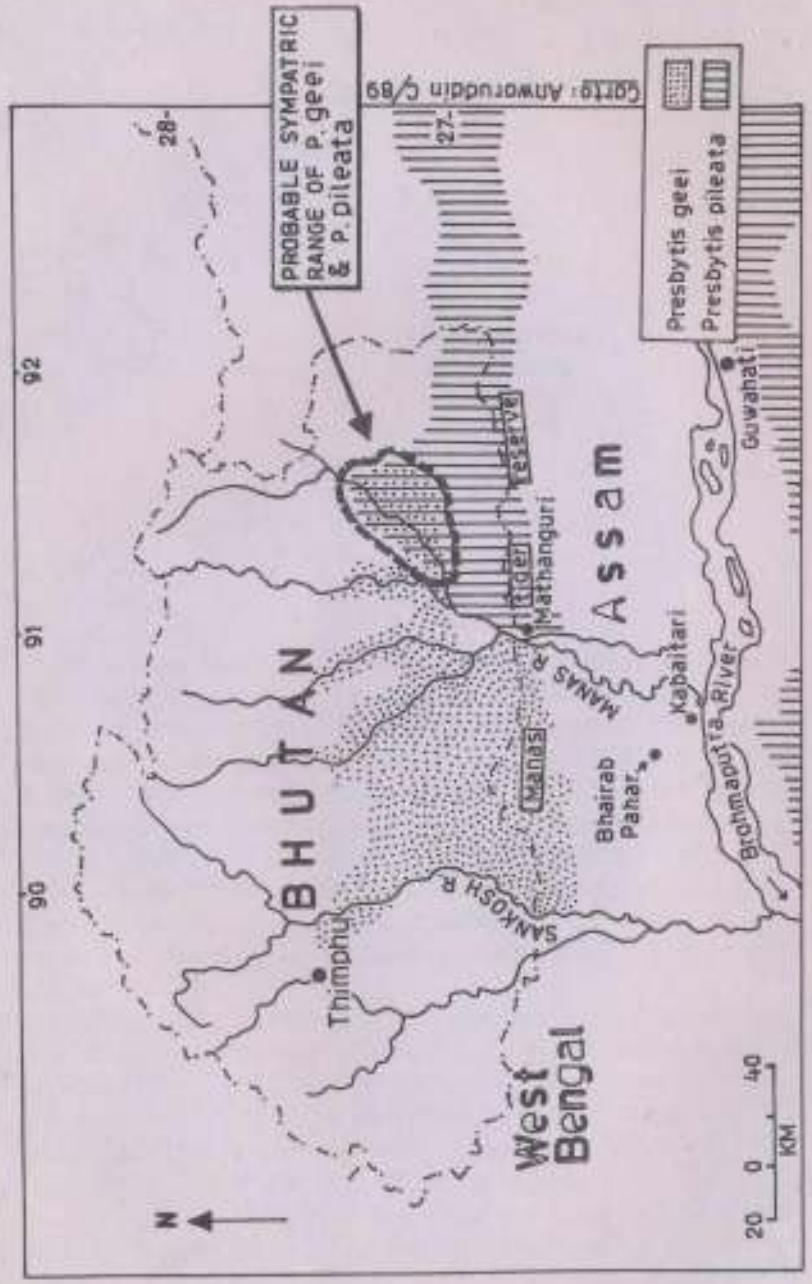

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Present Status of Wintering Geese in the Indian Subcontinent

Dr. J. C. Uttangi

Studies on Wintering Geese in India are meagre and unless the existing data and other available information on Geese, their northern and southern distribution, the number of species actually visiting our country, their foraging methods and time of foraging, diet preference, composition of flocks both feeding and migrating, their behaviour at roosting time, sex ratio and variation in number of young and adult, are tested, verified and redetermined by conducting large scale surveys and field studies scientifically, no satisfactory assessment or conclusions in respect of any one of the features or aspects referred to herewith can be achieved.

The question whether the cold weather immigrant, namely the White-fronted Goose, *Anser albifrons*, which is a rare visitor to Punjab, Sind and Cutch still winters in these regions, remains yet to be solved. Census lists on water birds prepared in recent years show that it does not occur. More extensive and systematic surveys only can firmly decide on this issue. Similarly, occurrence of one more rare species of goose, namely the Lesser White-fronted Goose, *Anser erythropus*, also called the Dwarf Goose needs to be determined. A survey to find the doubtful

Pinkfooted Goose is also wanted. As these forms mingle with other water birds like ducks and teals and select remote corners of large rivers and jheels they escape notice.

The only two species of goose that visit our country in large flocks today are the Barheaded Goose, *Anser indicus* and the Greylag, *Anser anser*. Both of them breed in central Asia and winter in the northern parts of India, including Punjab, Rajasthan, Uttar Pradesh, Orissa, Gujarat, Madhya Pradesh but, the Barheaded Goose prefers to move further down to south India and today it occurs in Karnataka, Tamilnadu, Andhra Pradesh but not in Kerala and along the coastal regions. The distribution of this species also needs study. The Greylag on the other hand is confined to colder parts of Northern India and is not reported so far from the south. This should be reexamined and confirmed. Census programmes recently carried out on the 12th and 13th Jan. 1991 in the districts of Dharwad and Bellary revealed occurrence of one large flock of 800 Barheaded Geese roosting in the Tungabadra dam and another flock consisting of 1000 geese was observed in a large jheel near Naregal in the Dharwad district. A rare association of 50 Brahminy ducks with Barheaded Goose in Naregal Tank was quite interesting to observe. Other adjoining districts in Karnataka are also likely to attract these graminivorous water birds and hence it is judicious to extend survey work to these areas also.

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Mini Nagendran Arrives with Rare Chicks in Siberia

Five chicks of the rare Siberian Crane have completed the last leg of their journey into the wilderness of western Siberia, where conservationists hope to release them into the wild to bolster declining populations of the species. The chicks started the journey in mid-May as eggs from captive breeding centres in the US, Germany, and the Soviet Union.

The "egg lift" was part of a last-ditch effort by an international team of Soviet, American, German and Indian researchers to save the western flocks of the endangered Siberian Crane. Although about 2600 Siberian Cranes breed in the far eastern Soviet Union, the rapidly declining western flocks now total only about 14 birds. The western flocks have the longest migration route of any crane — over 5,000 miles.

Jim Bland, an ornithologist who carried the eggs to Siberia, explained the importance of saving the western flocks: "Their migration route is a tradition that is handed down to chicks from older birds. The urge to head south in fall is instinctive, but the route they take and where they wind up is learned. The fear is that if this flock is lost, the migration tradition will be lost, and then it will be too late to reintroduce cranes back into the western USSR, Iran, or India, because they won't know where to go."

Two of the eggs were produced in the US at the International

Crane Foundation (ICF) near Baraboo, Wisconsin, and were carried in a portable incubator, sitting in a seat beside Jim Bland on the Lufthansa jet. They were joined en route by four eggs from Vogelpark Walsrode in western Germany, and two eggs from Oka Nature Reserve in the USSR. In the frontier Siberian village of Gorki, all eggs from the US and Germany hatched in the electric incubator, but the two eggs from Oka failed to hatch. One chick died from respiratory parasites, but June 5 the remaining five were transported by helicopter, together with ICF researcher Meenakshi Nagendran and Russian colleagues, to a wilderness camp within the territory of one of the wild pairs of Siberian Cranes. Only two pairs of wild cranes could be found on the breeding grounds of western Siberia this year.

Dressed in a crane costume, Nagendran is now walking around the wetland with five chicks, teaching them to feed on natural foods and protecting them from bears, wolves, otters, lynx, and eagles. Every effort is being made to raise the chicks in visual and vocal isolation from humans, so they will remain wild. In August when the chicks fledge, it is hoped they will join the wild cranes and migrate south to their wintering grounds in either India or Iran. Plans also called for fitting chicks with radio transmitters that can be tracked automatically by satellites. Once their migration route is revealed, hunter education programmes can be activated to help protect the birds from further losses.

The research is being conducted in an area of forest and bogs near where the Ob River empties into the Arctic Ocean. Bland continued; "The Kunovat Basin was only recently opened to foreigners. Nagendran was welcomed as the first citizen of India ever to set foot in the area, and I was only the third American to visit. The most vivid impression I had from the helicopter was this huge expanse of forest as far as you can see, teeming with wild life. Thunderstorms had just come through, and there was a forest fire burning on the horizon. On the vast Siberian plain, the huge fire looked like a little puff of smoke. It was going to carry on until it quitely burned itself out — quite a contrast to the uproar caused by recent fires in Yellowstone National Park."

"The Soviets were wonderful. I have done field work in seven different countries, and these people were by far the most

professional, the most prepared. Their science is on par with that of the US. They have the funding they need to accomplish the job. In addition, they were a lot of fun to work with very enthusiastic and energetic — because they love their work".

One tense moment came on the egg-lift flight after landing at a Soviet military airport. When a policeman saw the video camera Bland had brought along to document the flight, he said Bland and the eggs would have to stay behind for questioning. A delay would have been a disaster for the eggs, but Bland's Russian colleagues managed to calm the official. "These Soviet researchers are real experts at getting over bureaucratic hurdles," Bland remarked with a touch of admiration.

Lufthansa Airlines donated the airlift of Jim Bland and the eggs from Chicago to the USSR, and the flight of researcher Nagendran from Germany to the USSR.

International Crane Foundation
USA, News Release

पाणी : शुद्ध आणि अशुद्ध

डॉ. सुभाष आठले

पिण्यासाठी पुरेसे व शुद्ध पाणी मिळणे व इतर घरगुती वापरासाठी पुरेसे पाणी मिळणे ही आरोग्य, स्वच्छता व सुसंस्कृत जीवन यांसाठी आवश्यक गोष्ट आहे.

पिण्यासाठी शुद्ध पाणी म्हणजे काय? तर एक म्हणजे ते रोगकारक जंतू व इतर जीव – कृमी, कीटक, इत्यादि – यांपासून मुक्त असावे. दुसरे म्हणजे आरोग्याला हानिकारक अशा रासायनिक पदार्थांपासून – (उदा. आर्सेनिक, पारा, डीडीटी, नायट्राइटस्, ४ पीपीएम पेक्षा जास्त प्रमाणात फ्ल्युओराइडस्, डायॉक्सिन्स्, किरणोत्सर्गी पदार्थ वगैरे वगैरेंपासून) मुक्त असावे. तिसरे म्हणजे त्याला रंग, वास, गढूळपणा व बाईट चव असू नये. पिण्याचे पाणी क्षारयुक्त म्हणजे जड असले तरी चालेल. किंबहुना हलक्या (म्हणजे क्षारमुक्त) पाण्यापेक्षा जड (क्षारयुक्त) पाणीच आरोग्यदृष्ट्या चांगले. इतर घरगुती वापरासाठी कमी दर्जाचे पाणी चालेल. उदा. बागेसाठी बाथरूममधून बाहेर येणारे किंवा सेप्टिक टैंकमधून बाहेर येणारे पाणी चालेल. संडास फ्लश करण्यासाठी बाथरूमचे किंवा वॉश बेसिनचे पाणी चालेल. स्नान, कपडे धुणे, व भांडी स्वच्छ करणे यांसाठी मात्र पाणी पिण्याच्या पाण्याइतकेच स्वच्छ असलेले चांगले. कपडे धुण्यासाठी पाणी हलके असलेले चांगले, नाही तर साबण फार जास्त लागतो व कपडे स्वच्छ निघत नाहीत.

पाण्याचे प्रदूषीकरण

पाण्याच्या प्रदूषीकरणाची तीन प्रमुख कारणे आहेत.

१) मानवी उत्सर्ग : मलमूत्र, थुंकी इत्यादी.

२) शेती व शेतीमाल प्रक्रिया उद्योग : खते – नायट्रोजन, फॉस्फेट व नायट्राइटस्, जंतुनाशके, तणनाशके व कृमिनाशके – डीडीटी, गॅमेक्झिन व ऑरगॅनो फॉस्फरस कांपाउंडस्, आर्सेनिक.

३) औद्योगिक प्रदूषण : पारा, आर्सेनिक, शिसे, डायॉक्सिन्स्, वेगवेगळी ॲसिडस् व इतर अगणित रसायने, किरणोत्सर्गी द्रव्ये.

भारतात अजूनपर्यंत मानवी मलमूत्र यांमुळे होणारे प्रदूषण हेच सर्वांत महत्त्वाचे आहे. पण झपाट्याने होणारे औद्योगीकरण व प्रदूषणविषयक कायदे-नियम न पाळण्याची व न अंमलात आणण्याची वृत्ती यांमुळे इतर दोन्ही धोके झपाट्याने वाढत आहेत.

पिण्यासाठी शुद्ध पाणी मिळवणे व मानवी मलमूत्रावर व इतर सांडपाण्यावर योग्य प्रक्रिया करून त्याचा योग्य निचरा करणे या एकाच नाण्याच्या दोन बाजू आहेत व त्या एकमेकींपासून वेगळ्या करता येणार नाहीत.

पाणी कोठून मिळते?

१) भूपृष्ठावरील पाणी – उदा. नदी व तळी.

२) भूपृष्ठाखालील पाणी – विहिरीचे.

३) झरे – जेथे भूपृष्ठाखालील पाणी आपोआप पृष्ठभागावर येते. जेथे मानवी वस्ती नाही अशा डोंगरातून येणाऱ्या झऱ्याचे पाणी हे शुद्ध असते व तसे गृहीत धरायलाही हरकत नसते.

भूपृष्ठाखालील पाणी : पावसाचे पाणी झिरपून जमिनीत जाते. खडकांच्या दोन थरांमध्ये साठून रहाते. झिरपण्याची क्रिया ही बऱ्याच जाड अशा मातीच्या थरांतून होत असल्यामुळे, पाण्यातील जीवजंतू व गढूळपणा गाळले जातात व खडकातील पाणी त्या दृष्टीने सुरक्षित असते. तसेच हे पाणी पुन्हा वापरायला येण्यापूर्वी खूप काळ भूपृष्ठाखाली साठून रहाते. माणसाला रोगकारक असणारे जंतू, कृमी वगैरे शरीराबाहेर वाढत नाहीत व फार काळ जिवंतही राहू शकत नाहीत. पाणी हे जंतूंच्या दृष्टीने चांगले (कल्चर मिडीयम) माध्यम नाही. त्यामुळे भूपृष्ठाखाली खूप दिवस साठून राहिलेले पाणी रोगजंतूंपासून मुक्त असते. पण विहीर जर उथळ असेल – म्हणजे खडकाच्या पहिल्या थराच्या बरच असेल तर मात्र अशा उथळ विहिरीच्या पाण्यात रोगजंतू असण्याची शक्यता असते. (उदा. संडासाचे पाणी किंवा फुटलेल्या अंडर ग्राउंड ड्रेनेजच्या नळातून बाहेर पडणारे पाणी, यांमुळे.)

भूपृष्ठाखालील पाण्याला सूर्यप्रकाश मिळत नाही व त्याचे ऑक्सिजनेशनही होत नाही. त्याचा हवेशी संपर्क येत नाही व त्यामुळे त्यात विरघळलेले सेंद्रिय पदार्थ नष्ट होत नाहीत. असे पाणी विहिरीतून काढल्या काढल्या चवीला चांगले असते, पण एखादा दिवस ठेवल्यावर, हवेशी संपर्क झाल्यावर त्याला थोडा वास येऊ लागतो. असे पाणी रोगजंतूंपासून मुक्त असले तर आरोग्यदृष्ट्या हानिकारक नाही. विषारी रासायनिक पदार्थ जर भूपृष्ठाखालील पाण्यात मिसळले गेले तर मात्र ते पाणी जवळ जवळ कायमचे प्रदूषित होते, आरोग्यदृष्ट्या हानिकारक होते व पुन्हा निसर्गतः शुद्ध होण्यास किती दशके किंवा शतके लागतील हे सांगता येत नाही. हे प्रदूषण खूप लांब अंतरापर्यंत पसरूही शकते. असे रासायनिक प्रदूषण हे रसायने, जंतुनाशके, रंग, तणनाशके व औषधे तयार करणाऱ्या कारखान्यांपासून होते. बहुतेक कारखान्यांना सांडपाणी शुद्ध करण्याची यंत्रणा नाबापुरतीच बसवलेली असते. त्यामुळे अत्यंत प्रदूषित असे सांडपाणी जमिनीत मुरते, कित्येक किलोमीटर पर्यंतच्या विहिरींचे पाणी प्रदूषित करते. कित्येक वेळा हे कारखाने आपले विषारी टाकाऊ पदार्थ पत्र्याच्या पिंपात भरतात व ही पिंपे कचरा डेपोमध्ये टाकून देतात. बऱ्याच वेळा ही गोष्ट गुपचुप केली जाते. जवळपासच्या जनतेला किंवा संबंधित स्थानिक अधिकाऱ्यांना त्याची कल्पना दिली जात नाही. कालांतराने ही पत्र्याची पिंपे गंजून त्यातील विषारी पदार्थ बाहेर पडतात व पावसाच्या पाण्याबरोबर जमिनीत मुरून त्या सर्व भागातील भूगर्भातील पाणी प्रदूषित करून टाकतात. हा धोका इतका मोठा आहे की अशा कारखान्यांवर लक्ष ठेवण्यासाठी एका वेगळ्या गुप्तहेर खात्याची गरज आहे.

नदीचे पाणी/तळ्याचे पाणी (भूपृष्ठावरील पाणी) : फार प्राचीन काळापासून मानवी संस्कृतीमध्ये नद्यांचे स्थान महत्त्वाचे राहिले आहे. पाणीपुरवठा, अन्नपुरवठा, जलमार्गी वाहतूक व सांडपाण्याचे नैसर्गिक शुद्धीकरण अशी सर्व कामगिरी नदी पार पाडत आली आहे. गोड्या पाण्याचा मुबलक पुरवठा नदी करीत आल्यामुळे मोठमोठी शहरे नदीकाठीच वसली व वाढली. नदी ही सर्वांत सखल भागातून वाहत असल्याने शहराची सर्व गटारे निसर्गतःच नदीला मिळत व अजूनही मिळतात. शिवाय नदीचा वापर स्नान, कपडे धुणे, जनावरे धुणे वगैरेंसाठीही केला जातो. यांतून येणाऱ्या घाणीचे नैसर्गिक शुद्धीकरणही नदी करीत असे. वाहत्या पाण्याचे होणारे ऑक्सिजनेशन, सूर्यप्रकाश, घाण व जंतू खाऊन त्यावर वाढणारे इतर जंतू, कीटक, वनस्पती, मासे वगैरेंच्या साहाय्याने हे नैसर्गिक शुद्धीकरण होत असे. पण नैसर्गिक शुद्धीकरणाची नदीची ही ताकद अमर्यादित नाही. तिला मर्यादा आहे. जोपर्यंत शहरे लहान होती, एकमेकांपासून लांब होती व जोपर्यंत घरणे नसल्याने नदी बारा महिने वाहत असे, तोपर्यंत

नैसर्गिक शुद्धीकरण पूर्ण क्षमतेने होत असे. पण आता शहरांची लोकसंख्या प्रचंड वाढली, त्यामुळे सांडपाण्यात प्रचंड वाढ झाली. दोन शहरांमधील अंतरेही कमी झाली. धरणे व जंगलतोड यांमुळे नद्या आता फक्त पावसाळ्यातच सतत वाहतात, इतर महिन्यांत धरणातून पाणी सोडले तरच नदीत पाणी येते व थोडे फार वाहते. या सर्व कारणांमुळे नदीची नैसर्गिक शुद्धीकरणाची यंत्रणा कोलमडून पडली आहे. नदीच्या पाण्यात फॉस्फेटस्, नायट्रोजन यांचे प्रमाण इतके वाढले आहे की, ते 'सुपीक' बनले आहे. त्यामुळे पाण्यावर जलपर्णीचा (*Water hyacinth*) जाड थर निर्माण होतो. या थरामुळे सूर्यप्रकाश पाण्यापर्यंत पोचत नाही. त्यामुळे सूर्यप्रकाशामुळे रोगजंतू नष्ट होणे व सेंद्रिय पदार्थांचे विघटन होणे ही क्रिया थांबली. याच जलपर्णीच्या थरामुळे हवेचा पाण्याशी संबंधच येत नाही. पाण्यातील सेंद्रिय पदार्थांचे प्रमाण वाढल्यामुळे जो थोडासा ऑक्सिजन पाण्यात विरघळेल, तो लगेच नष्ट होतो. त्यामुळे पुन्हा सेंद्रिय पदार्थांचे विघटन व रोगजंतू नष्ट होणे या क्रिया थांबतात. तसेच पाण्यात ऑक्सिजन कमी झाल्यामुळे मासे व इतर जीव मरतात, वाढू शकत नाहीत. अशा रीतीने सूर्यप्रकाश, ऑक्सिजन, मासे या शुद्धीकरणाच्या सर्व यंत्रणा एकामागून एक निकामी होतात. ऑक्सिजनच्या कमतरतेमुळे पाण्यातील सेंद्रिय पदार्थांचे ॲनरोबिक कुजणे सुरू होते. त्यामुळे काळसर रंग, घाण वास व मिथेन सारख्या विषारी वायूचे बुडबुडे या गोष्टींची निर्मिती होते व पाणी वापरण्याला निरुपयोगी होते.

शहरे, खेडी यांच्या सांडपाण्याव्यतिरिक्त शेतांतून वाहात येणारी खते, जंतुनाशके, तणनाशके, साखर कारखान्याची मळी, डिस्टिलरीजचा स्पेंट वॉश, वेगवेगळ्या कारखान्यांची ॲसिडस्, रंगद्रव्ये, सेंद्रिय व इतर रसायने, पारा, शिसे इत्यादि धातू यांनी दूषित झालेले सांडपाणी ही सर्व नदीत सोडलेली असतात. त्यामुळे नदीचे पाणी अधिकच धोकादायक होते.

मोठी शहरे व गावे, नदीच्या पाण्यावर गाळणे, क्लोरीन मिसळणे वगैरे प्रक्रिया करून नदीचे पाणी निदान रोगजंतूंपासून तरी मुक्त करण्याचा प्रयत्न करतात. (सेंद्रिय व इतर रसायने, पारा, शिसे, जंतुनाशके इत्यादि प्रदूषणे पाण्यातून बाजूला काढण्याची काही पद्धत अस्तित्वात नाही). पण नदीतीरावर लहान गावे, वस्त्या यांना ही फिल्टरेशन व क्लोरिनेशन यंत्रणा परवडण्यासारखी नसते. त्यांना दूषित पाणी तसेच प्यावे लागते व आजारपण पत्करावे लागते.

पिण्यासाठी पाणी कोणते वापरावे?

लहान प्रमाणात : जेव्हा लहानशा वस्तीला किंवा काही घरांना पाणी पुरवठा करायचा आहे, तेव्हा जर झऱ्याचे किंवा विहिरीचे पाणी उपलब्ध असेल तर ते

वापरणे नदीचे पाणी वापरण्यापेक्षा उत्तम, कारण ते पाणी दूषित असण्याची किंवा भविष्य कालात दूषित होण्याची शक्यता नदीच्या पाण्याशी तुलना करता फारच कमी. अर्थात झऱ्याचे किंवा भूगर्भातील पाणी शुद्ध राखण्याची जबाबदारीही त्याबरोबरच स्वीकारावी लागते.

मोठ्या प्रमाणावर पाणी पुरवठा : मोठ्या गावांना किंवा शहरांना लागणाऱ्या पाण्याचा पुरवठा झरे किंवा विहिरी यांमधून पुरेसा होणे ही अशक्य गोष्ट असल्याने नाईलाजाने नदीचे पाणी घ्यावेच लागते व मग नदीचे पाणी आणखी खराब होणार नाही यासाठी व असलेले प्रदूषण कमी करण्यासाठी धडपड करणे आवश्यक ठरते.

वर पाहिल्याप्रमाणे नदी सर्वांत सखल भागातून वाहत असल्यामुळे सर्व गावांची, शहरांची गटारे नदीलाच मिळतात. नदीतून पिण्याचे पाणी घ्यावयाचे असल्यास एकतर नदीच्या उगमाजवळ, जेथे फारशी वस्ती नाही अशा भागात धरण बांधून ते पाणी नळाने शहरापर्यंत आणणे आवश्यक आहे. म्हणजे नदीच्या पाण्याचे प्रदूषण होण्यापूर्वीच ते घेऊन प्रदूषण होणार नाही अशा रीतीने ते शहरापर्यंत नेता येते. ही गोष्ट अर्थातच नदीच्या उगमापासून ४०-५० मैल अंतरापर्यंत वसलेल्या शहरांच्या बाबतच शक्य आहे. इतर शहरांना नदीचेच पाणी उचलणे भाग पडते व त्यासाठी नदीचे पाणीच शुद्ध ठेवण्याची, ते प्रदूषित होणार नाही अशी काळजी घेतली पाहिजे.

नदीच्या पाण्याचे सर्वांत जास्त प्रदूषण मोठ्या शहरांच्या भूमिगत गटार योजनांच्यामुळे होते. स्वतःच्या मलमूत्राची योग्य विल्हेवाट लावणे ही प्रत्येकाची मूलभूत जबाबदारी आहे व सुसंस्कृततेचे ते एक प्रमुख लक्षण आहे. पण ही गोष्ट भारतीय समाजमनाला अजून तरी पटलेली नाही. त्यामुळे रस्त्याकडेला विधी उरकत असलेली माणसे हे ओंगळवाणे दृश्य भारतीय खेडी, गावे व शहरे या सर्वांचे वैशिष्ट्य झाले आहे. अक्ख्या जगात याबाबतीत भारताशी कोणी स्पर्धा करू शकत नाही! भारतीय व्यक्तींप्रमाणेच भारतीय नगरपालिकांनाही मल-प्रक्रियेचे महत्त्व व मलप्रक्रियेला अग्रक्रम दिला पाहिजे हे जाणवत नाही. त्यामुळे मलप्रक्रिया केंद्रांकडे अक्षम्य दुर्लक्ष केले जाते. त्यांच्यासाठी पुरेशी आर्थिक तरतूद केली जात नाही, तज्ज्ञ व तळमळीने काम करणारी माणसे तेथे नेमली जात नाहीत, देखभाल केली जात नाही व लोकसंख्यावाढीबरोबर मलप्रक्रिया केंद्रांच्या क्षमता-वाढीच्या योजनाही आखल्या जात नाहीत. त्या प्रत्यक्षात आणणे तर सोडूनच द्या. अक्ख्या भारतात फक्त मुंबईचे दादर येथील व दिल्लीतील अनेक केंद्रांपैकी एकच मल-प्रक्रिया केंद्र उत्तमरीत्या चालू आहे. बाकी सर्व केंद्रे प्रक्रिया न करता किंवा अर्धवट प्रक्रिया करून शहराचा सर्व मल एकत्र करून नदीच्या पाण्यात नेऊन सोडतात – म्हणजे कोणाच्या ना कोणाच्या

तरी पिण्याच्या पाण्यात नेऊन कालवतात! नागरिकांच्या डोळ्याआड ही गोष्ट झाल्यामुळे पिण्याच्या पाण्याला वास व रंग येईपर्यंत नागरिकांचे तिकडे लक्षही जात नाही. प्रत्यक्षात ही गोष्ट रस्त्याकडेला विधी करण्यापेक्षा जास्त रानटीपणाची व आरोग्यदृष्ट्या जास्त धोकादायक आहे. या परिस्थितीत नजीकच्या कालावधीत बदल होण्याची शक्यता नाही. भारतीय माणूस आज ज्या आर्थिक, नैतिक, सांस्कृतिक व शैक्षणिक टप्प्यावर आहे, त्या टप्प्यावर केंद्रीकृत मल-प्रक्रिया केंद्रे नीट चालणे अशक्य आहे, हे समजून घेऊन पर्यायी मलप्रक्रिया पद्धतीचा अवलंब करणे आवश्यक आहे – व अशी स्वस्त, विकेंद्रित व फुलप्रूफ पद्धती आहे – ती म्हणजे सेप्टिक टैंक किंवा बायो गॅस पद्धत. सेप्टिक टैंकने रोगजंतूंचा व जंतांच्या अंड्यांचा पूर्ण नाश होतो, सेंद्रिय पदार्थांचे पूर्ण विघटन होऊन बाहेर येणाऱ्या पाण्यात फक्त निरिंद्रिय द्रव्येच शिल्लक राहतात. नीट बांधलेल्या सेप्टिक टैंकमधून बाहेर येणाऱ्या पाण्याला वास येत नाही व ते चूळ भरण्याइतके स्वच्छ असते. शक्य असेल तेथे ते बागेला वापरले, किंवा सोक-पिट मध्ये सोडले तर नदीच्या प्रदूषणाचा प्रश्नच उद्भवणार नाही. शक्य नसेल तेथे ते पाणी उघड्या गटारांनी किंवा अंडर ग्राउंड ड्रेनेज योजनेने एकत्र करून शेतीसाठी वापरता येते, किंवा आणखी थोडी प्रक्रिया करून नदीत सोडता येते. ही प्रक्रिया अतिशय सोपी असल्याने ती सहसा बिघडणार नाही व बिघडली व ते पाणी तसेच नदीला मिळाले तरी फारसे प्रदूषण होणार नाही.

मळावर बायोगॅस प्लँट चालविणे थोडे अधिक अवघड व थोडी देखरेख लागणारे असते. पण त्यापासून गॅस व खत दोन्ही मिळत असल्याने खेडेगावातून व शहरातील मोठ्या कॉलनीमध्ये, जेथे पुरेसा मानवी मल एकत्र करणे सोपे आहे तेथे बायोगॅस प्लँट चालविणे आर्थिकदृष्ट्या योग्य ठरेल. सर्व भारतासाठीच असा धोरणात्मक निर्णय घेतला पाहिजे की शहरी भागात होणाऱ्या प्रत्येक घराला सेप्टिक टैंक असणे सक्तीचे असेल. तसेच जुन्या घरांनादेखील शक्य असेल तेथे सेप्टिक टैंक बसवला तर म्युनिसिपल करांमध्ये सवलत द्यावी. जेवढे जास्त सेप्टिक टैंक बसतील, तेवढा केंद्रीय मल-प्रक्रिया केंद्रावरील ताण कमी होईल. पर्यावरण खाते, नागरी सुविधा खाते, पाणीपुरवठा व मलनिस्सारण खाते, ऊर्जा खाते वगैरे शासनाच्या विविध खात्यांनी मल-प्रक्रियेच्या या विकेंद्रित व्यवस्थेमध्ये रस घेणे फायदेशीर ठरेल. प्रत्येक संडासाजवळ सेप्टिक टैंक (किंवा बायोगॅस प्लँट) अशी योजना जर राबवली तर गंगा शुद्धीकरणाच्या योजनेवर कोट्यवधी रुपये खर्च करण्याची गरज राहणार नाही.

व्यक्तिगत पातळीवर विचार केला तरी स्वतःच्या मलमूत्राची योग्य विल्हेवाट लावणे प्रत्येकाची मूलभूत जबाबदारी आहे. नगरपालिकेला कर देऊन हे काम करण्यासाठी आपण एजंट म्हणून ठेवले आहे. पण नगरपालिका ही जबाबदारी

पेलण्यास सक्षम नाही असे लक्षात आल्यावर ही जबाबदारी आपण व्यक्तिगत (अथवा सहकारी) पातळीवर पुनश्च उचलली पाहिजे व त्यासाठी सेप्टिक टैंक सारखे सोपे व स्वस्त साधन उपलब्ध असताना ती टाळण्याचे काही कारण नाही.

मलप्रक्रिया व स्वच्छ पाणी पुरवठा या गोष्टी इतक्या निगडित आहेत, की त्यामुळे या विषयावर इतक्या विस्ताराने लिहिणे भाग पडले.

शेतीमुळे होणारे नदीचे प्रदूषण : डीडीटी, बीएचसी वगैरे दीर्घकाळ टिकणाऱ्या जंतुनाशकांवर बंदी घालणे, मातीचे पृथःकरण करून आवश्यक तेवढीच खते वापरणे, ठिबक-सिंचनाचा वापर करणे वगैरे उपायांनी शेतीपासून होणारे नदीचे/तलावांचे प्रदूषण कमी करता येते.

कारखान्यांमुळे होणारे प्रदूषण : साखर कारखाने, कागद कारखाने व विविध प्रकारचे रासायनिक कारखाने यांपासून निघणारे सांडपाणी हा नदी/तलाव यांच्या प्रदूषणाचा सर्वात जास्त धोकादायक व नियंत्रणाच्या दृष्टीने सर्वात अवघड प्रकार आहे. कारण

१) या कारखान्यांना पाणी प्रचंड प्रमाणावर लागत असल्याने ते नदीशेजारीच बांधले जातात.

२) या सांडपाण्यात असणारी द्रव्ये बऱ्याच वेळा जंतूंद्वारे विघटन होण्यासारखी (बायोडिग्रेडेबल) नसतात. त्यामुळे या सांडपाण्याच्या शुद्धीकरणाची यंत्रणा ही तांत्रिक दृष्ट्या अवघड, जास्त मांडवळ लागणारी व चालवायलाही जास्त खर्चिक असते. त्यामुळे कारखान्यात तयार होणारा पदार्थही महाग होण्याची व व्यापारी चढाओढीत मागे पडण्याची शक्यता असते.

३) असा खर्च व त्रास घेऊन सांडपाणी शुद्ध करण्यापेक्षा लाच-लुचपत, फसवा-फसवी व गुप्तता किंवा दंडेली यांच्या साहाय्याने सांडपाणी तसेच नदीत सोडून देण्याकडे, किंवा जमिनीत मुरू देण्याकडे कारखान्यांचा कल असतो. सहकारी व सरकारी कारखानेही याला अपवाद नसतात.

४) पुढारलेले देश हे प्रदूषण नको म्हणून बरीच रंगद्रव्ये व रसायने आपल्याकडून आयात करू लागले आहेत. त्यामुळे आपल्या रासायनिक व रंगद्रव्ये तयार करणाऱ्या कारखान्यांना उत्तेजन मिळाले असून त्यांची संख्या व उत्पादने वाढत आहेत. अर्थात प्रदूषणाचा धोका वाढला आहे. पुढारलेल्या देशांची डोकेदुखी आपण आयात केली आहे.

५) एकदा नदीच्या पाण्यात मिसळल्यावर ही द्रव्ये पाण्यापासून वेगळी करण्याची काही पद्धत वा प्रक्रिया अस्तित्वात नाही. शहरांना पाणीपुरवठा करणारी जलशुद्धीकरण केंद्रे फक्त गाळणे व क्लोरिनेशन या दोनच क्रिया करतात – त्यामुळे पाण्यात तरंगणारे विविध घन पदार्थ व जंतू यांची

विल्हेवाट लागते. विरघळलेल्या रासायनिक पदार्थांवर त्याचा काही परिणाम होत नाही.

जनतेने स्वतः जागरूक राहून या प्रदूषणाच्या प्रश्नावर सरकारशी व कारखान्यांशी लढा दिला नाही तर प्रदूषणाचा हा प्रकार वाढतच जाणार.

पाणी व दांत किडणे : पिण्याच्या पाण्यामध्ये दर दशलक्ष भागांमध्ये १ ते ४ भाग फ्ल्युओराइड असणे आवश्यक असते. यापेक्षा कमी असल्यास दांत किडण्याचे प्रमाण दुपटीने तरी वाढते. म्हणून पाश्चात्य देश व अमेरिका येथे जलशुद्धीकरण केंद्रात योग्य त्या प्रमाणात पाण्यात फ्ल्युओराइडस् मिसळले जातात. त्यामुळे तेथील जनतेत विशेषतः लहान मुलांत दांत किडण्याचे प्रमाण खूपच कमी होऊन डेंटल कॉलेजे बंद करण्याची वेळ आली आहे. भारतातही बऱ्याच ठिकाणी पाण्याचे फ्ल्युओरायडेशन करणे आवश्यक आहे, कारण खूप ठिकाणी निसर्गतः पाण्यात फ्ल्युओराइडस्चे प्रमाण १ पीपीएम पेक्षाही कमी आहे. उदाहरणार्थ – कोल्हापूरला ते ०.१ पीपीएम पेक्षाही कमी आहे.

फ्ल्युओरॉसिस : पिण्याच्या पाण्यात ४ पीपीएम पेक्षा जर जास्त फ्ल्युओराईड असेल तर फ्ल्युओरॉसिस नावाचा आजार होतो. यात दांत पिवळे व ठिसूळ होणे, हाडांची अनैसर्गिक वाढ होऊन मज्जारज्जूंवर दाब येणे व अस्थि-व्यंग निर्माण होणे अशी लक्षणे उद्भवतात. पंजाब, आंध्रप्रदेश, राजस्थान वगैरे काही ठिकाणी हा आजार सापडतो. विशेषतः जेथे ट्यूबवेलचे पाणी पिण्यासाठी वापरले जाते त्या ठिकाणी. दुसरीकडून चांगले पाणी पिण्यासाठी आणणे हाच त्याच्यावरचा उपाय होय.

निष्कर्ष

मोठ्या शहरांना पाणी पुरवण्यासाठी नदीचेच पाणी वापरावे लागते. नदीचे प्रदूषण होऊ नये म्हणून सेप्टिक टँक किंवा बायोगॅस प्लँट यांना उत्तेजन देणे आवश्यक आहे. विशेषतः शहरांमध्ये शेती व उद्योगधंदे यांनी होणाऱ्या प्रदूषणावरही नियंत्रण ठेवणे महत्त्वाचे आहे. पिण्याच्या पाण्याच्या शुद्धीकरणाबरोबर त्यात कमी पडणारे फ्ल्युओरिन सारखे घटक त्यात मिसळले तर त्याचा नागरिकांच्या आरोग्यावर चांगला परिणाम होईल.

डॉ. सुभाष आठले
२५ नागाला पार्क
कोल्हापूर ३

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1. Field-work for the Sarus Project which was continuing from the last year, ended in March 1990. The technical report on Phase II of the Project was submitted to the Ministry of Environment & Forests in August 1990. The Report was favourably commented upon by Mr. Zafer Futehally and Dr. Rehmani of Bombay Natural History Society.
2. While in Moscow last year, we were asked to collaborate in the writing of the Red Data Book of the Russian Soviet Republic, supplying information on birds that migrate between USSR and India. This write-up was sent to RSFSR Academy of Sciences in April 1990 and was accepted for publication in the Red Data Book.
3. In April Central Water and Power Research Station, Khadakwasla, organized a visit to our project site at Panshet as a part of the programme of their Seminar on environmental impact assessment. Participants from all over India and abroad were explained the salient features of our Project.
4. On 2nd May 1990 the sanction for the research project concerning the UJNI reservoir was received from the Ministry of Environment and Forest. A suitable site near Kumbhargaon village on the peripheri of the reservoir was selected with the help of the Irrigation Department, Government of Maharashtra. The Project work began in June 1990 with recruitment of the staff.
5. To date the socio-economic survey of the surrounding villages is complete. Botanical and Geomorphological surveys are continuing. An inspection hut, a plant nursery and an experimental marsh are now in place. Habitat improvement work is continuing. Tenders for building

bunds and barrages are floated. The Irrigation Department will help us in the construction of these.

6. We are in constant touch with the Irrigation Dept. for initiating eco-development work on some of their projects. In July it was decided that Chaskaman catchment area should be developed as a model for the eco-development of hill catchments. We carried out a preliminary survey of the whole catchment and proposed certain schemes and locations to be developed. Shree Bongirwar, Commissioner, Pune Division, convened a meeting of all the departmental heads to coordinate the work of eco-development plan suggested by us. The plan was approved in principle and departments such as Building and Construction, Forest, Irrigation etc. were allotted responsibilities. We have taken up the work initially of providing a nursery of indigenous, aquatic and semi-aquatic plants.
7. Journal Vol. 3 was published in June 1990. Its publication was delayed as the Director and Editor was out of Pune for field-work between January and March 1990.
8. The Orientation Course of Ecological Considerations in Water Management for Irrigation officials was conducted in Aurangabad in Sept. 1990 in collaboration with Water & Land Management Institute and Engineering Staff College. This was attended by Irrigation engineers from Vidarbha and Marathwada. Another training course for engineers from Western Maharashtra was conducted at Panshet in January 1991. These training programmes have become popular and are considered useful by the Irrigation Department. We are requested to carry out three such courses during the 1991-92 season.
9. A seminar was held at Jayakwadi on the subject of Environment around Reservoirs and Lakes in February-March 1991. It was attended by Irrigation engineers as well as representatives of NGOs from Aurangabad.
10. The grant received from the Department of Science and Technology, Govt. of India, for holding training programmes, and seminars and towards the publication of the Journal is gratefully acknowledged.

Executive Director

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.

All contributions and correspondence to the Society should be directed to the official address of the Society in the name of the Executive Director or the Editor, Journal of Ecological Society, as the case may be.

Views and opinions expressed in the Journal or other publications of the Society are not necessarily of the Editor of the Journal or the Trustees of Ecological Society.