I N T R O D U C T I O N

" We have modified our environment so radically that we must now modify ourselves to exist in this NEW environment ".

- N. Wiener (1972).

I. From Transition to Transition :

" We live in the time of transition " are the words believed to have been said by Adam as he led Eve out of Paradise. Man has been living in 'transition' ever since. 'Transition' is a fact of life in this universe. Homo sapiens species of biosphere have witnessed the transition through the ages. All our history is nothing but a record of 'transitional' processes. As Aldous Huxley puts it - 'In the past man's worst enemy was 'Nature' - mountains were barriers, seas posed to be impassable divisions, famines and pestilences were the order of the day. Then came the

periods of industrial revolution, agricultural revolutions including the Green revolution, the pure and applied scientific revolutions in fields of medicines, life sciences, physical sciences and technology, culminating in computerization. 'In the process ... Nature has been subdued if not conquered' remarks Aldous Huxley. These developmental and technological activities brought with them the problems which had not been perceived even faintly as the growth and production oriented projects dominated the affairs of human activity and thought. The problems of environmental degradation and pollution, erosion of various resources and materials including the genetical material and the population growth are the results of the 'transitions' we have had earlier. This period is again that of 'transition' in almost all the spheres of human activity and thought. Experts opine that man has generally acted as a parasite on his environment, taking what he wants with little regard for the welfare of his life-supporting system - the nature and all the problems of this modern age have origin in this parasitic behaviour of man. (Commoner, 1971; Odum, 1971). These problems have endangered the delicate balance of the entire ecosystem of the spaceship 'earth' (Commoner, 1971). And it is due to all these 'transitions' in our environment that the man has come to realize that the present crisis is of our own making, our technology, our science. Some calls of going 'back to nature' are heard but

that is not a practical solution. The only cure for science and technology is more science and more technology. We are suffering from the effects of a little science, badly applied. The remedy is a lot of science, well applied (Huxley, 1954). And it is here the science of ecology comes into the picture - as an integrative science - the science that conceives the totality of man and environment.

II. Ecology - The science of totality of man and environment :

'Ecology' has become a household word during the last decade all over the world. It is not, now, only the science of a few specialists of the university departments but the science that has diffused into masses to the extent which might not have been even imagined by the authors of the works, like the Silent Spring, The Closing Circle, Science and Survival, who intentionally pioneered its popularization(Carson (Rachel, 1965; Commoner, 1967; Ehrlich, 1968; Dubos, 1970; Commoner, 1971). The ecologists all over the world have been dragged into controversial issues due to the popularization or over popularization of Ecology. The western world has seen the detergent Ecolo-G, and has also witnessed the garages to get their cars 'ecologized' (McIntosh, 1974). The popular as well as scientific ecological literature has witnessed a

mushroom growth. From the Silent Spring (Carson Rachel, 1965) to the 'Ecological Citizen' (Sickle, 1971) and 'Doomsday Syndrome' (Maddox, 1972) the ecological literature for masses presents both the gloomy as well as the not-so-gloomy sides of the environmental problems.

But the professional ecologist and research ecologist has been silently contemplating on the problems of environment and has been struggling to find the solutions to these problems of badly applied science and there has been a great spurt in the publication of ecologically oriented scientific journals, technical books, research reports, proceedings of seminars and symposia. The research effort and the literature has multiplied to an extent that it is not improper to lable this period of history as the 'era of ecology'. Ecology has revolutionized our approaches to the mode of living on this planet. 'We live in a revolutionary age' remarked Julian Huxley once and further clarified that it is the age of the race between disintegration and reintegration. This revolution has been brought by ecology - in our own life time. The holistic approach and the ecosystem theory so well founded in ecology today are integrative aspects and have prompted the belief of many persons that ecology stands for the study of "totality of man and environment". However, the word ecology in its real sense of the term stands for "the totality or

pattern of relations between organisms (including MAN) and their environment" (Odum, 1971). That man's power to alter the environment has been increasing to a considerable extent is evident from the recorded human history. The civilization resulted in creating organized human settlements which attained the climax patterns either as the cities or the towns or the villages. The growth of such clustered units of human population and their activities brought problems of environment since their inception. What is new today is not the problems of environment but the magnitude of the problems of environment. Ecology - the science of organism - environment - interactions has two distinct disciplines to deal with urban and rural ecosystems and the settlements of human beings along with their interactions with the other components of these ecosystems - viz. the urban ecology and the rural ecology. Rural ecology is fast developing branch especially for the regions where rural settlements exceed the urban ones. India has great potential material for research in this branch, being a country with rural centres in dominance.

III. Rural Ecology - its relevance to India :

Rural Ecology deals with the rural ecosystems keeping in view the holistic approach which is the central core of

modern ecological concepts (Odum, 1971; Otto Somoerwotto, 1974).

This branch of ecology has relevance to the underdeveloped countries where the problems of rural environment might not have reached the magnitude of the affluent nations but are sure to face the problems some day due to their rural developmental projects.

In India, the developmental activities have been mainly confined to the urban ecosystems. The rural ecosystems in India have received meagre attention from all the quarters of human activity. It is actually the primary production of the rural ecosystems that sustains the great number of consumers distributed over large urban ecosystem areas. It is evident from the disparity between the urban and rural life styles that the urban human component has been a constant parasite on the rural counter part resulting into the underdeveloped conditions of the rural ecosystem (Myrdal, 1977; Sud, 1977). The importance of rural ecosystems can in no way be undermined especially in Indian subcontinent where the economy is still basically dependent upon agriculture to a considerable extent.

Any developmental project or programme has to keep in view the rural ecosystem along with the other considerations of the environmental parameters. According to Otto Somoerwotto

(1974) the developing nations have to learn lessons from the developed ones and concentrate their efforts on the development of rural ecosystem with due environmental considerations.

IV. Rural Ecosystems : Problems, Potentials for development and Optimization strategies :

Otto Somoerwotto (1974) visualizes the rural ecosystem to consist of three constituent subsystems viz. the village ecosystem, crop ecosystem and forest or vegetational ecosystem. His assessment about the studies of the rural ecosystem in general, is revealing the fact that ecologists have neglected the rural ecosystem till this day. Forest and vegetation ecologists, Crop ecologists and Human ecologists have separately conducted studies on the constituent systems but no attempt has ever been made to study the rural ecosystem as a unified whole. This observation is true for Indian rural ecosystems also. While some progress has been made in forest ecology, grassland ecology and a little in crop ecology - no attempts have been made so far to study all the components of rural ecosystem in a unified and comprehensive manner.

The problem and potential areas of each rural ecosystem will vary depending upon the environmental settings, habitat

complex and resources. Each rural ecosystem is endowed with specific properties, components and interactions. Therefore, no planning for development and no strategy for optimization can ever remain viable if it is prepared without analysing the particular rural ecosystem complex completely i.e. both qualitatively and quantitatively. In India, as anywhere else, each rural ecosystem will show different structural, functional and interactional attributes and therefore, only a specific kind of developmental and optimization strategy will be imperative for the ecosystem in question.

These factual observations and broad conceptual frame work led the author to conclude that the developing nations like ours are in urgent need of comprehensive analytical data at both the local and regional levels for each of the rural ecosystem before any optimization and developmental plan can be conceived. These observations were discussed by the author with the research supervisor of this doctoral project who further enhanced the interest of author in the rural ecosystems of Gujarat by his observations as an agronomist. Prof. C.H.Pathak, himself a qualified and trained agronomist and ecologist inspired the author to go deep into the study of rural ecology and ecosystem analysis. That was the first step in the genesis of this work. It was then decided to generate analytical data and develop optimization strategies for the rural ecosystem

at Chokari estuarine area which we hit upon during our ecological survey tours of the region. The genesis of the present ecosystem analysis and optimization study is discussed in Thesis Component I - Unit I.