

PREFACE



Man's progress over many thousands of years has been the result of his continuous efforts at making natural forces work for him. Nature – provides Man not only with food clothing, and shelter, but also inspires his creativity and fulfills his spiritual needs. The river is a source of natural god given wealth on which all life on earth depends. The river is nature's conveyor belt carrying great volumes of water down-stream, creating productive valley floor and rich, silt-laden plains.

Man learned how to adapt his ways of life to make the most of the river on whose banks he lived, using its water for domestic purposes, irrigation and transportation. He also learned how to manipulate the river to meet the growing needs of his life.

Massive dams across rivers are perhaps the most awesome feats of engineering by man, transforming rivers into large reservoirs and intricate canal network to carry the river water to dry and thirsty land, to people who have to walk miles to fetch their daily needs of drinking water or wait for hours in the hot sun for the tankers to bring them a bucketful of the precious liquid.

Water is critical to human survival. All major and minor civilizations of the world have sprouted, developed and flourished on the banks of major rivers – the Indus, the Euphrates, and the Nile. Cultures have evolved here, with these mighty rivers sustaining their material prosperity and nourishing their spirit. Rivers have always been and are the lifeline of the land they flow through. In Hindu philosophy water, along with fire, is a divine witness to all significant human deeds. A ritual bath in a sacred river promises salvation.

Rivers are also the final resting place for the physical remains, the ashes, of the dead.

The significance and necessity of managing the water resources of a region had been a subject of concern from very ancient times. Even during the Vedic period it was known that water is not lost in undergoing the various processes of hydrological cycle namely, evaporation, condensation, rainfall, stream-flow etc., but gets converted from one form to another. Water intake by plants, division of water into minute particles by sun rays and wind, different types of clouds, their heights, their rainfall capacities etc., along with the prediction of rainfall quantity in advance by observation of natural phenomena are illustrated in the Puranas, Vrahat Samhita (550 A.D.), Meghmala (900 A.D.) and other literature. The references of rain gauges are available in Arthasastra of Kautilya (400 B.C.), and Astadhyayi of Panini (700 B.C.). The quantity of rainfall in various parts of India was also known to Kautilya. Indians were acquainted with the cyclonic and orographic effects on rainfall, radiation and convectional heating of earth. Various other phenomena of infiltration, interception, stream-flow, geomorphology, artesian wells and erosive action of water were well understood. Ground water development and quality consideration were getting sufficient attention as evident from Vrahat Samhita (550 A.D.). Water management and conservation, and a well organized water pricing system existed in 400 B.C. Construction methods and materials used for dams, tanks etc., bank protection, spillways and other considerations mentioned in the ancient books, reflect the high stage of development of water resources and hydrology in ancient India.

The bank of Narmada has been the home of ancient civilization and kingdoms which have flourished over thousands of years in India. It was on the bank of this river near its conjunction with the Gulf of Cambay, that the king of asuras, Bali, performed his Yagna, which was visited by Lord Vaman as per our ancient scriptures. This episode according to Hindu mythology took place more than 5000 years ago.

The Narmada is one of the oldest and holiest of India's rivers, almost pre-historic. It was in the Narmada basin that early man is believed to have evolved. Geologists have proved that forty million years back, an offshoot of the Arabian Sea penetrated the landmass, which later became the Narmada.

The source of the Narmada River is near Amarkantak in the Vindhya mountain range in Madhya-Pradesh, which is a billion and half years old. Compared to these mountains the Himalayas are much 'younger', the Ganga coming even later. Though the Ganga is considered the holiest of all rivers by the Hindus, the Narmada is the only river who's "Pradakshina" on foot is the ultimate road to salvation. It is not surprising that Adi Shankaracharya, while on his way from south India to North India, chose to make a special visit to river Narmada, calling it "the holiest of holy rivers".

The Narmada River is the only major river in western India. It flows west from the Amarkantak, cutting through the fabulous marble hillsides around Jabalpur, meandering through Madhya-Pradesh, Maharashtra, and Gujarat for 1312 km till it empties into the Arabian Sea at the Gulf of Cambay, near Bharuch.

The Narmada River enters the territory of Gujarat at Hamfeshwer village and flows for 161 km through the state. It is the only vast perennial

river in Gujarat and its confluence with Orsang at Chandod near Vadadora is a holy sangam.

Gujarat has a total geographical area of 1.96 lakh sq km. Hardly 10% of this area is under forest cover. The climate is generally extreme with temperatures as high as up to 47°C to 48°C in summer and dropping to less than 5°C in winter. The rainfall in most parts is not only scanty, but also erratic and entirely undependable. It varies from 200 mm in the north and northwest of the state, to 2500 mm in the south (Dangs). The monsoon lasts for about 3 months i.e. July to September. Cyclonic storms sometimes lash parts of the state in winter or as pre-monsoon rains, causing more havoc than relief.

As a result, more than half Gujarat is chronically drought prone facing frequent famines and severe scarcities. Other serious environmental problems that affect the water situation, is the advancement of the desert from the northern and northwest part of the state, a serious saline and fluoride ingress along the entire coastal region, and the resultant over-harnessing of ground water by private agencies and individuals all over the state.

The Sardar Sarovar Project on the river Narmada promises to be the new lifeline for Gujarat as we enter the new millennium. The dam will store part of the Narmada water, which would otherwise have been emptied into the sea, for utilisation by the people of Gujarat. The water of Narmada has potential to enrich the lives of all strata of people, in different regions of the state, from the hills of south Gujarat to dry, hot northern lands, from the desert of Kachchh to the water starved bowl of Saurashtra.

The Sardar Sarovar project is one of the largest and most ambitious river development projects in India. Its aim is to harness the water of the river

Narmada which flows through 3 states, viz., Madhya Pradesh, Maharashtra and Gujarat and provide much needed water to the arid areas of these states, particularly Gujarat. The problem of water shortage has always been most acute in Gujarat. The western part of the state in particular has always been subjected to droughts due to paucity of rainfall and shortage of both ground and surface water. The Narmada dam (Sardar Sarovar) with its network of canals was expected to substantially change the land use pattern in Gujarat and help to recharge the ground water resources while ensuring perennial flow of surface water within the command area of the Sardar Sarovar project.

However, the progress and implementation of this project has been fraught with environmental, social economic and political controversies, ever since its commencement in the year 1961. It is appropriate at this stage to asses the environmental impact of this project so that corrective measures may be taken wherever shortcomings are noted.

Economic, social and environmental changes are inherent to development. Whilst development aims to bring about positive change it can lead to conflicts. In the past, the promotion of economic growth as the motor for increased well being was the main development thrust with little sensitivity to adverse social or environmental impacts. The need to avoid adverse impacts and to ensure long-term benefits led to the concept of sustainability. This has become accepted as an essential feature of development if the aim of increased well being and greater equity in fulfilling basic needs is to be met for this and future generations.

In order to predict the environmental consequences of any development activity and to provide an opportunity to mitigate the negative

impacts and enhance positive impacts, the environmental impact assessment (EIA) procedure was developed in the 1970s.

EIA may be defined as a formal process to predict the environmental consequences of human development activities and to plan appropriate measures to eliminate or reduce adverse effects and to augment positive effects (Wathern, P. (ed). 1988).

EIA thus has three main functions:

- To predict problems,
- To find ways to avoid them, and
- To enhance positive effects

The third function is of particular importance. EIA provides a unique opportunity to demonstrate ways in which the environment may be improved as part of the development process. EIA also predicts the conflicts and constraints between the proposed projects, programme or sectoral plan and its environment. It provides an opportunity for mitigation measures to be incorporated to minimize problems. It enables monitoring programmes to be established to assess future impacts and provide data on which managers can take informed decisions to avoid environmental damage.

EIA is a management tool for planners and decision makers and complements other project studies on engineering and economics. An environment assessment is now accepted as an essential part of development planning and management. It should become as familiar and important as economic analysis in project evaluation.

The aim of any EIA should be to facilitate sustainable development. Beneficial environmental effects are maximized while adverse effects are

avoided to the greatest extent possible. EIA will help select and design projects, programmes or plans with long term viability and therefore improve cost effectiveness.

Initially some project promoters saw EIA as a constraint to development but this view is gradually disappearing. It can; however be a useful constraint to unsustainable development. It is now well understood that environment and development are complementary and interdependent and EIA is a technique for ensuring that the two are mutually reinforcing. A study carried out by the Environment Protection Agency (USA) in 1980 showed that there were significant changes to projects during EIA process, marked improvements in environmental protection measures and net financial benefits. The costs of EIA preparation and any delays were more than covered by savings accruing from modification, (Wathern, 1988)

Irrigated agriculture is crucial to the economy, health and welfare of a very large part of the developing world. It is too important to be marginalized, as it is vital for world food security. However, irrigated agriculture often radically changes land use and is a major consumer of freshwater. Irrigation development thus has a major impact on the environment. All new irrigation and drainage development results in some form of degradation. It is necessary to determine the acceptable level and to compensate for the degradation. This degradation may extend both upstream and downstream of the irrigated area. The impact may be both to the natural, physical environment and to the human environment. All major donors consider large irrigation and drainage developments to be environmentally sensitive.

An EIA is concerned both with impacts of irrigation and drainage on the environment and with the sustainability of irrigation and drainage itself. Clearly an EIA will not resolve all problems. There will be trades-offs between economic development and environmental protection as in all development activities. However, without an objective EIA, informed decision-making would be impossible.

The present study is aimed at investigating the changes in the land use and land cover in the command area of Sardar Sarovar Project, and to identify the appropriate land use and cropping pattern that may be adopted in the area in order to increase the productivity of the land, maintain the quality of the environment and allow for sustainable development in the region.

The study has been organized in nine chapters. Chapter I introduces the salient features of the Sardar Sarovar Project and its need. It explains the objectives of the study and its significance and outlines the methodology adopted for the work. It concludes with a brief review of the available literature on the main theme of the study. Chapter II reveals the personality of the area in terms of its physical environment. Chapter III studies the social and economic dimensions of the area, including the socio-economic implications of the Rehabilitation and Resettlement programmes of the Sardar Sarovar Project. Chapter IV examines the soil resources, including soil types, soil series and analytical results of soil samples collected from the study area. Chapter V reveals the details of land irrigability classes and land characteristics. Chapter VI analyses the hydrological characteristics and estimates the ground water resources. Chapter VII estimates the irrigation needs for the growth of crops in the study area. Chapter VIII brings out the