ENVIRONMENTAL DEGRADATION OF RIVER KRISHNA IN MAHARASHTRA – A GEOGRAPHICAL STUDY

THE PROJECT SUBMITTED

UNDER

MINOR RESEARCH SCHEME

IN
GEOGRAPHY

TO

UNIVERSITY GRANTS COMMISSION (W. ZONE)

BY

DR. B. N. GOPHANE
M. A., Ph. D.
Associate Professor & Head

Department of Geography,

Venutai Chavan College, Karad,

Tal. Karad, DIst. Satara (Maharashtra) - 415124.

2013

DECLARATION

I, the undersigned **Dr. B. N. Gophane**, Associate Professor and Head of the Department, Venutai Chavan College, Karad declare that the Minor Research Project entitled ***" Environmental Degradation of River Krishna in Maharashtra – A Geographical Study"*** sanctioned by University Grants Commission (W. Zone) is carried out by me. The collection of data, references and field observations are undertaken personally. To the best of my knowledge this is the original work and it is not published wholley or partly in any kind.

Place: Karad

Date:

Dr. B. N. Gophane

Principal Investigator.

ACKNOWLEDGEMENT

The Minor Research Project entitled “Environmental Degradation of River Krishna in Maharashtra – A Geographical Study” has been completed by me. The present research project is an outcome of an extensive field observations conducted by me since 1984, and 2007, when I was working on another research projects on different aspects but as little bit same region. I would like to acknowledge number of personalities and institutes on this occasion.

First of all I should owe my deep sense of gratitude to holy Krishna River who has shared her emotions with me. I would like to offer my deep gratitude to the authorities of University Grants Commission (W. Zone) for sanction and financial support. I am also thankful to Director, BCUD and other authorities of Shivaji University, Kolhapur who forwarded this proposal for financial consideration. I have a deep sense of gratitude with Hon’ble Prakash Pandurang Patil (Bapu), Secretary of Shri Shivaji Shikshan Sanstha, Karad for his full hand and moral support for this work. I am thankful to Principal B. N. Kalekar for giving me opportunity for this work.

I should owe deep sense of gratitude to my friend Dr. Balasaheb S. Jadhav, Head, Dept. of Geography, Shri Vijaysinha Yadav College, Peth Vadgaon for his full co-opration. Thanks are due to Professor K. C. Ramotra, Head, Dept. of Geography, Shivaji University, Kolhapur, Dr. Arun Patil, former BOS Chairman, Dr. C. U. Mane, Shri. S. J. Sakat, Shri Ravindra Pawar, Mrs. Priyanka Pawar for their support. I am thankful to all the authorities, officers to whom I have contacted for collection.

Lastly I should offer my deep emotions with my wife Devyani and my family Dr. Dipti and Dr. Kailas Mane, Darshana and Dr. Dhairyashil who have given full inspirations to complete this work.

Thank to all good wishers.

Dr. B. N. Gophane,

M. C. Member& BOS Chairman,
Shivaji University Kolhapur
and
Associated Professor &
Head, Dept. of Geography,
Venutai Chavan College,
Karad, Dist. Satara.

CONTENTS

Chapters	Particulars	Page No.
	Acknowledgement	
	List of Tables	
	List of Figures	
	List of Plates	
Chapter - 1 :	INTRODUCTION: THE APPROACH	
Chapter - 2 :	GEOGRAPHICAL SETTING OF THE STUDY AREA	
Chapter - 3 :	ENVIRONMENTAL DEGRADATION OF RIVER BY NATURE	
Chapter - 4 :	MAN IN DUCED ENVIRONMENTAL RIVER DEGRADATION	
Chapter - 5 :	CONCLUSION AND SUGGESTIONS	
	Bibliography	

CHAPTER – I

INTRODUCTION: THE APPROACH

CHAPTER – I

INTRODUCTION: THE APPROACH

1.0 INTRODUCTION

Everyone is closely associated with environment because environment provides surroundings in which a person, animal or plant lives or operate. While, an environmental hazard is a generic term for any situation of events which possess a threat to the surrounding. The environmental issues are widely discussed on the platform which range from local to Global. This issue remained not for a group of certain nation, continents, researcher, philosopher, scientisest, discipline, society or religion. It has covered all the biotic phenomena which are present the Earth.

We are concern the threat created in the environment by a number of factors which are called agents. This threat can be called as hazards. The hazards can be classified into following five categories:

a) Chemical hazards

b) Mechanical hazards

c) Physical hazards

d) Biological hazards

e) Psychological hazards

All above hazards can be grouped into following two categories by its origin:

a) Natural hazards

b) Anthropogenic hazards

Nature itself is a creature of hazards. The tornados, tsunamis, earthquake, volcanoes, famines, torrential rains and severe floods, severe colds and tremendous deserted hot and all kinds of pollutions are some examples. But if we see the occurrence and frequency of all above events, it seems that these are very rare occurrences and cover only certain part of the earth surface. But the anthropogenic origins of hazards are of more serious concern and can be treated as world environmental challenge. The over whelming growth of population of the

world, general and certain countries in particular leads to exhaustive use and misuse oftenly abuse of available resources to fulfil its unending expectations resulted into challenge of survival of 'Planet Earth'. This manmade hazard is continuous process and it is like slow poisoning. It is not the matter to think upon population health or animal health but we must pay our maximum attention on 'Global Health'. Columbia university as its foundation, the earth institute dravs upon the scientific regor and academic leadership interdisciplinary research by undertaking hundreds of research projects on these issues.

The pollution is one of the hazardous phenomena and it has got special characteristics. Firstly it is not sudden occurrence by nature and secondly the pollution is created both ways by nature as well as by man. Thirdly it has long lasting effect and lastly it affect severely total globe as such.

Pollution a comparatively recent phenomenon is a threat to our civilization. Government, Scientist, researcher as well as common men of the different countries agree that unless we stop abusing our vital life-supporting system, the whole civilization will be in deep trouble. We must maintain the system or shall pay the penalty of either death on total destruction. Broadly speaking environmental pollution is of four types, which are air, water, land and noise pollution.

Water is an essential ingredient for our daily life. There are five major end uses of water like a) Public supply, b) Recreation and aesthetic values, c) Fish and other biotic resources, d) Agricultural use and e) industrial use.

Pollution of rivers in India has attracted wide attention even at the international level. The issue of such pollution has been deep affected on human life as well as total environment. The river water pollution is caused by natural as well as human activities. The natural activities have very long history but the water pollution in severe strength is an outcome of recent year. So, the main causes of water pollution are human activities, encroachment in river bed, excavation of sand, brick manufacturing, swage from industries, waste water from industries, agriculture and domestic sectors are main pollutant agents.

In this study an attempt has been made to study the water pollution and environmental degradation made by the different agents through various incidences in the river Krishna. The Krishna is one of the major rivers in the Maharashtra state (western part of the state).

1.1 THE STUDY REGION

The study region comprises south-western Maharashtra, particularly Krishna river basin. The river Krishna one of the three great rivers of south India take its birth at a internationally famous hill station Mahabaleshwar in Satara district of western Maharashtra. The river flows through Satara and Sangli districts and lastly enters into Karnataka state. The total length of river is nearly 243 kms and also the Krishna is perennial water bearing and the result is that the total course region of river is dotted with dense population and its different activities. The agriculture, industrialization and urbanization are the outcome of river water supplys. Wai, Satara, Karad, and Sangli ate the big urban places in the basin while Satara, Taswade, Kupawad and Madhavnagar etc. centres are the fragmented industrial estates are important.

1.2 OBJECTIVES

1. To study the Krishna basin and its annual flow of water.
2. To make survey of pollution factors along the Krishna river course.
3. To find out the sources of degradation along the Krishna and its tributaries.
4. To access the pollution gravity and its effects.
5. To suggest environment friendly strategy for river resources.

1.3 SIGNIFICANCE OF THE STUDY

Global health is most important and should keep on the first priority for consideration. The environmental degradation is a global phenomenon. The degradation in water bodies and water driven bodies become an very serious matter because water is supposed a life for everyone. The drinking water source in the study region is only surface water flow through various rivers. The recent report from the Indian River Water Assessment Commission shows that all the surface water comes through rivers and tributaries has become contaminated by forcing bodies. The river environment is degradated by nature and man and the result of this degradation is to be studies in various angles. So that some remedial planning can be suggested. The degradatted water bank affects not only personal health but the social and national health is also suffered. Such type of study can be conducted all over the region so certain policy for rescue operation can laid down. This becomes path finder to parallel studies.

1.3 REVIEW OF LITERATURE

The references like research articles, reference books, reviews, reports and news paper clips are notable to Quote. There are national and international work which is taken for reference. The review has been taken for the last decade only due to huge work on various angles of environment. Trivedi R. K.(2000) has worked on river pollution in Indian context. He was suggested some biomonitoring strategy for getting purified river environment. Karan Sunilkumar (2001) has worked internationally corered surface water pollution with reference to Nepal, India and Bangladesh. Khan T. A. et al (2005) has worked on physio-chemical analys is of drains in Delhi. The Delhi water quality was analysed by the researcher in ground reality manner while Patil A. M. et al (2007) has worked on physio-chemical analysis of Panchmahal Dam back water of Godavari river of Maharashtra. Paliwal and Sati (2007) has worked on physio-chemical and bacteriological analysis of Kosi river in central Himalaya. Sinha D. K., N. Kumar (2008) were worked on levelof Gangan river water pollution in and around Muradabad whereas Lokhande, Shinde et al (2008) were worked on Hydrobiological studies of Ulhas river in Thane district. They have tested water by taking comples from various locations. Mandal Prakash (2008) was analysed effects of pollution statues of Kawar wet land of Bhihar on flora and fauna. Shukla (2009) was taken a topic for analysis entitled Indian river system and pollution whereas Nagdeve (2010) has worked on population growth and environmental degredation in India. Kedzion (2011) has taken a topic for research on pollution knowledge and urban water politics in the Ganges River Basin. Trivedi M. P. and et al (2012) has worked on sediment contamination due to toxic heavy metals in Mithi river of Mimbai whereas Park (2012) stressed on needs information regarding dye-works and river water pollution in Tirupur in Tamilnadu. The report on Yemuna, Jal Abhiyan (2012) was remarkable to study. It is river Yemunadying by default or by design has clearly picturarised on water quality degradation.

1.4 DATA COLLECTION

Present study is based on primary as well as secondary sources of data, which are as:

a) Primary Data

An extensive field work will be carried out from source to the boundary of Satara and Sangli district to locate the source points of pollution, agents and agencies of pollution. The field work to will become beneficial to udated base map preparation, dialogue with affected sectors making photography and videos, measuring intensity and observing effects.

b) Secondary Data

Gazetter of concern districts, socio-economics reports, district statistical abstructs, district industrial centers, district pollution department, district food and drug department, district environment department, WALME. The references can be collected from main library of Shivaji University, Kolhapur and Pune University, Pune for all this data collection the vast field work is undertaken in the course region of river Krishna.

1.5 METHODOLOGY

The collected statistical information is tabulated in proper manner. Some mathematical calculations are carried out. The results are interpreted by applying appropriate cartographic techniques and maps. Researcher has collected photographically information from the sources of degradation. These photographs are self explanatory of and evidences of responsible factors. The subject itself has prime importance and very less work was done on the same river so we have had related primary information. This information was collected by undertaking vast field work. So, the fieldwork methodology, dialogue with stakeholders was also applied.

1.6 ORGANIZATION OF WORK

The total research work has been divided into following five chapers:

Chapter One	:	Introduction – The Approach
Chapter Two	:	Introduction to Study Region
Chapter Three	:	Environmental Degradation of River by Nature
Chapter Four	:	Man Induced Environmental Degradation of River
Chapter Five	:	Conclusion and Recommendations

1.7 REFERENCES

Abhiyan, (2012): Yemuna River, Dying by default, Report.

De, (2008): Studies of Water Pollution in the Thermal Power Stations.

Gazetteer, (1885): Govt. of Maharashtra, Sangli District.

Gazetteer, (1885): Govt. of Maharashtra, Satara District.

Gophane B. N., (1981): '*The Manjara Plateau – A Geographical Study in Rural Planning and Development*', Unpublished Ph. D. Thesis, Submitted to Shivaji University, Kolhapur.

Karan, (2001): Surface Water Pollution in Three Urban Territories Nepal, India and Bangladesh.

Kedzior, (2011): Pollution Knowledge and Urban Water.

Khan, (2005): Physio-Chemical Analysis of Drains in Delhi.

Lokhande, (2008), Hydrobiological Study of Ulhas River Thane District.

Mandal, (2008): Pollution Status of Kawar Wetland North Bhihar.

Mishra, (2012): Sediment Contamination Due to Toxic Heavy Metal – Mumbi.

Nagdeve, (2010): Population Growth and Environmental Degradation in India.

Paliwal, (2007): Physio-chemical and Bacteriological Analysis of Kosi River.

Park, (2012): Need Information Regarding Dye-works and River Water Pollution.

Shukla, (2009): Indian River Systems and Pollution.

Sinha, (2008): Level of Gangan River Water Pollution in and Around Mordabad.

CHAPTER – II

GEOGRAPHICAL SETTING OF THE STUDY AREA

CHAPTER – II

GEOGRAPHICAL SETTING OF THE STUDY AREA

INTRODUCTION

India is a great country of great people. It had glorious past. It has good present and a bright future. (Singh, 2001) India is India, No parallel example exists. Its cultural eminence can be traced in its ancient literature. India has always been for peace and has been spreading the message of tolerance and universal brotherhood. India is vast country. It has lofty mountains, great rivers, rich fertile soil, vast mineral resources, forests, and abundant of other natural resources.

The Republic of India is politically divided in to 28 states and 7 territories. The vastness of its area has produced a corresponding variety in respect of the physical and natural resources as well as the social conditions for which India has been described as the “epitome of the world”. (Singh, 2001) India’s social variety is equally pronounced. The immensity of the population of India embraces the widest variety in culture and social life. (Socio – economic review, 2001) The ethological variety is accompanied by a wider variety of languages in India.

In the scheme of geographical regionalization of India, Maharashtra State is one of the important states of India. Maharashtra stands out as a large but fairly homogeneous region. The homogeneity of the region manifests itself in both the physical and cultural traits. Practically, the entire region rests on a basaltic base which is, at places, tectonically disturbed, eroded and buried beneath a mantle of alluvium. Maharashtra, also sometimes called, the land of Maratha, is a very distinct cultural region because of the identity of language, a typical social organization based on the village as an economic unit and the robust historical traditions for which the Marathas are known. Irrespective of castes and professions the Maharashtrians are forged into a society which speaks a common language, finds a unifying force in its recent history, in the glory of the Maratha rule, and above all in Shivaji Maharaj who brought the conflicting elements of the Maharashtrian society together welding them into a formidable force. The entire Maharashtra state is drained by three principal river

systems, the Tapi, the Godavari and the Krishna. Except the Tapi basin, which is drained to the Arabian sea, the rest of the region is drained to the Bay of Bengal. More than half the area is covered by the Godavari basin, one fifth by the Tapi, and the remaining by the Krishna. The principal component of the region, the plateau of Maharasthra is drained by the Godavari in the north and the Krishna and its tributaries in the south. Maharashtra state is divided in to 35 districts, Satara district is one of the important districts of them.

LOCATION

Satara district lies at the western limit of the Deccan table and in southern Maharashtra. It is situated in the river basins of the Bhima and Krishna but from the point of view of the peninsular drainage, the entire land of the district belongs to the larger drainage system of the Krishna River. The district extends between $17^0$5' and $18^0$11' north latitudes and $73^0$33' and $74^0$54' east longitude. It is surrounded by Pune district to the north, Solapur to the east, Sangli to the south and Ratnagiri district to the west. It is also has a small boundary of about 24km with Raigarh district in the north-west. The district has an area of 10480 sq. km and a population 30, 03,922 as per the 2011 census. The density of population is 287 persons per sq.km as per the 2011 census. Amongst the 35 districts of the Maharashtra state, Satara ranks 12^{th} in terms of area and 13^{th} interms of population. The headquarters of the district is located at Satara town with a population of 108048 as per 2001 census. The distict is devided into 11 tahsils administratively. These are Mahabaleshwar, Wai, Khandala, Phaltan, Man, Khatav, Koregaon, Satara, Javoli, Patan and Karad.

PHYSIOGRAPHY

The relief of Satara district changes from place to place and these variations in land are due to the geological complexity of the region and varied geomorphological evolutions (Deshpande, 1971). The relief is an important element of the ecological setting directly influencing on land use of the area. The affects of altitude are felt directly and indirectly through climate, vegetation and soil etc.

I) SAHYADRIAN RANGE

The Sahyadrian is a main range within the Satara district along the western side. Its entire length of 96.77 kms from north to sourth. The Sahyadris enters within the Satara districts from about 12.90 kms north of Pratapgad pass south-west for about 32.26 kms. The crest then turns to the south-east, and in an irregular line, continues to stretch south by east about 64.52 kms till it enters Kolhapur district near Prachitgad about 24.19 kms south-west of Patan.

Wthin the Satara limits Sahyadris crest has major five forts. From the north these are Pratapgad, Makarandgad, Jangli-Jaygad, Bhairavgad and Prachitgad. There are eight passes which connect the Konkan with Deccan trap and these are FitzGerald or Ambinali, Par, Hatlot, Ambli, North Tivra, Kumbharli, Mala and South Tivra passes. Five spurs pass east and South-east from Sahyadris. Beginning from the north these spurs may be named the Kamalgad, Vairatgad, Hatgegad-Arle, Bamnoli-Gheradategad, and Bhairavgad-Kandur: the last two are large ranges each with three minor spurs (Satara District Gazetteer, 1889).

Kamalgad spur starts about 8 kms north of Mahabaleshvar and passes about 16 kms east ending in the hill fort Kamalgad. It becomes a water divider between the Valki river (in north) and Krishna river (in south). The second is Vairatgad spur which is a part of Mahabaleshvar plateau. It is leaves close to Mahabaleshvar and stretches south-east about 32 kms and ending the hill-fort of Vairatgad. It is water divider between Krishna (north-east) and Kudali (south-west). The Hatgegad-Arle spur starts like the Vairatgad and it is parallel to Vairatgad range. It is the water-parting between the Kudali (north-east) and the Yenna or Vena (south-west). The Vamnoli-Gheradategad is the major spurs of the Sahyadri. It has three major spurs extended east and south-east across the plain. These spurs are Satara spur, Kelvali-Sonapur spur and Jaln-Vasantgad spur. In the southern part of Satara district starting from the main line of the Sahyadris near Bhairvgad about 64.52 kms south-west of Patan, a great belt of hills stretches south-east. It has three major lines which are Gunvantgad, Kahir-Kirpa and the Kalgaon- Jakinvadi spurs.

II) MAHADEV SYSTEM

The second system of Satara district is Mahadev system. The Mahadev hills take place 16 kms away from north of Mahabaleshvar and it stretches east and south-east across the hole portion of the district. The first 48 kms it runs east-west and after crossing Khamatki pass it stretches south-east up to eastern part of the district. The significant characteristic of this system is it stretch discontinuous and it is known by various names. In western part it is known as Gandhardev hills, at central part of Mhaskoba hills and eastern part its recognized as Seetabai hills as well as Mahade system, it have chief three sub supers. The first is Chandan-Vandan and it runs about half across the district. The second spur is Vardhangad-Machindragad spur begins from Mol (Khatav) and cross the boundary between Satara and Sangli district. The spur has some hills named as Uardhangad, Sadashivgad and Machindragad. The third Machimangad spur begins from the Mahadev hills about 14.52 kms east of the starting point of Vardhangad-Machindragad range and stretches sout-east.

PLATEAU AND PLAIN

The vast central and eastern portion of Satara district is come under this category of topography. The central Krishna basin as well as area of Khandala, Koregaon, Phalatan, Man and Khatav tahsils occupied major portion of undulating relief. The height is varying, in northern part it shows more than 1000 m and in southern part it recorded up to 450 m. The both central and eastern portion has occupied nearly 70.01 per cent out of the total area of Satara district.

GEOLOGY

The entire area of the district is covered by basaltic lava flows of Upper Cretaceous – Lower Eocene age. These flows are part of the Plateau Basalts of the peninsular part of India and have been extruded by fissure type of volcanoes. The basalts are capped by laterite, which is found in the plateau above 900m from Mean Sea Level. Along the courses of the major rivers alluvium has been deposited in recent times (Geological Survey of India, 1976).

CLIMATE

The climate of the Satara district can be divided into the following groups:

a) Rainy Season

Rainy season begins from mid June and lasts until the end of September. 95 per cent of the total rainfall of the study area receives in the rainy season.

b) Winter Season

Before to begin winter season generally from October to mid-November the season becomes again hot. But after mid-November up to January end, the season is cold. However, from February to the end of the March the intensity of cold season is high.

c) Summer Season

The summer season starts from April month and ends up to mid-June. In this season climate is so hot.

DRAINAGE SYSTEMS

The Sahyadris and Mahadev ranges played significant role as a water divider. The river Nira, Krishna, Yarala and Manganga are the major river systems within limits of the Satara district.

1) Nira River

The Nira river separates Satara from Poona in the north. It rises on the Sahyadri range at Pant Sachiv of Bhor and runs east along the northern boundary of Khandala and Phaltan tahsils of Satara district. There after she enters in Solapur district. The length of the Nira River within the study area is 209.67 kms. The study area has one dam on this river, named Veer dam which is helpful to change the landscape. 76 kms right bank canal of Veer dam is providing water for agricultural purpose. Irrigationaly Nira River has more importance.

2) Krishna River

The Krishna river is one of the three great rivers of south India. The Krishna rises on the eastern prow of the Mahabaleshvar plateau 06 km east of the village Jor. From Jor to Wai it runs east and thereafter it runs south in hole district of Satara and entered

in Sangli district. The length of Krishna River within the Satara district is 176 kms and this course it joins Kudali, Veena, Urmodi, Tarali and Koyana, which are the chief tributaries of the Krishna system. These all tributaries rises in Western Ghats and runs eastward and meets to Krishna river to its right bank as well as only Vasana river flows southward and joins its left bank. Beside these some other small tributaries also meets to this river. Within the Satara, after crossing 88 kms course it receives Urmode 03 km away south-west of Venegaon. The river Tarli and North Mand meets this river in Karad tahsil near Umbraj. At Karad, the river Koyana meets Krishna from the right side.

Within the limits of Satara district Krishna is not suitable for navigation. The course of river is too rocky as well flow of water is too rapid. The banks are 06 to 10 m high from the water level and generally sloping earthy and broken. The river bed is some places rocky and sandy. The water of the Krishna is little used for irrigation.

On this river dam Dhom was constructed in Wai tahsil. The Dhom dam has two canals, which are right (59 km) and left canal (113 km). Due to these canals most of the area comes under the irrigation.

3) Kudali River

The river Kudali is a small feeder of Krishna in the north. It rises near Kedamb in Javli and flows 25.81 kms south-easterly direction and meets the Krishna from the right about 1.60 km south of Panchvad in Wai tahsil.

4) Yenna River

The river Yenna is a chief feedrs of Krishna river. Ti rises on the Mahabaleshvar plateau and falls into the Yenna valley and a south-easterly course of about 64.52 kms through Javali and Satara tahsils and after it joins to Krishna River near Mahuli, 05 km east of Satara. In the summer season the stream stops but the water stands in the form of pools. It is crossed by no ferries. It has one dam (Kanher) with right and left bank canals respectively 58 kms and 21 kms. Beside this foot bridge at Medha and Javli and also it have four road bridges at Varya, Kanhera, Kelghar and Vadha-Kheda.

5) Urmodi River

The Urmodi is a small feeder of Krishna. It rises near Kas in Javli tahsil and flows south-east about 32 kms and joins Krishna near 03 km south-east of Venegaon. The banks of the Urmodi are high and steep. In summer season its flow is stopped. It has one bridge at Latna.

6) Tarli River

The Tarli is a small tributary of the Krishna, it rises in the north-west of Patan about 16 kms above village of Tarli. It flow south-east nearly 32 kms and joins Krishna on its right bank at Umbraj.

7) Koyana River

Within the limits of the Satara district Koyana is a largest feeder of the river Krishna. It rises on the west of the Mahabaleshvar plateau near Elphinstone point. The first 64 kms east direction. The chief feeders of the Koyana's are Solashi, Kandali, Kera, Morana and Wang etc. after all Koyana joins Krishna at Karad. In the first 64 kms the Koyana is seldom more than 30 m broad, and banks are broken and muddy as well bed is of gravel. The next 64 kms course the bed is 90 to 150 ms broad. In the hot months the stream often ceases, but the water stands in deep pools through the driest years.

8) Vasna River

The Vasna rises in the Mahadev range near Solshi in the north of Korgaon. It flows southward for about 32 kms and from the left falls into the Krishna nearly 1.5 km east of Mangalpur in Koregaon tahsil.

9) Manganga River

The Manganga is the tributary of river Bhima. It rises in the Tita hill in the north of Man. The total length of Manganga within the Satara district is only 64 kms. In Man it runs south-east. It has water during the rains and almost dry in other times. The bed is sandy and banks earthy and sloping.

FOREST

Satara district as endowed with natural vegetation. Distribution of vegetation cover, vegetation types in study area is gets affected by the climatic variations, relief, soil type, slope and human intervention. The total area of forested land of Satara district is 1503.87 sq. km out of that reserved forest has 1349.44 sq. km, protected forest only 47.77 sq. km and unclassified forest has 106.66 sq. km. The lands are scattered over the whole district, and also found in broken form by private and cultivated land.

The study area has chief three types of forest. These are as follows:

a) Evergreen Forest
b) Semi-Evergreen Forest
c) Dry or Arid Forest

a) Evergreen Forest

The distribution of evergreen forest in the study area as along the western Ghats in 9 to 21 kms broad north-south belt. Which is divided into five forest ranges (Wai, Stara, Javali, Mahabaleshvar and Patan). Where annual rainfall is above 5000 mm. these five forest ranges are fairly compact and have little cultivated land. The chief species consist of Jambhul, Anjan, Ain, Umbar, Kenjal, Hirda, Phanas, Nana and Bamboos. They contain many trees valuable both for timber and as fire wood.

b) Semi-Evergreen Forest

The semi-evergreen forest have considerable portion of the slopes of the spurs. In the eastern part there are five ranges, Khandala, Karad, Man, Khatav and Koregaon, which branch east from the Sahyadris is covered with teak mixed with brushwood. The major species includes of Nimb, Mango, Karanj, Babhul and Palas etc. The eastern ranges have more land under private and cultivated tracts.

c) Dry or Arid Forest

The remaning major portion of the study area belongs to this category of forest. This area receives less rainfall as compare to other parts. The major species like Babhul, Chinch, Grass and shrubs etc.

SOIL

The agricultural practices as well as some other occupations of human beaing, mostly concern with soil. In the study area diversity of soil are vary from place to place. The single village has different types of soil. But in general soil of Satara district is classified into major three categories and these are as follows:

a) Lateright Soil
b) Sandy Soil
c) Clay Soil

a) Lateright Soil

The lateright soil locally known as red or tambad. It is commonly found at hills of Mahabaleshvar and early course of Koyana river. Some places it mixed with black soil. Along the hill slopes soil erosion is a major problem observed in the lateright soil zone. Depths of these soil are varying from place to place i.e. 30 cm to 03 m. It is rich with nitrogen but poor inorganic composition.

b) Sandy Soil

The sandy leading light coloured soil are the malran or murum mal a hard rocky soil commonest at the base of the more eastern hills. The same soil mixed with red at the foot of the Sahyadris. Maximum proportion of this soil are observed in Man and Khatav tahsils. These soil content with lime and potassium followed that nitrogen as well organic carbon etc.

c) Clay Soil

The clay soil are coloured in black. Which soil are generally found in belts lying along the banks of the leading streams, the breadth of the belt varying with size of the stream. In the Krishna valley is found the broadest of this rich soil (Govt. Gazetteers Dept., 1884). It is very rich in nitrogen and carbon.

REFERANCES

1) Deshpande C. D., (1971): Geography of Maharashtra, National Book Trust of India, New Delhi. pp. 10-43.
2) Govt. of India, Satara District, Gazetteers Department (1884).
3) Geology of the Satara District (1976): Maharashtra, Geological Survey of India.
4) Census of India, 2001: District Census Handbook, Satara District.
5) http://www.censusindia.net/

CHAPTER – III

ENVIRONMENTAL DEGRADATION OF RIVER BY NATURE

CHAPTER – III

ENVIRONMENTAL DEGRADATION OF RIVER BY NATURE

3.0 INTRODUCTION

Major river systems of the World become the lifeline of the respective countries due to their continuous and steady supply of fresh water. But in the recent era, the quality of fresh water is too much deflected from their original state. The quality of fresh water is varying from river to river. Land and water degradation threaten food security for many of the poorest and most food insecure living in Asia, Africa and Latin America (Kaiser, 2004).

The river degradation has been forming owing to natural and manmade causes. Therefore, here attempt has been made to study the river degradation of Krishna River within the limit of Satara and Sangli district (Maharashtra). In this chapter only natural causes are considered, which are playing major role in river degradation. Physical phenomenons are the common and lifelong agents of river degradation. The main degradation types related to sediments quality and quantity include: excessive erosion which leads to increase of sediment load in the river, chemical contamination impacting sediment quality, extreme events as floods and organic matter like vegetation.

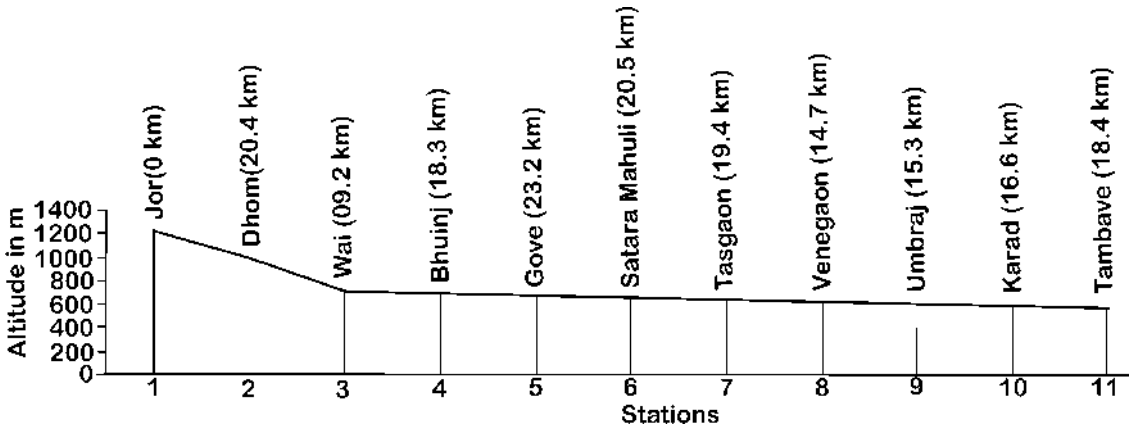
3.1 COURSE REGION OF RIVER KRISHNA

The river Krishna rises at Mahabaleshvar (17^0 59’ N and 73^0 38’ E) at the altitude of 1220 m from MSL. The Arebian sea is located 65 kms west away from the origin point of Krishna river but it flows south-east ward along the Western Ghats (Sahyadrian range) within the Satara distric. The entire course of Krishna river in study area is 176 kms and in this course chief tributaries namely Kudali, Veena, Urmodi, Tarali and Koyana. These all tributaries rises in Western Ghats and runs eastward and meets to Krishna river to its right bank beside the only Vasana river flows southward and joins its left bank. Beside these some other small tributaries also meets to this river. Within the Satara, after crossing 88 kms course it receives Urmodi 03 km away south-west of Venegaon. The river Tarli and North Mand meets this river

in Karad tahsil near Umbraj. At Karad, the river Koyana meets Krishna from the right side.

The Krishna river system falls in the Deccan trap. As in other parts of the West Deccan the hills are layers of soft or amygdaloid trap separated by flows of hard basalt and capped by laterite or iron clay (Gazetteers Department, 1884). Western Ghats is the major water divider located in western part of Krishna basin due to such physiographic condition number 1st and 2nd order streams are rises and flows eastward. 3rd to 6th Order Rivers flows to east and south-east direction. The early stage of Krishna drainage system the slope of land is steep up to Dhom dam and there after course gradient become gentle. An average slope of this system is 3.15^{0}. The western part of the area receives more rainfall. Therefore, the rain is the major source of water supply as well springs are other source. The discharge of water from three stations (Dhom, Khodshi and Karad) observed that annual average discharge of water 23.0, 84.7 and 157.9 TMC. Fig. 3.1 shows the profile of the Krishna river. While flowing to south and southeast the river at first 80 km comes very rapidly thereafter it becomes gentle.

Fig. 3.1: Profile of the Krishna River



KRISHNA RIVER BASIN IN SATARA

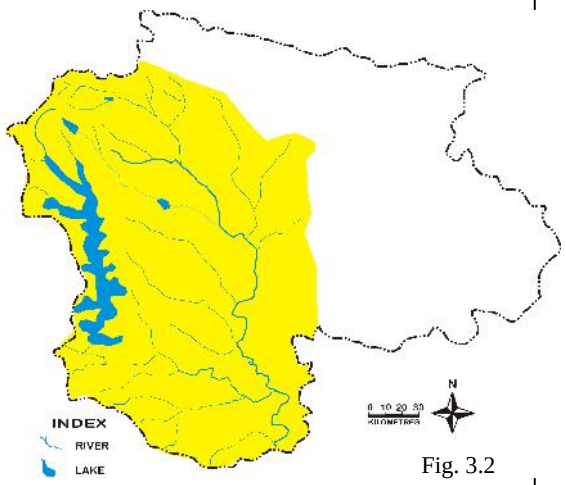


Fig. 3.2

3.3 CHARACTERISTICS OF NATURE COURSE REGION

The course region of Krishna river is located at north-western part of Deccan Trap. The total length of Krishna river within the limit of Satara district is 176 kms. Generally, river flow tends to maintain a dynamic equilibrium. Sediment load and size tend to balance stream discharge and slope (Tyagi, 1998). If one of these variables alters, the adjustment in other variables is required to maintain the balance. The complex Geological nature of the region reflects in the landscape. The landscapes are molded due to various aspects like nature of rocks, structure and texture of rocks, Hydro-meteorology, discharge of water, landslides, erosion and vegetation cover etc. All these phenomenon's are the major natural causes of river degradation. The river Krishna is degraded through natural way. The detailed analysis of is as follows.

3.3.1 Nature of Landform

The Sahyadrian and its finger ranges with availing Krishna and his tributaries combinally formed the typical type of topogaraphy of the basin. Eastern slope of Western Ghats is having steep slope with number of streams. These streams are developed their own gullies. Such gullies have formed various structural landforms. The structural landforms are associated with volcanic eruption and work of running water. Volcanic eruption concerned to formation of Western Ghats itself and its off-

shoots, table lands and plateaus. On other hand river work responsible for the formation of ‘V’ shaped valleys, rapids, waterfalls, cliffs, alluvial fans, river meanders and flood plains etc.

It reveals that in the total runway of river Krishna, half of the portionis having very undulating nature of physiography. It always happens due to hot summer and cold winter in the Sahyadri top hills weathered rapidly due to sun heat, winds and water from rains.

Above namely landforms are deeply concerned with sum total weathering and erosion. Along the western slope of mountain, plateau, hills and foot hilly area always come under the process of denudation. In the process of denudation rocks are converted in to small pieces up to fine particles. These all material which comes under the influence of running water, both rock material and water mixed up to certain level cause the river degradation.

3.3.2 Nature of the Rocks

The Krishna river basin comes within the western part of the great Deccan Trap fields. The major varieties of the rocks in this area are basalt, amygdaloid, vesicular and clay and lime, which with some intertrappean sedimentary beds and numerous highly ferruginous clays beds made up the great mass of the basin. The lower strata's are mostly basaltic in character, the medium strata's are alternatively basaltic and amygdaloid and upper are chiefly basaltic capped with clay and laterite.

Due to the insolation or variation in temperature exposed rocks of the basin caused weathering, but weathering intensity is differing from rock to rock. The soft rocks like clay, lime and sedimentary are disintegrated faster than the basalt. The rocks are composed by various minerals with its physical and chemical properties. When such rocks are braking or disintegrated into gravel, bolder, sands and clay etc. forms as well rock like lime can easily dissolve in water. In this process rock content element like calcium, iron, magnesium, aluminum, copper, zinc, nitrogen, phosphorous, potassium, sulpher, sodium and chloride etc. mixed in river water. Therefore, river water loses its quality.

3.3.3 Hydro-metrology

Yearly and monthly discharges recorded during 1969-1985 at Dhom, Khodshi, Koyana and Karad stations are located in the north-west, western and southern part of the Krishna watershed, were analysed. The yearly extreme average maximum discharge varied between 735.59 and 10190.92 m^3/s. The yearly extreme an average minimum discharge remained below 22.9 m^3/s. The monthly average maximum discharge was greatest in August (38731 m^3/s) at Karad and least in February (4 m^3/s) at Dhom during 1965-1985.

The maximum and minimum average yearly rainfall was respectively 500 mm and 1200 mm during 1991-2011. Generally, June, July and August experienced high rainfall. November, December and January experienced low rainfall. The total monsoonal rainfall (1991-2011) was slowly increasing. Therefore, the discharge should have also increased at present. Monthly means of maximum and minimum temperatures recorded during 1991- 2011 exhibited somewhat constant range.

Averages of mean-maximum and mean minimum temperatures are 32.8^0C and 19.5^0C, respectively. June, July, August and September possessed high temperature whereas December, January and February possessed low temperature.

Hydro-metrological phenomenons are the one cause of river degradation. During the high discharge period severely erosion is happened. The discharge of water is concerned to the rainfall. The Krishna water shade is having more rainfall. Though in the rainy season surface area is washed and that washed sediments mixed in the river water. Particularly at the time of flood muddy water is commonly observed in river course and also such muddy water should be observed after flood up to one week.

3.3.4 Land Sliding Events

The land sliding events are commonly occurs particularly first and second stream orders. Losing earth material or debris towards downward along the sloppy land is called land sliding. In Krishna water shade has occupied vast area by the first and second orders flow and the same area has received more than 1200 mm rainfall. Such condition is ideal for land sliding. The event of land sliding provides chemical material to lowering the quality of Krishna River. The land sliding is every year phenomena, particularly in the passes. Due to heavy weathering by sunlight, hot temperature, chemical reaction, wind blowing and heavy rainfall the loosed, weakened rocks and bolders to collapsed heavily and directly falls in the river flow creates dirty, muddy and polluted water of the river.

3.3.5 Biodegradation

The western part of Krishna basin is rich in biodiversity. It has various plant and animal species. Biodegradation is more taken place through the vegetation. The dense forest has provided the different parts of plants like as leafs, roots, and branches of trees. Such vegetation material is mixed in river water and decomposed. The river bed is some places rocky and sandy. The rocky bad have number of ponds. Such ponds have various species of plants but in summer season unavailability of fresh water these are decomposed in the same ponds which water become degraded.

SUMMARY

The river Krishna flows from Mahabaleshwar up to end of the Sangli district on tough bedrock, even though it gets depredated by the nature frequently. The source region receives very heavy rains in the rainy season before a hottest summer prevails. In hot summer the rock structure became weak due to denudation process. The slope of the hills is very steep and naturally the land sliding takes place in rainy season. The debrees always collapse in the river bed and river gets polluted. Most of the time the water flows is come down very rashly resulted into very heavy erosion and the total water become bloord.

The basin area in the Mahabaleshwar, Jaoli, and Wai talukas are having very dense forests. The forest type is deciduous, so the leafs of the forest deepen into water and the water gets polluted. This process continues throughout the year. The leaf is followed with flowers and fruits.

The river itself is one of the causes of environmental degradation. What happen in the first phase i.e. youth stage, the vertical erosional practices are strong which results very deep valley of rivers. The erosional material comes down in the river bed and the total scenario changed.

The founa in the water bodies are also have some effect on degradation.

References

Govt. of Maharashtra, (1984), Gazetteers Department, Satara District.

http://cgwb.gov.in/watershed/index.html

http://google earth image

Kaiser, J., (2004): Wounding Earth's Fragile Skin. Science 304, 1616-1618.

Mehta, S., S. Mundle, and U. Sankar (1994), Controlling Pollution: Incentives and Regulation, Sage Publications, New Delhi.

Parikh, J. (2004), 'Environmentally Sustainable Development in India', available at ttp://scid.stanford.edu/events/ India2004/JParikh.pdf last accessed on 22 August 2008.

Tyagi, S.K., Kamyotra J.S., Makhijani S.D., and Chakrabarthi S.P., (1998): “Water Resources management and Pollution Assessment: Indian Scenario”, Journal IAEM, Vol. 25, pp. 15-21.

CHAPTER – IV

MAN IN DUCED ENVIRONMENTAL RIVER DEGRADATION

CHAPTER – IV

MAN IN DUCED ENVIRONMENTAL RIVER DEGRADATION

4.0 Introduction

In early days, water was primarily used for domestic needs like drinking, washing, bathing and cooking etc. But due to industrial and urban development, requirement of water for these activities has increased along with domestic purpose. Water of good quality is required for living organisms. The quality of water is described by its physical, chemical and microbial characteristics. But if, some correlations were possible among these parameters, then significant ones would be fairly useful to indicate the quality of water (Dhembare et.al, 1997). The deterioration of quality, loss of biodiversity and fast depletion of water resources are the main challenges, which need urgent attention.

The river Krishna is a well known for their civilization in western Maharashtra which associated with number of saintly temples, settlements and religious structures are built up on and along the right and left bank. In the recent decade's construction of bridges, growing population and urbanization, river sediments are excavated for different purposes. The speedy industrialization and urbanization as well as rapid growth of settlements during the recent past become the major causes of exploiting river resources has increased remarkably. On the other side peoples of the basin largely depends on the rivers for domestic utility of water and agricultural activities. Beside this vegetation clearing along the river banks, waste disposal in rivers, intensive farming and overuse of fertilizers in agricultural productions are identified as agents who are responsible for river degradation.

4.1 Human Elements and River Degradation

The quality of freshwater at any point on the landscape reflects the combined effects of many processes along water pathways. Human activities on all spatial scales affect both water quality and quantity. Alteration of the landscape and associated vegetation has not only changed the water balance, but typically has altered processes that control water quality (Peters and Meybeck, 2000).

4.1.1 Quarrying Activity

Human history itself proves the significance of quarrying activity. In ancient period man dug caves for his shelter but in these days nature of quarrying was negligible but now a day's nature of shelter and its amalgamated activities are tremendously changed. Growth of population itself expanded its need of shelter, roads, dams and other constructions directly push the quarrying activity in the respect of building stone. Building stone is the major resource of the study region particularly it is occurred Sahyadrian mountain and its finger ranges. In Javali tahsil, Pasarni Ghats is a well known area for building stone. At the time of obtaining building stone there is need of blasting as well as upper more than 1m over burden is disposed which is drained into various channels of the river.

At the time of obtaining building stone blasting is unavoidable; similarly each mining place having more number of trucks, due to the blasting different harmful chemical content and truck oil beside that over burden which contain oxides and hydroxide of Aluminium easily mixed in the water streams of rivers during Monsoon which create water pollution. Therefore, such water is harmful to human being, animals and plants.

4.1.2 Deforestation

Loss of biodiversity is primarily due to degradation or alteration of ecosystems, in particular the habitats of site specific species (Hughes, 2001). In the study region, vegetation cover alters vary rapidly due to human interference. The forest land transpired into building constructing, roads, quarrying activity, expansion of agricultural land and timber for different purposes. Collectively all these human activities generate soil erosion as well its leaps and branches fallown into river water, this condition perform change the chemical properties of original water and decomposing of vegetational biomass cause the river degradation.

In rainy season soil erosion is common in whole region due to deforestation, and decomposing of vegetational biomass cause the change the color, taste and smell which water is not utilizable.

4.1.3 Cultivation

Agricultural activity is the main stay of study region. Therefore, intensive agriculture is practiced for taken more and more production from limited land. The recent decades shows that modern technology mostly applied for higher yielding of crops e.g. chemical fertilizers, pesticides, insecticides, excess use of water, use of hybrid seeds and soil exercises combinenally cased the river degradation.

The Krishna basin of Satara and Sangli district is well known for sugarcane cultivation and for flowers, vegetables and other marketable agricultural products. For the better production of crops farmers are intensively used chemical fertilizers, content of such fertilizers mixed into artificial supply of water as well as rainwater which drain into river. Similar happen down with the pesticides which become major threat of river degradation. Four months rainy season and eight months are dry due to that condition crops needs to artificial water supply but in the study region it is observed that each farmer used more than requirement water for crops due to that lower salts come up at ground level and that salt easily drain into river. All these factors of cultivation generate pollutants in water as well these pollutants mixed into river water and its intensity in recent years are upgrading.

4.1.4 River Water Excavation

Growth of population in rural and urban areas, industrialization and urbanization accelerates demand not only of river water but also the sand for building constructions. Both lift of water and excavation of sand from river combinable generates the river degradation. Particularly past few years the demand of water is increasing rapidly for domestic, industrial and agricultural sectors, due to that the river water is lifted in enormous volume and it effect prominently observed in dry season. At the same time the excavation of sand of Krishan river has going on number of places. The river sand played significant role as a natural filter but now a days this natural filter is losing rapidly from river course. The excavation of sand also responsible for soil erosion in rainy season and it is observed after the flood condition at number of places along the river course.

The natural filter like sand is lost form river and volume of water become very less or it present in the form of ponds. Due this condition solid waste or liquid waste material deposited in river water and decomposed in these respective places. Impact of this all process found on river water which is cause the river degradation.

4.1.5 Waste Water of Settlements

The river Krishna is the major drainage system of western Maharashtra and this part of Maharashtra state is leading in all sectors of human activities. The development of human activities from the concrete base for urbanization with high population centres e.g. Wai, Satara, Karad and Sangli. Beside that numbers of rural settlements are located along the course of Krishna river. As per estimation, in India per man per day requirement of water for urban population was 89 liters in 2010. Out of this 29 per cent water was only utilized for bathing, 20 per cent for toilet, 35 per cent for house utilities (dishes and clothes washes) and only 4 per cent needs to drinking purpose. All these figures reveals the 84 per cent water can be known as waste water by per man per day in urban centres. Till date these urban settlements did not implemented proper and adequate water treatment plants for waste water. The number of rural settlements are located on the right and left bank of river Krishna. These settlements also drained their waste water in the river but its proportion is less than the urban settlements. Therefore, without treated waste water of these urban and rural settlements drained the waste water in river Krishna and it is the chief cause of river degradation.

Fig. : Krishna River side Settlements Outlet Waste Water, 2012.

4.1.6 Industrial Waste

In the study region Satara, Karad and Sangli are the well-known industrial centres. It has posses different types of plants as well as agrobaised industries. The industries required more water for their without upheaval functioning but in that process abundant waste water is outleted. The Krishna basin is known for sugar industries not only in Maharashtra but also in India on the basis of sugarcane yield and its recovery which is the concern to total production. Numbers of sugar industries are established in Krishna basin along with or its tributaries bank. In the process of sugar production it needs enormous or more quantum water for various purposes. But in study region only one sugar factory has avail proper waste water treatment plant and other sugar industries have observed very poor performance in the respect of waste water treatment plants. It is found that in upper Krishna basin the sugar industries were discharge their waste water in respective rivers in the rainy season but from last few years these industries were discharge their untreated water with molasis in rivers due to that the aquatic life become in danger e.g. number of fish species are dead in Warana river in the month of December, 2012 (Photo) as well as the habituated population along these river had been suffered by various diseases.

Such waste water has content various chemical components like carbons, oxides, sulphur, zinc, iron, lead, oils, gris and colors etc. as well as solid wastes which dump without treatment in river basin. Industrial waste is a major threat of river degradation as compare to other threats of river degradation in study area.

Fig. : Industrial Waste Water Discharge in River Warana, 2012.

4.1.7 Brick Industries

The river Krishna and his tributaries are deposited fine or clay sediments on the both right and left banks at the time of flood or optimum water level. Such fine soil is ideal for brick manufacturing. In study region urbanization is going on vary rapidly as well as the house construction with using bricks is common among the villagers. Due to this fact demand of bricks are increasing tremendously from last two decades and its impact is shown on river

degradation. The brick manufacturing needs an abundant supply of fine radish fertile soils which is only available along the banks of rivers. Therefore, the banks of the river or river course are the ideal location for brick manufacturing.

The brick manufacturing activity permute two ways for river degradation. First is excavation of soils cause for soil erosion which is discussed in last chapter, how soils erosion generates river degradation. Secondly, in the brick forming process it needs valuable material like coal and bagas. At the end of brick forming ash and unburned particles of coal, bagas and radish burned soils particles remains which easily mixed in river water, though the quality of water is changed up to some level.

Fig. : Brick Manufacturing at the Bank and in River Course of Krishna and Koyana Rriver, Jan., 2013.

4.1.8 Vehicle and Cloth Washing

The vehicle and cloth washing phenomenons are common among the rural habitats as compare to urban population. But such activity continuously observed in river side settlements. The both vehicle and cloth washing are the major causes of river degradation. At the time of vehicle washing, oils, gris, iron particles, colour and detergent mixed in river water. The thin layer of oil and gris formed on the surface water which become obstacle in the path of natural purification of water. The cloth washing is a cause of water pollution, for the washing of cloths it needs detergent. The chemical properties of detergents easily dissolved in river water. Therefore, the phenomenons like vehicle and cloth washing and their impact severally observed in dry season in study region.

Fig. : Vehicle and Cloth Washing in Krishna River, 2012.

4.1.9 Burned Ash Disposal

World history reveals the major civilizations were origin, develops and spared on the different parts of the continents of the earth. In India, the rivers Ganga, Godavari, Krishna and Kaveri are the major religious rivers as compare to other rivers. The Hindu populations with higher numbers are habititated in river basins. In Hindu culture the dead bodies are burned and remaining ash and bones are dumped in to the river water. It is observed that particularly in urban centres nearly 3 to 5 tons ash per day with bones is dumped into river water at Satar, Karad and Sangli. Due to this tradition ash is the major threat of river pollution or degradation.

4.1.10 Biodegradation

Biodegradation is the major threat of man induced environmental degradation of river in study region. The river side settlements have a common and general dumping ground for organic waste i.e. dead bodies of animals which is decomposed in river water. The numbers of major hospitals are located in chief cities and also major settlements due to that the hospital wastes are dumped in the rivers as compare to other threats of river degradation this is very dangerous way of river degradation. Beside that on market day unwanted parts of vegetables collected through the concern authority and dumped on the banks of rivers. Though these bio-waste matter easily mixed in the river water which become a habitual way of river degradation.

4.1.11 Fairs and Festivals

River is the creedal of human civilizations. Therefore, various religious, cultural and social activities of man intensely fasten with river. As per field observations Wai, Sangm Mahuli (Satara), Karad, Audambar and Sangli are the religious centres in study region as well as each river side settlement has major temple on river bank. Numbers of peoples are visited to these temples with religious mind for adoration. Beside that in a year there are one fair is celebrated by these settlements. In this course of action number of pious peoples are bring with them rosary a necklace, coconut, red, yellow and black powder and oil etc. all are offer in worship but it gathered in bulk. Bulky waste matter on one hand dumped in river and other hand it drained into river water.

Festivals are the common fact dominantly observed in study region. The festivals of god Ganesha, goddess Gouree and Durgamata (Navratry) are the common as well as the festival like Parayan played fundamental role in river degradation through the offering nirmalya and idols are dump into river water. The size of idols is different as well these idols are having chemical colors and plaster of paris which is cause of river degradation. At the time of Parayan, thousands of peoples are gathered together in river course.

4.1.12 DOMESTIC FESTIVALS

Water samples from Krishna and Warana rivers are taken in April, June, August, October and December, 2011. The physic-chemical characteristics of river water are knowing through considering P^H, DO, BOD, COD, Chloride, Sulphate, Calcium, Magnesium and Hardness etc. the table 1 and fig. 1 clearly reveals the quality of river water of Krishna and Warana.

Table 1: Average Physico-Chemical Characteristics of Krishna and Warana Rivers, 2011.

Sr No	Parameters	April	June	August	October	December	Average
1	P^H	7.8	8.1	7.8	7.3	7.4	7.68
2	D.O.	7.2	6.0	5.6	5.4	5.1	5.86
3	B.O.D.	13.2	6.8	6.1	7.4	6.6	8.02
4	C.O.D.	30	26	21	28	27	26.40
5	Chloride	54	97	83	67	48	69.80
6	Sulphate	13	5.8	5.2	5.1	12.6	8.34
7	Calcium	83	72	70	72	62	71.80
8	Magnesium	79	65	74	64	56	67.60
9	Hardness	175	160	172	147	145	159.80

Source: Based on field work, 2011.

a) P^H

According to Shaikh, Nisar and Yeragi (2003) pH is considered to be most important factor particularly in the case of the green algae. Das et. al, (1961), observed that high pH values coincided with plankton peak. The lower values of pH during rainy season may be due to the dilution of alkaline substances or dissolution of atmospheric carbon dioxide (Shaikh, Nisar and Yeragi, 2003). p^H value is the logarithm of reciprocal of hydrogen ion activity in moles per liter. Dissolved gases such as carbon di oxide, hydrogen sulphide and ammonia also affect the P^H of water. The chemical analysis of river water reveals that the average P^H is 7.68 which higher than the normal P^H value (7) and month-wise it remains always more in June (8.1) due to rain water wash the chemicals from watershed and drain in river and Industrial wastes may be strongly acidic or basic and their effect on pH value of receiving water depends on the buffering capacity of water. But in other months cultural factors dominated to increase the P^H value of the river water.

b) D. O.

The DO of the river water is observed in normal (4 to10 mg/1) position in upper Krishna basin.

c) B. O. D.

BOD values are changing as per months, April it found 13.2 mg/1 which is highest but in April, photo-transmutation caused to increase river pollution and in the month of August it reveals low (6.1 mg/1). An average value of BOD is 8.02 mg/1.

d) C. O. D.

The normal COD value of water is 30 mg/1, but in only April month it found normal position and in other month's as well average condition remain below the normal value of COD. For this happen human factors are more causal.

e) Chloride

The proportion of chloride is varied from 48 to 93 mg/l, the amount of chloride is maximum permissible up to 500mg/1 for drinking water according to WHO. More dominance of chlorides is observed near urban areas due to waste water, pesticides, grease and oil, metals and other toxic materials.

f) Sulphate, Calcium and Magnesium

The Sulphate range observed is 5.1 to 13 mg/l in the entire examination. The maximum amount observed is in the month of April 2006; which may be due to agricultural runoff. The proportion of calcium is varying from 52 to 73 mg/1. The magnesium levels varied from 56 to 79 mg/1 and average level of magnesium is 67.60 mg/1. The average hardness is observed 159.80 mg/1 and it ranges from 145 to 175 mg/1. The maximum values are during monsoon while minimum values are during winter season.

REFERANCES

Das S.M., (1961), Hydrogen ion concentration, Plankton and fish in fresh water eutropic lakes of India Nature 20.

Dhembare, A.J. and Pondhe, G.M.(1997). Correlation of ground water parameters ofpravara area, Maharashtra state,India.Vol.l2 (1 and 2): 32- 33.

Shaikh, Nisar and S.G. Yeragi (2003) Seasonal Temperature changes and their influence on free carbondioxide, Dissolved (DO) and pH in Tansa river of Thane District, Maharashtra. *JAqua. Bioi.*, VoLl8 (1), p. 73-75.

Peters Norman E. & Meybeck M., (2000), Water Quality Degradation Effects on Freshwater Availability: Impacts of Human Activities, International Water Resources Association, Water International, Volume 25, Number 2, Pages 185–193.

CHAPTER – V

CONCLUSION AND SUGGESTIONS

CHAPTER – V

CONCLUSION AND SUGGESTIONS

The Satara district is to be found in the river basins of the Bhima and Krishna but from the point of view of the peninsular drainage, the entire land of the district belongs to the larger drainage system of the Krishna River. The district has geographical area about 10480 sq. km, which avails a population 30, 03,922 as per the 2011 census. According to same census the density of population is 287 persons per sq.km and the growth of population is 6.94per cent. Satara distict is one of the leading districts on all fronts in the Maharashtra state. The district Satara ranks 12th in terms of area and 13th in terms of population. It is devided into 11 tahsils administratively. These tahsils are Mahabaleshwar, Wai, Khandala, Phaltan, Man, Khatav, Koregaon, Satara, Javoli, Patan and Karad.

The study area is enjoying by major three seasons like rainy season, winter season and summer season. Nearly 95 per cent rainfall occurred in rainy season, while from October to mid-November the season becomes again hot. But after mid-November up to January end, the season is cold and from April month and ends up to mid-June the climate is hot.

The Satara district has complicated physiographic and geological structure which reflects in drainage pattern. The Sahyadrian range and Mahadev range played dominant role as a water divider. Therefore, The rivers Nira, Krishna, Yarala and Manganga are the major river systems. The length of the Nira River within the study area is 209.67 kms. It has one dam named Veer dam. 76 kms right bank canal of Veer dam is providing water for agricultural purpose. Irrigationaly Nira River has more importance. The Krishna river has its own dam which is named Dhom. The Dhom dam has two canals, which are right (59 km) and left canal (113 km). Due to these canals most of the area comes under the irrigation. Yenna has one dam (Kanher) with right and left bank canals 58 kms and 21 kms respectively. Beside this foot bridge at

Medha and Javli and also it have four road bridges at Varya, Kanhera, Kelghar and Vadha-Kheda.

The area under the forest land of Satara district is 1503.87 sq. km out of that reserved forest has 1349.44 sq. km, unclassified forest occupied 106.66 sq. km and protected forest has only 47.77 sq. km. The forest lands are scattered over the whole district, and also found in broken appearance by private and cultivated land. The dense forest cover occur at the hilly part of the district, particularly the Mahabaleshwar, Pratapgad and Pachagani area. The dense forest are also occurred in the vallags of Koyna, Krishna, Venna where the rivers are deepen the hillsides. Bamnoli, Jaoli, Thosegrah, Navaji, Koyana are the ezamples of dense forested areas. As it observed west to east the forest cover become scanty. Particularly the eastern dry climate area reports only scrubs and dry deciduous vegetations. In the study area diversity of soil are vary from place to place. The single village has different types of soil. But broadly the soil of Satara district has been grouped into three categories namely laterite soil, sandy soil and clay soil. Laterite soil is found in western part of the district where very heavy rainfall receives. The wehills are made by the igneous and phospetic rocks resultant into laterite due to leaching. Whereas the sandy type of soils are found in the dry zone of the area. The clay soil is predominant in the basins of all the rivers.

Physical occurrences are the common and lifelong agents of river degradation. The quality and quantity of sediments relates to excessive erosion leads to increase of sediment load in the river, chemical contamination impacting sediment quality, extreme events as floods and organic matter like vegetation decomposed in river course etc. also major natural causes of river degradation have observed in study area. The entire course of Krishna river in study area is 176 kms and in this course chief tributaries namely Kudali, Veena, Urmodi, Tarali and Koyana. The early stage of Krishna drainage system the slope of land is steep up to Dhom dam and there after course gradient become gentle. An average slope of Krishna system is 3.15^{0}.

The western part of study area receiving high rainfall to compare with eastern part of Satara district. It is observed that rainfall is major source of water supply and springs are the subsidiary sources of water. The discharge of water from three stations

(Dhom, Khodshi and Karad) are exhibits that annual average discharge of water 23.0, 84.7 and 157.9 TMC. The river work responsible for the formation of 'V' shaped valleys, rapids, waterfalls, cliffs, alluvial fans, river meanders and flood plains etc. all these landforms are deeply connected with the weathering and erosion. It is observed that western slope of mountain; plateau, hills and foot hilly area always come under the process of denudation. Under this circumstances eroded material from bolder to clay mixed into river water.

As per the field study it reveals that the soft rocks like clay, lime and sedimentary are disintegrated faster than the basalt. When rocks are braking or disintegrated into gravel, bolder, sands and clay etc. forms but the rock like lime can easily dissolve in water. In this process rock content element like calcium, iron, magnesium, aluminum, copper, zinc, nitrogen, phosphorous, potassium, sulpher, sodium and chloride etc. mixed in river water in rainy season.

The maximum and minimum average yearly rainfall were respectively 500 mm and 1200 mm during 1991-2011. The yearly extreme average maximum discharge varied between 735.59 and 10190.92 m^3/s. The yearly average minimum discharge remained below 22.9 m^3/s. The monthly average maximum discharge was greatest in August (38731 m^3/s) at Karad and least in February (4 m^3/s) at Dhom during 1965-1985. Hydro-metrological phenomenons are the one cause of river degradation. Particularly at the time of flood muddy water is commonly observed in river course and also such muddy water should be observed after flood up to one week. The land sliding events are commonly occurs particularly first and second stream orders. The event of land sliding provides chemical material to lowering the quality of Krishna River.

Man induced factors are highly accountable than the natural factors in relation with river degradation. The river environment of Krishan shows that the number of saintly temples, religious structures, and settlements are built along the right and left bank. In the recent decade's construction of bridges, growing population and urbanization, river sediments are excavated for different purposes. The speedy industrialization and urbanization as well as rapid growth of settlements during the recent past become the major causes of exploiting river resources has increased

remarkably. Intensive farming and overuse of fertilizers in agricultural productions are identified as agents who are responsible for river degradation.

Western part of study area is rich in building stone. To obtaining such resource blasting is unavoidable. In this process oxides and hydroxide of Aluminium easily mixed in the streams of rivers during Monsoon which generate water pollution. Deforestation caused both erosional and decomposition of vegetational biomass in river which change the color, taste and smell of the water.

The Krishna basin within Satara district limit reveals that it is shimmering in agriculture activity. The farmers are used unnecessary chemical fertilizers, pesticides, high yielding verities of seeds and excess of water become the major threat of river degradation. The excavation of sand of Krishan river has going on at number of places. The river sand played significant role as a natural filter but now a days this natural filter is losing rapidly from river course. The excavation of sand also conscientious for soil erosion in rainy season and it is observed after the flood condition at number of places along the river course.

The waste water from settlements (urban and rural) is generate vast river pollution. It is observed that till date these urban settlements did not implemented proper and adequate water treatment plants for waste water. As per estimation 2010, urban centres drains waste water nearly 84 per cent per man per day. The industrial waste water content various chemical components like carbons, oxides, sulphur, zinc, iron, lead, oils, gris and colors etc. as well as solid wastes which dump without treatment in river basin. Industrial waste is a major threat of river degradation as compare to other threats of river degradation in study area. In the study region the identified industrial estates are at Wai, Satara, Taswade, Karad, Kundal, Kirloskarwadi, Madhavnagar and Sangli. The insustrial waste of many kinds merges in the water. There are a number of sugar factories production units also contribute in river water contaminated.

In the study area it is observed in the respect of vehicle and cloth washing. The oils, gris, iron particles, colour and detergent mixed in river water. The thin layer of oil and gris formed on the surface water which become obstacle in the path of natural purification of water. Therefore, the occurrences like vehicle and cloth washing and

their impact severally observed in dry season in study area. It is observed that particularly in urban centres nearly 3 to 5 tons ash per day with bones is dumped into river water at Satar, Karad and Sangli.

As per field observations Wai, Sangm Mahuli (Satara), Karad, Audambar and Sangli are the religious centres in study region as well as each river side settlement has major temple on river bank. Each year these settlements celebrated one or two religious function. In the celebration of function peoples are offered flowers, oil, coconuts, read, yellow and black powder. This easily mixed in river water. The festivals of God Ganesha, Goddess Gouree and Durgamata (Navratri) are the common as well as the festival like Parayan played fundamental role in river degradation through the offering nirmaly and idols are dump into river water. Beside these home functions like Vastushanti, Shravanee Puja (Satyanarayan) and Margshirsh Guruvar etc. the people offering variety of organic matter and next day it dump in water body. Due to above all factors river water becomes degraded. The hindu religion observe river as an praying and offering place. So, every ceremony is associate with river. A number of day to dayreligion happenings at domestic level ultimately meet at river. People use to dump all religion waste to river which resulted into degradation of river.

The chemical analysis of river water reveals that the average P^H is 7.68 which higher than the normal P^H value (7) and month-wise it remains always more in June (8.1). The DO of the river water is observed in normal (4 to10 mg/1) position in upper Krishna basin. BOD values are changing as per months, April it found 13.2 mg/1 which is highest but in April and in the month of August it reveals low (6.1 mg/1). An average value of BOD is 8.02 mg/1. COD value of water is except April month it found below average limit of normal value these happen human factors are more causal. More dominance of chlorides is observed near urban areas due to waste water and other causes are pesticides, grease and oil, metals and other toxic materials.

SUGGESTIONS

1. The denudation is common phenomenon. Therefore, aforestation in study area is put into action very seriously.

2. Excess excavation of sand should be controlled the artificial sand production should be given more importance.
3. Government legislations should be followed very seriously in the respect of forest and water use.
4. Local peoples movement is to be boosted in avoiding river degradation and river purification.
5. Considerable precautions must be take when bridge and road construction.
6. Quarrying activity and any type of washing in river course or watershed area is strictly prohibited.
7. Now a days agriculture is a major threat of river degradation. Though there is need of proper system for awareness among the farmers in relation to chemical fertilizers, pesticides, insecticides and how to provide water to crops?
8. Central and State Government should be provide sufficient grants to built the proper and adequate water treatment plants for urban and rural settlements with considering next 25 years.
9. No permission is to be given for new industry along with the river course. The severe action is to be taken on those industries which direct drain waste water in rivers.
10. Local people should aware about river degradation and its impact on human health.
11. Offering materials to Gods and Goddess should be collected separately and processing on it to be as fertilizer.
12. The Munciple Corporations and village Grampanchyats of concern settlements who are located on the bank of river should observe and take care of river course and for this special assistance should be given by the concern authority.
13. Priority should be given to the drinking water and it can be lifted without disturbing water ecology.
14. There should be complete ban on to discharge biomedical waste, washing of vehicles and installation of brick industries.

15. The alluvial soil which is deposited in the basin is now a days on demand and thousands of tons of such soil is excavated by the people. It has resulted into change in the river flow. It should be prohibited.
16. Last but not least one should get realized that the rivers are life lines of human being as well as all biological aspects. So, the awareness of protection is to be made through school education.