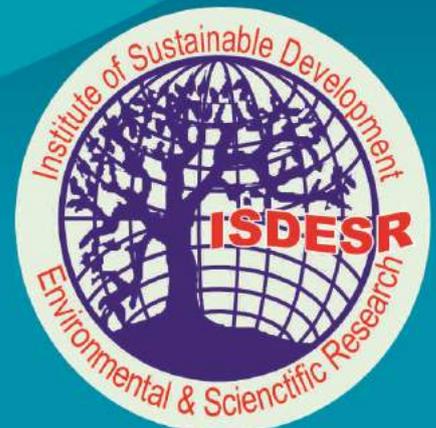


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SUSTENANCE OF WATER RESOURCES IN BIKANER DISTRICT : ISSUES AND PROSPECTS

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Abstract: *Water is a prime natural resource of earth. It is essential for sustenance for all forms of the life, food production and human development activities. All these properties impart to water its greater utility for human well-being. Scarcity of water resources is one of the constraints of development in the arid and semi-arid regions of our country. In the desert ecosystems, water constitutes the most important and an indispensable natural resource that limits plants growth and yield. Over exploitation of ground water for agriculture uses leading to fast depletion of limited ground water resources. The continuous decreasing trend of water table has become matter of concern for hydrogeologists and environmentalists. Therefore, surface and ground water resources and their conjunctive uses are equally important for over all development of these water stress regions. In view of these circumstances, there is an urgent need of protection, conservation, and sustainable development of scarce water resources of this desert region.*

Key words: *Water, Natural resources, Hydrology, Scarcity*

Introduction

Ever increasing population, urbanization and industrialization are becoming the major problems for the quality of surface as well as ground water resources. The surface water and ground water resources of the country play a major role in agriculture, hydropower generation, livestock production, industrial activities, forestry, fisheries, navigation and recreational activities etc. Unfortunately, it is being adversely affected both in terms of quality and quantity by human activities. Potable water, which is hardly 0.1% of all the water available on the planet, the scarcity of water is increasing day by day. The management of ground water is more important than the surface water, because cleaning of

ground water and making it suitable for domestic or agricultural uses is more complicated problem. Water quality directly affects the health of human beings and animals to a large extent. The mushrooming of concrete jungles and network of roads and paved areas has literally sealed the top surface of land and blocked the natural path of water infiltration to aquifers in the urban areas. This imbalance between the depletion of ground water resources on the one hand and their slow recharging on the other. It has resulted in the rapid depletion of aquifers and the consequent lowering of the water table at an alarming rate in the Bikaner district. Rainwater harvesting is an engineering solution to water problem especially in this arid ecosystem.

Hypothesis

The main purpose of the study is to present a holistic view of the ecological problems of water availability, water quality and water supply in a geographical perspective. The spatial and temporal aspects of such studies are thus the main focus and are highly valuable under ever increasing pressure of population for space and resources, which has caused disequilibrium in nature. In this context, an attempt has been made to test the hypothesis that the demand of water resources are continuously increasing and the quality of water is also deteriorating due to ever increasing demographic pressure and human development activities in the study area.

Objectives

1. To provide a comprehensive picture, evaluate the existing water resources in relation to the demand of water for domestic, industrial and agricultural sectors.
2. To relate quality of drinking water with health, explore relationships between biotic and abiotic composition of water, nature of industrial effluents and urban sewage, morphological and geological structure of the study area.
3. To suggest a strategy for rational and conjunctive use of ground and surface water resources to mitigate the problems of water supply both in regard to the quantity and quality.
4. To recommend ecologically feasible measures for sustainable development of water resources along with environmental conservation, protection and sustainable development of this desert ecosystem.

Database and Methodology

The present study includes secondary as well as primary data. The secondary data were collected from published and unpublished documents of government

departments like PHED, Ground Water Board, Municipal Corporation, UIT, Town Planning, Census, Directorate of Economic and Statistics and Directorate of Public Health and Industries etc.

Present Status of Water Resources

Bikaner district is located in the north-western part of Rajasthan. It covers about 30387.75 sq.km. (7.98% of the state's area) area with population of 1901005 (3.36% of the state). Rajasthan is located in the Thar desert, and it has only one percent of country's water resources on account of limited erratic and unpredictable nature of monsoon climate. The study area has acute shortage of water along with the average monsoon and non-monsoon season rainfall is 26.37 cm and 7.58 cm, respectively. The Bikaner district has no river system therefore, it has acute shortage of surface as well as ground water resources. Ground water resources are not adequate to fulfill the ever-growing needs of water resources of the study area. Therefore, canal facilities (IGNP) were developed in 1961. After inception of canal irrigation in the north-western Rajasthan, surface water resources are also being used for drinking, agriculture and industrial uses. In the north-western part of Bikaner district which is served by canal irrigation system, the surface water is also used in drinking as well as agricultural purposes. In north-eastern, eastern, central and southern part of the district which is covering about 84083 ha. area, the ground water is used for irrigation purposes. The district has total irrigated area of about 194098 ha., out of which 43.32 percent area is irrigated by ground water resources. Presently Bikaner district's 56.81% (438) villages are depended on ground water resources and the remaining 43.19% (333) villages (Poogal, Khajuwala, Chhattargarh) are served by canal water services. The villages of Nokha and Sridungargarh tehsils are fully dependent of ground water resources. The villages of Bikaner, Kolayat, Lunkaransar are served by surface as well as ground water resources.

Water Availability

Underground water, which is the main source for drinking, agriculture and other purposes in Bikaner district. It is generally found at a depth of about 80 to 120 metres below the ground level. The discharge from the well varies from 18,200 litres per hour (4000 gallons per hour) to 91,000 litres per hour (20000 gallons per hour). In Bikaner district, there are four major hydrological units viz., *Bilara limestone*, *Nagaur sandstone*, *tertiary sandstone* and the *quaternary alluvium*. The study area has about 227.0832 mcm ground water resources and presently 214.9282 mcm water is being exploited. The percentage of ground water availability of the different blocks of the study area varies from 11.82 percent (Kolayat) to 27.86 percent (Nokha) blocks. Therefore, Nokha block has maximum (63.2686 MCM) available ground water resources (Table 1). The

ground water availability for irrigation purposes is about 17.1003 mcm and the ground water development rate is about 94.65% in the study area. The alluvium formations cover major part (north-western part) of the district but due to saline ground water and thick sequence small area in north-eastern and south-western part in Lunkaransar and Kolayat blocks have been delineated as ground water potential. In these geological formations depth to water table ranges from 100 to 140 m and these formations occupy about 14% potential area. The general depth to water table increases from south-west to north-east direction. The water table contours indicate that the general direction of ground water flow is south-east to north-west. The ground water studies indicate that hydraulic gradient generally varies from 1.1 to 2.5 m/km. The quality of ground water is suitable for irrigation and drinking purposes. In southern part gradient become more steep (4.5 to 5.0 m/km). In Bikaner and Kolayat blocks quality of ground water is saline.

Table 1 : Bikaner District : Status of Ground Water Resources, 2004

SN	Name of Panchayat Samities	Area in sq.km.			Ground water resource (MCM)			Ground water development rate (%)	Condition of ground water source	
		Area	Suitable ground water area	Salty ground water area	Availability of ground water	Ground water exploitation	Surplus ground water		2001	2004
1	Bikaner	9278 (100)	3191 (34.39)	6087 (65.61)	57.2622	60.5696	-3.3074	105.78	critical	over exploited
2	Kolayat	7970.86 (100)	1924 (24.13)	6046.86 (75.87)	26.8388	16.3356	10.5032	60.87	safe	safe
3	Loonkaransar	6328.02 (100)	2071 (32.73)	4257.02 (67.27)	32.3287	9.0055	23.3232	27.86	safe	safe
4	Nokha	3800.97 (100)	3712.63 (97.68)	88.34 (2.32)	63.2686	83.3723	-20.1037	131.78	critical	over exploited
5	Sridungargarh	3003.90 (100)	2703.88 (90.01)	300.02 (9.99)	47.3849	45.6452	1.7397	96.33	safe	critical
6	Bikaner District	30381.75 (100)	13602.51 (44.77)	16779.24 (55.23)	227.0832	214.9280	12.1550	94.65		-

Note : Figures in brackets are in percentage.

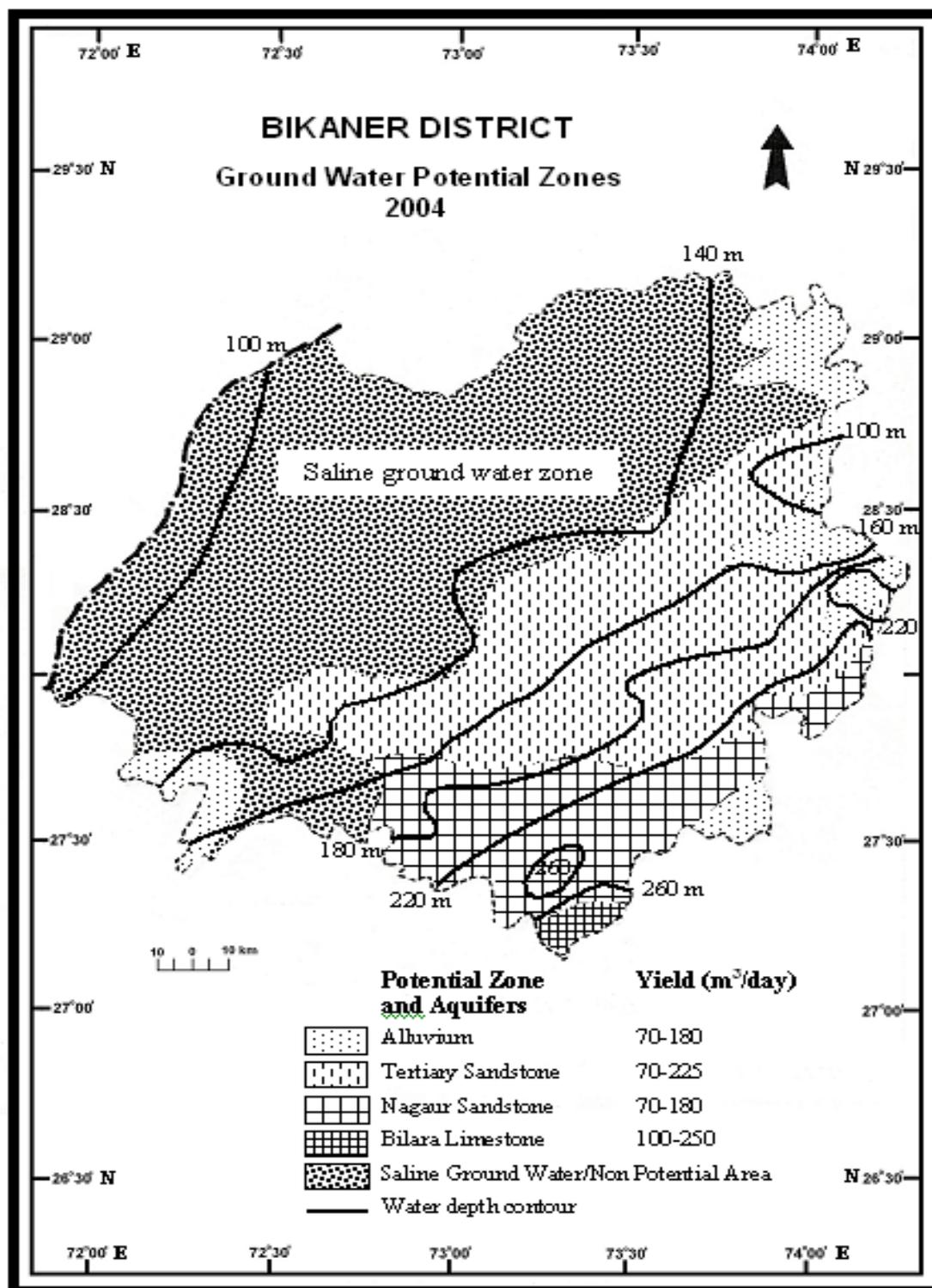
Source : Ground Water Resource and Management Report, G.W.D., Bikaner (2004)

Ground water study indicates that tertiary sandstone formations occupy south-western part of the Bikaner block where it covers extensive area. These formations also spread in peripheral part of adjoining block. The depth to the water table in these geological formations ranges from 140 m in the west to 200 m in the eastern part of the district. These hydrogeological formations encompass about 56% potential area. The ground water capacity of these formations range from 110 to 200 m³/day (Table 1 and Fig. 1).

The third important geological water bearing formations are Nagaur sandstone which belong to Marwar super group rocks. The thickness of the litho

units varies from 140 m to 250 m. Geographically southern part of Kolayat and Nokha tehsils are covered by these hydrogeological formations.

Figure 1



Source : Ground Water Department, Bikaner, 2004

The depth of ground water in these formations varies chronologically and it ranges from 38.10 to 116.38 m. The quality of ground water of these formations suitable for domestic and non-domestic uses. The depth to the water table ranges from 160 m to 260 m. The depth to the water table increases to north to south. Nagaur sandstone formations occupy about 28% potential area. The southern part of Nokha tehsil is covered by Bilara lime stone formations where depth to water table is increases more than 260 m. The thickness of the hydrogeological formations varies 115 to 225 m. These litho units covers small area in southern peripheral part of Nokha block, which covers nearly 2% potential area. The depth of ground water ranges from 48.42 m to 78.20 m. The ground water capacity varies from 70 to 120 m³/day. The quality of ground water of these hydrogeological formations suitable for consumptive uses. Qualitatively, alluvium geological formations of Bikaner and Kolayat contain saline water, which is not potable. The depth to water table in these formations ranges from 23.87 m to 47.59 m in the Bikaner tehsil and 11.12 m to 63.48 m in the Kolayat tehsil block.

Water Potability

Bikaner district's 55.22 percent area (16779.24 sq.km.) contains saline ground water, and the remaining part of the district (44.78 percent) has potable water, which is used for domestic as well as non-domestic uses. The Bikaner district has about 749 villages, about 62.08 percent (465) villages have potable water resources and the remaining 37.92 percent (284) villages have saline water. As far as the spatial distribution pattern of ground water resources is concerned, the northern and western (Kolayat, Khajuwala, Chhattargarh, Pugal and Lunkaransar) part, have saline ground water and remaining more than half part of southern and eastern parts (Bikaner, small portion of Lunkaransar, Dungargarh and Nokha tehsils) have potable water. The availability of ground water in the Bikaner district ranges from 11.12 to 135.15 metres. Geohydrologically, Kolayat and Lunkaransar tehsils are safe ground water zones, where potable water is found at the depth of about 37.85 m to 135.15 m and 20.53 m to 66.15 m, respectively.

As far as potability of ground water resources is concerned blockwise percentage ranges from 24.13 percent (Kolayat) to 97.68 percent (Nokha block). The south-eastern part of the district where Nokha and Sridungargarh block are situated the percentage of potability of water is above 90%. On the other hand western part of the district (Kolayat, Bikaner, Lunkaransar) has very little percentage of potable water, the percentage of saline ground water ranges from 65.61 percent in the Bikaner block to 75.87 percent in the Kolayat block.

Water Quality and Impact on Health Water quality directly affects the health of human beings and animals in a profound manner. The trends of increasing population, urbanization and industrialization are gradually becoming a threat to the quantity and quality of surface water as well as ground water resources. As far as the quality of water is concerned the ground water of Kolayat and Lunkaransar have more salinity in comparison to Nokha and Bikaner tehsils. Therefore, the chemical analysis of TDS indicates that the quality of ground water in the study area is not suitable for consumptive uses. The study highlights that whole district area has heavy concentration of abiotic components like chloride and nitrate in ground water and the values of the contaminants are greater than the maximum recommended values of WHO norms. The spatial distribution of fluoride of the study area reveals that slightly to moderately saline water is normally free from fluoride contamination.

The study area is fully depended on ground water, which is free from biotic contaminants. An assessment of biotic contaminants in water is more significant for the reason that most of the water-borne diseases like cholera, diarrhoea, dysentery, typhoid and hepatitis spread through contaminated waters. Therefore, the study area needs a sound water management strategy to solve the problem of human health.

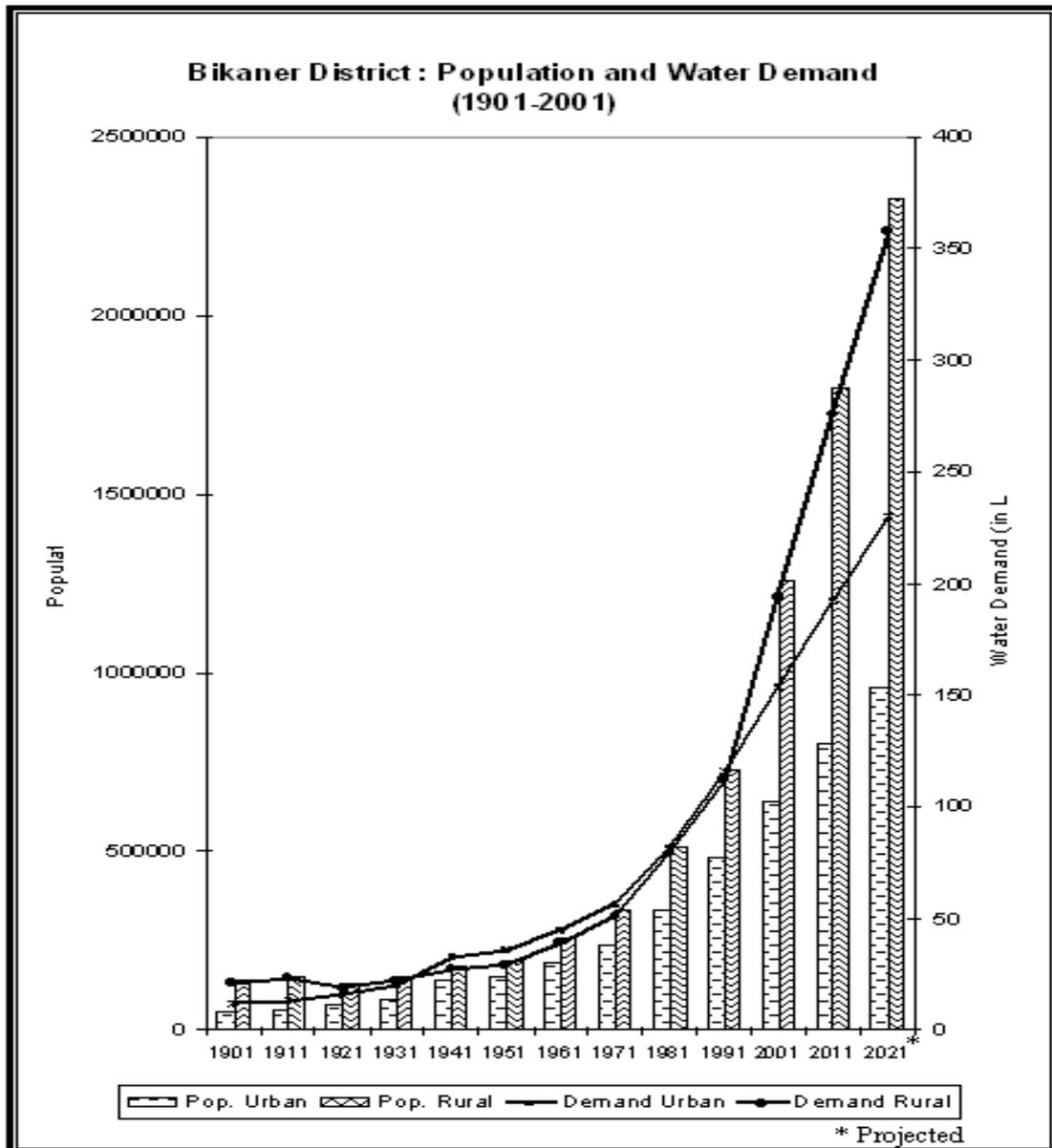
Water Consumptive Patterns

Water demand in Rajasthan is fast increasing with increase in population, urbanization and industrialization. Water in Rajasthan is mainly consumed for irrigation purpose, and second and third priorities are for drinking and industrial purposes, respectively. About 63.33% of the net irrigated area exists under ground water irrigation. At present the water supply should be 3952.73 lac gallons for 13205444 persons of urban area according to central norms of water supply but actual supply of water is only 2672.11 lac gallons. Thus, a wide gap exists between the water demand and supplied to the people. The gap may be widens when our future demand of water would be raised to 6723.85 lac gallons for urban population of 226.61 lac in 2021. Likewise for rural population, the water demand according to central norms would raised to 10843.15 lac gallons in 2021 (Fig. 2).

In 1901, the population of Rajasthan was 1,02,94,090 and it increased to 1,59,70,774 in 1951 but during the same duration, the population of Bikaner district also increased from 1,90,457 to 3,43,091. On account of increasing population, water demand also increased in the state from 1721 lac GPCD (gallon per capita per day) to 2719 lac GPCD and in the Bikaner district 33 lac GPCD to 65 lac GPCD. If we compare the population growth and water demand of urban and rural areas for the above mentioned period of data analysis indicates that urban population in the Rajasthan state for the first five decades

increased almost double (15.5 lac to 29.5 lac), consequently water demand also increased approximately in the same ratio (375 LGPCD (lac gallon per capita per day) to 715 LGPCD). But in the study area, the urban population of Bikaner district increased three times during the same period. Consequently water demand in the urban areas also increased three times (12 LGPCD to 36 LGPCD) The overall population migration trend is from rural to urban areas, therefore demographic pressure is continuously increasing in the urban area on account of better infrastructural facilities. Consequently the water demand also increased in the urban areas.

Figure 2



Note : Water demand : @70 LPCD (urban area), @120 LPCD (rural area)

Source : District Primary Census, Handbooks of Bikaner, 1901-2001, Govt. of Rajasthan, Jaipur

Looking to the population growth and migration trends of the population indicate that after 1951 population growth and water demand are both increasing continuously in the each decade. The overall population increase of the state of Rajasthan was recorded 5.5 times during the last century. But in the urban areas population growth increased more than 8.5 times. As a result, water demand also increased in the same manner. The study area of Bikaner district recorded higher (56.96%) population growth rate than Rajasthan state (28.33%) and country as well (21.34%) in 2001. This growth rate is running higher since 1971 due to introduction of Indira Gandhi Canal. The livestock population has also increased by two and half time since last 50 years. If we compare the study area of Bikaner district with the state of Rajasthan the overall growth of population was noticed more than 10 times during the last century but the increase of the urban population was observed more than 12 times. Consequently, water demand in the urban areas also increased in the same ratio (12.04 times) for the above mentioned period.

The detailed analysis of the population growth and water demand indicates that the population of the state will increase to 8.15 crores in the year 2021. The population increase and the water demand will also increase in the study area of Bikaner district. The projected population of the Bikaner district will be approximately 32.8 lac in the year 2021. The data analysis further shows that the population growth rate in the urban areas will be higher than that of rural areas. Therefore, it is expected that the water demand will be also increased faster that of rural areas in the study area (Fig. 2).

With the rise in population and steady growth of industries have increased the demand of ground water. Ground water is the sole source of drinking water for local residents, industries and agriculture in the study area. The study area of Bikaner was under safe zone in ground water till 1998. But as the exploitation of ground water with increasing number of public and field tube wells enhanced, the district reached in critical and very critical stage. In the year 2001, the ground water resources were in critical stage, but continuous unplanned and excess use of water (131.78%), resources is the main cause of the change in the stage of over exploitation of ground water development. The exploitation of groundwater for irrigation and adoption of commercial and water loving crops has put Nokha (131.78%) and Bikaner tehsils (105.78%) in very critical zone while Dungargarh (96.33%) has reached in critical level. The main cause of depletion of ground water resources are continuous increasing of water demand on account of increasing demographic pressure and poor recharge of ground water resource due to little and unpredictable monsoon rainfall. The other tehsils like Kolayat and Lunkaransar have saline water which is not suitable for cultivation. The remaining three tehsils i.e. Chhatargarh,

Khajuwala and Pugal have canal irrigation facilities and have brackish water. Therefore, it is essential to conserve rain water to mitigate the water crisis.

Under such circumstances, it is essential to conserve rainwater to mitigate the ill-effects of drought, stabilize agricultural production and develop water resources for the region. The use of water in a society varies in time and space. There are two different ways in which society makes use of water resources. The first is the traditional and the second is the modern. Traditional methods of water use are devised to make the optimum use of the available water.

In the arid areas of Rajasthan people build unique underground structures of various shapes and sizes to collect rain water for drinking purposes. These structures called tanka, kund or kundi are constructed. Since tanka are the main source of drinking water in these areas, people zealously protect and maintain them. Just before the onset of the monsoon, the catchment area of the tanka is cleaned up to remove all possible pollutants, and human activity and grazing of cattle in the area are prohibited. The stored rain water is utilized for the whole year. These simple traditional water harvesting structures are useful even during years of below-normal rainfall. It is therefore essential to adopt water management strategies to conserve and protect the limited available water resources of this arid district.

Conclusion

Water, although inexhaustible, is highly limited in quantity and quality both in respect of space and time. Ground water should be used with due care and it should not be depleted in reckless and uncontrolled manner. The techniques like watershed management, rainwater and ground water harvesting, judicious use of water in household, agriculture (sprinkler, drip, irrigation and dry farming), industry and appropriate water recycling techniques should be used for the purpose. The proper assessment, conservation and efficient use of surface and ground water resources is essential for developing water management strategies. The study suggests to evolve a strategy to fix priorities for optimum utilization of limited ground water resources (domestic, agricultural and industrial uses) in this desert ecosystem.

The ground water replenishment is not keeping pace with extraction. We must resort to age-old and time-tested traditional practices of rain water conservation (Kui, Nadi, Bawri, Tanka, Talab, Johar, Khadin, Jhalra etc.) to overcome the water crisis. Careful examination of water quality and periodical monitoring of abiotic and biotic contaminants of water is necessary to safeguard the health of the residents. There is an urgent need to create public awareness regarding rational use of limited water resources of the district. Water Cost must be charged according to quantity of water used. Water conservation and

development should be interlinked for the protection and sustainability of the water ecology of this desert ecosystem.

References

1. Vidyanathan (2006) : India's Water Resources Contemporary Issues on Irrigation, Oxford University Press, New Delhi, India.
2. B.W. Pandey (2005) Natural Resources Management, Mittal Publications, New Delhi, India.
3. D.K. Todd (1959) : Ground Water Hydrology, Tokyo, Toppan and Co., 195, 268
4. D.S. Deshmukh (1975) : Status of Groundwater Studies, Development and Utilization in India. Approaches and Methodologies for Development of Groundwater Resources. Proceedings of Indo-German Workshop, pp. 1-20.
5. Dasgupta, K. and Mann, H.S. (ed.) (1977) : Ground Water Resources in Desert Ecosystem and Its Importance. CAZRI monograph No. 1, Jodhpur Central Arid Zone Research Institute.
6. G.W.D. (2003) : Ground Water Resource and Management Report, Bikaner (Rajasthan).
7. G.W.D. (2004) : Re-Appraisal of Ground Water Resources of Bikaner District, Rajasthan.
8. Govt. of Rajasthan (2003) : Public Health and Engineering Department, Unpublished Data on Water Resources, Bikaner.
9. Prakash, Anjal (2007) : Challenges of Water Management, Economic and Political Weekly, Jan. 27, Vol. XLII, No. 4, p. 293.
10. Raju, K. Srinivasa, Sarkar, A.K. and Dash Moti Lal (2004) : Integrated Water Resources, Planning and Management, M/s Jain Brothers, 16/873, East Park Road, Karol Bagh, New Delhi.
11. Ranga, Shashikala (2012) : Water Management in the Desert Ecosystem of Bikaner District : Problems and Prospects, Ph.D. Thesis Awarded, M.G.S.Univ., Bikaner.
12. V. Ratana Reddy and S. Mahendra Dev (2006). Managing Water Resources. Policies Institutions and Technologies, Oxford University Press, New Delhi, India.

SPATIAL DECISION SUPPORT SYSTEM FOR UTILITY INFRASTRUCTURE DEVELOPMENT : A CASE STUDY OF JODHPUR CITY ELECTRICAL DISTRIBUTION NETWORK

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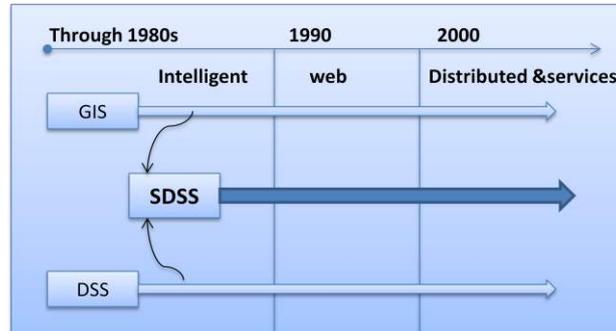
Abstract: *A typical power system consists of generation, transmission and distribution. The total network is a complex grid of interconnected lines. This network has the function of transmitting power from the points of generation to the points of consumption. The distribution system is particularly important to an electrical utility for two reasons: its proximity to the ultimate customer and its high investment cost. But, Distribution is considered the weakest link in the chain of power supply because of high losses (T & D losses). The paper is an attempt to throw light on electrical distribution network of Jodhpur City with a web based SDSS develop to improve energy efficiency. To efficiently manage utility operations, separate systems exist and the role of each system is different and unique. The lacuna falls here, in operating process of these unique and different systems, as there is lack of proper flow of information between these systems. With the huge & complex electrical distribution network consisting of many sources, feeders, alternate feeding points; updating and management of network data is a Herculean task. As stated above a multi disciplinary, multi-attribute, web based open source spatial decision support system can assist in solution of complex problems and provide efficiency gains in operational & non-operational areas of utility business, most importantly will help utility sector for simple & effective visualization of complex distribution network, together with fast electrical operations.*

Key words: *Infrastructure Management, Spatial decision support systems, Distribution Network, Power System.*

Introduction

Spatial decision support systems have evolved greatly over the last few decades based on advances in underlying technologies such as computer hardware and software, networking, and communication technologies. After early development in the 1970s and 1980s, the concept of SDSS gained traction in the 1990s. The development of SDSS became much more common in the late 1990s when ever greater amounts of digital spatial data were becoming available and personal computers were becoming widely used. The growth has continued into the 2000s with diversification based on technological developments. The development of SDSS generally followed developments in Geographic Information Systems, with many concepts and techniques of the science taken from decision support systems research and advances.

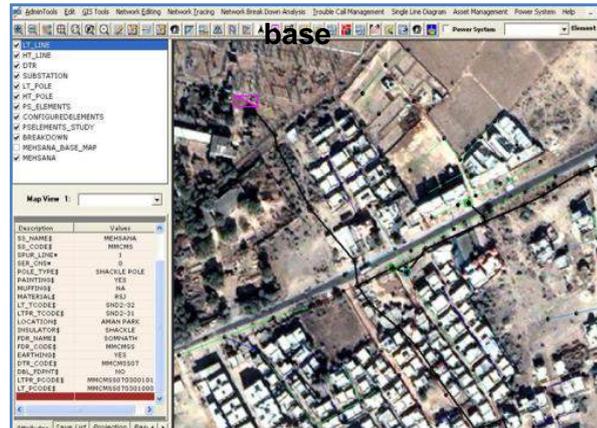
Figure 1. Evolution of Decision Technologies (DSS, GIS and SDSS)



In order to address complex multidisciplinary issues with spatial dimensions, spatial decision support systems have been designed, developed, and implemented for a variety of different application domains over the last several decades. The great advances in networking technology and the use of the Web led to the increased use of Web-based technologies in SDSS architectures in the last decade. With improving efficiency and usage of these systems, the ubiquity in domains like infrastructure management particularly in utility sector, SDSS that operate with multidisciplinary components are becoming feasible. While there are some ready-to-use SDSS available, it is more common for potential SDSS developers to design and construct a new system specifically while dealing with multidiscipline's systems. There are a variety of tools used for building SDSS applications, and the technology continues to evolve. Traditionally, many SDSS were GIS centric as GIS provided the necessary spatial data management and analysis functionality. Disadvantages of GIS-centric SDSS have been that GIS software is expensive and generally requires expertise to use. The development of open source and free GIS software is to some extent overcoming the first problem, while the development of GIS services over the Web and the development of digital spatial analytical and mapping libraries or modules are helping to address both issues. The use of these technologies allows the development of SDSS that only utilize a portion of the functionality available in a full-fledged GIS, and thus limits cost and reduces the level of expertise necessary to use the applications.

The above section depicts the importance of various technological components being evolved and used for the development of multidisciplinary SDSS over the period, with specific highlights for infrastructure management domain. The later section will particularly briefs on web based SDSS for electrical utility distribution sector. Man's use of energy can be seen in everyday operations such as mechanical motion and the production of heat and light.

Figure 2. Electrical network super imposed on geographical land



Electrification plays a prominent role in maintaining the standard of living. Energy demand has been increasing with burgeoning population coupled with intensive agricultural activities, industrialization and changes in living standards. A typical Power System consists of Generation, Transmission & distribution. The total network is a complex grid of interconnected lines. This network has the function of transmitting power from the points of generation to the points of consumption. The distribution system is particularly important to an electrical utility for two reasons: its proximity to the ultimate customer and its high investment cost. But, Distribution is the weakest link in the chain of power supply. Distribution has been identified as the key focus area in power sector reforms. Ideally, T&D losses should be in range of 5- 7%, but in India, T&D losses are in the range of 30-40%. This is the major factor of energy shortage. Some of the following areas shall be looked at to implement distribution reforms to reduce losses and improve energy efficiency. They are 100% consumer metering and AMR, proper & effective visualization and monitoring of complete electrical network, Feeder & DT metering etc. In the present days, many of the Electrical utility companies in India are facing problems due to high energy losses, reduced quality & reliability of supply, billing issues, theft of energy, no proper strategic revenue collection methods & representation, etc. This results in inefficient operation, consumer dissatisfaction & loss of market value of the utility in public. With the huge & complex electrical distribution network consisting of many sources, feeders, alternate feeding points; updating and management of network data is a Herculean task.

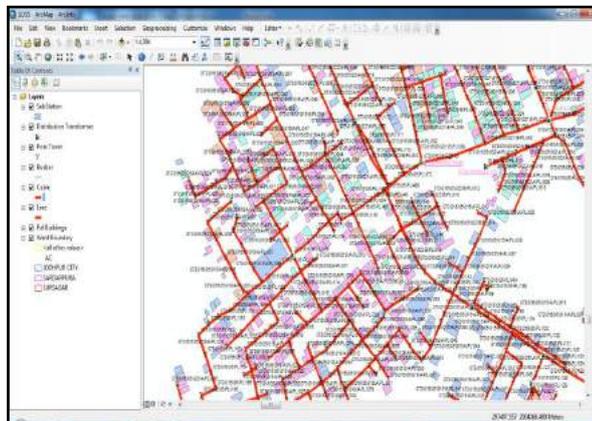
As stated above a multi disciplinary, multi-attribute spatial decision support system can assist in solution for complex problems and provide efficiency gains in operational & non-operational areas of business such as fast operations, Reduction in response time, Customer Care, proper Energy Auditing & forecasting, loss calculations & most importantly it helps utility sector for simple & effective visualization of complex distribution network.

Analysis

The ongoing reforms programme in the Indian power sector requires Information Technology (IT) to play a dominant role in institutionalizing the changes and improvements. Here these focused technologies serves a dual purpose, i.e. Provides the platform for execution of business processes and Creates the information base for timely, effective decision making at the operational and strategic levels. Enabling these focused technologies helps in achieving the above reforms (a) accurate up-to-date information of the entire network, (b) Electrical Network & Consumer mapping by physical pole to pole survey, (c) unique code for various electrical, (d) Technical attributes of the electrical network assets physically surveyed & linked with GIS map, (e) detailed door-to-door consumer survey for the creation of consumer database, (f) unique Consumer Index Number (CIN) provided to all types of consumers based on electrical address, (g) consumer database shall be linked with the network database for the purpose of defining the consumer's electrical connectivity.

Various functionalities provided by GIS Application Software are –(a) The changes in the network can be timely monitored, analyzed and correctly updated on a periodic basis.

Figure 3: Distribution N/w representation in GIS

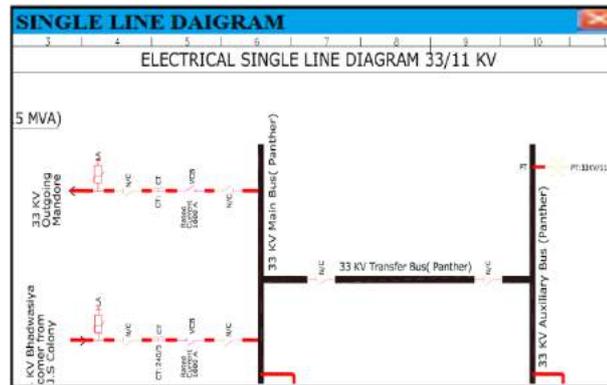


(b) Network Analysis: Evaluate 33 KV, 11 KV and LT feeder-wise technical losses. Identify the network section overloaded or having high technical losses. Identify the area of unbalanced loading of DT and LT Network and take corrective action to minimize technical loss. Work out voltage regulation of the network and identify the areas having high voltage drops and suffering with low voltage problem. Using the GIS & Network Analysis software, virtually network shall be re-configured to minimize technical losses, voltage drop, over loading.

(c) Load Forecasting: GIS becomes an effective tool in optimal design and choice of substation location, demand-side management, future load

assessment and load planning and load distribution. (d) EABS (Energy Auditing & Billing System): The Computerized Billing System shall be implemented for effective and prompt customer billing system, which will provide tools to monitor control and process the revenue collection functions of the DISCOM.

Figure 4: Distribution N/w representation in SCADA

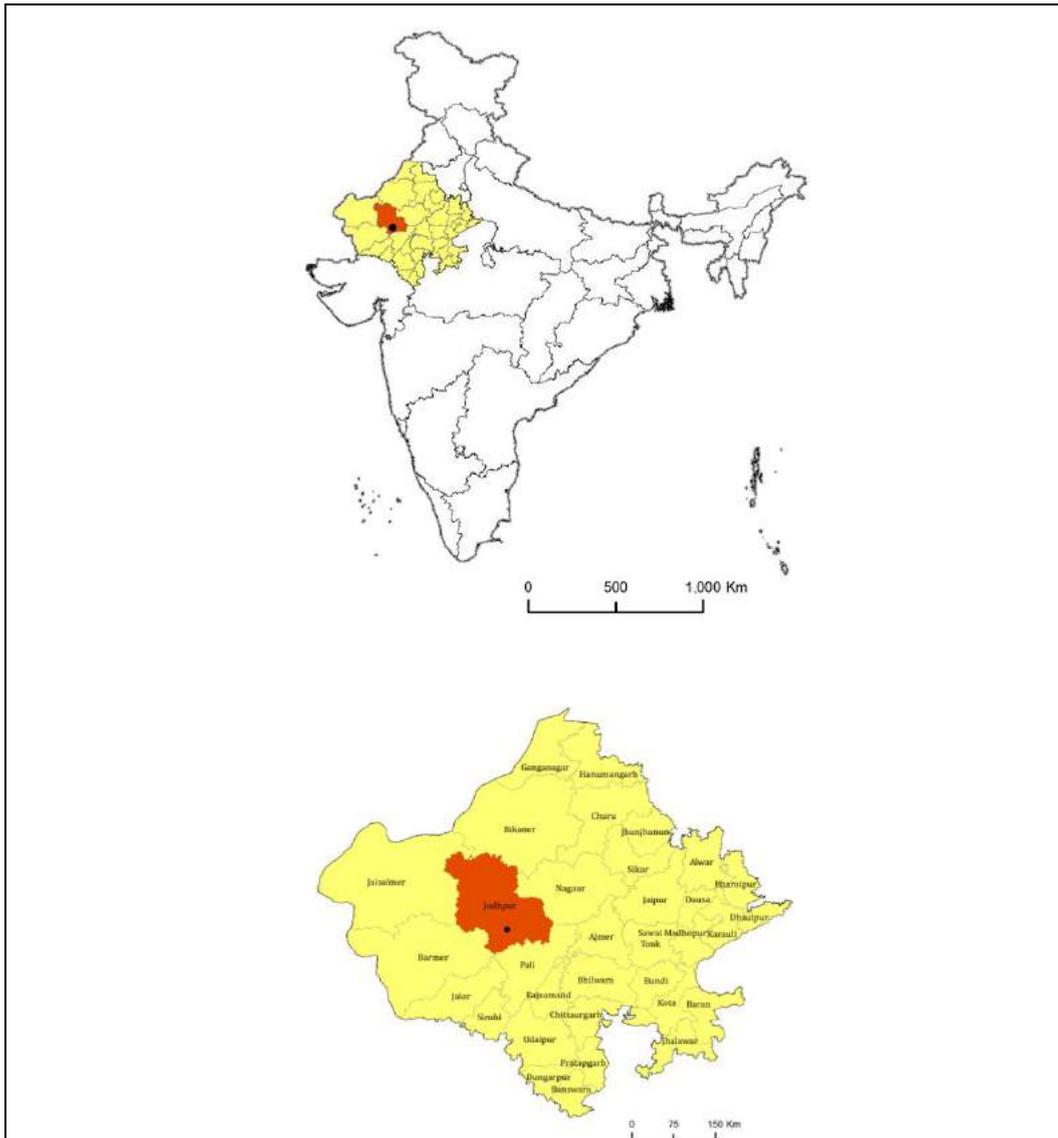


(e) *SCADA* (Supervisory Control and Data Acquisition): *SCADA* system like an alert watch dog monitors utility network in real time and provides remote control of switching devices, transformers and equipments. Integration with GIS facilitates Utility to coordinate the maintenance and fault rectification activities of the distribution system with in less turnaround time. (f) *DMS* (Distribution Management System): Supports operational improvements by using online network, data received from *SCADA*. Used efficiently to manage 11kV and below network, by providing planned switching orders and load flow analysis.

Case Study

Geographical area of investigation i.e. study area for research is Jodhpur city, second largest district of Rajasthan state which is centrally situated in Western region of the State.

Figure 5. Study Area – Jodhpur



Government of Rajasthan on 19th July 2000, issued a gazette notification unbundling Rajasthan State Electricity Board into Rajasthan Rajya Vidyut Utpadan Nigam Ltd.(RVUN), the generation Company; Rajasthan Rajya Vidyut Prasaran Nigam Ltd.,(RVPN), the transmission Company and the three regional distribution companies namely Jaipur Vidyut Vitran Nigam Ltd.,(JVVNL) Ajmer Vidyut Vitran Nigam Ltd.(AVVNL) and Jodhpur Vidyut Vitran Nigam Ltd.(JdVVNL)

Figure 6. State Load Dispatch Centre (SLDC), Rajasthan

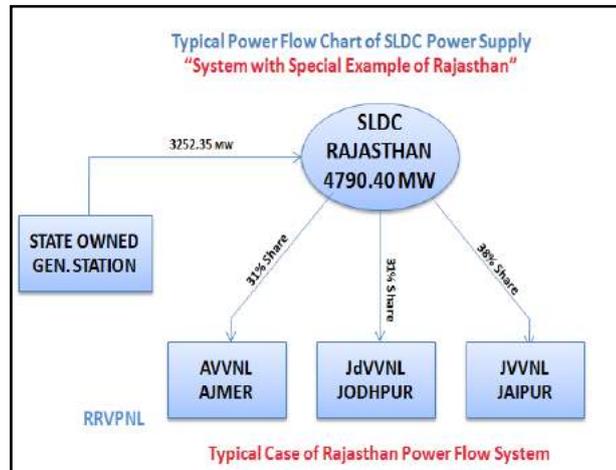
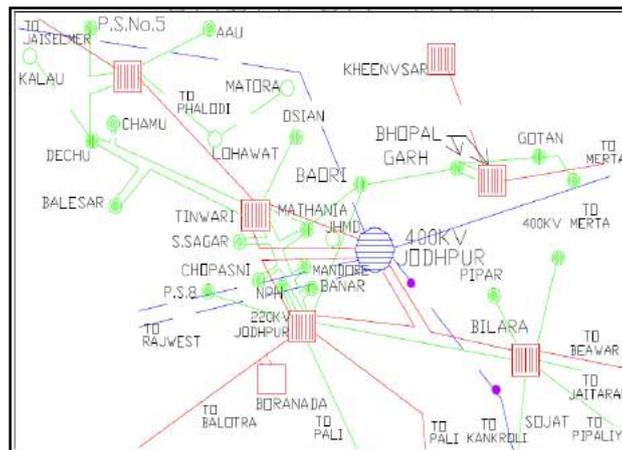


Figure 7. Power map of Jodhpur



The area of operation of Jodhpur Discom is 182509 sq. km, approximately electrifying 83% of villages/towns with 1520871 total customers with 39% of T&D losses. The research work was conducted for Jodhpur city, covering Pal area specifically. For the development of such multi disciplinary, multi-attribute spatial decision support system for Infrastructure Management, various data and collateral information were collected from different sources. JODHPUR DISCOM was the major source for electrical distribution network and electrical dataset so collected for Jodhpur city. From there, basic understanding about distribution network, flow of electricity from point of generation to point of distribution, network schematics and briefs about working and data flow among the departments were collected. The major source for spatial dataset i.e. ward boundary, building network etc. was from regional remote sensing center, Jodhpur (RRSCJ) and Google earth.

Simultaneously, research study was conducted which covers the need and significance of spatial decision support system nationally and internationally, its evolution and trends, major building components and its core drivers for development. Together with this, a detailed study was also conducted during the research for Infrastructure management, its developing trends and significance for society and SDSS, specifically for utility sector. Then the research coverage moved towards identifying the major components for development of web-based SDSS for infrastructure management. Once the components were identified, then research coverage moved towards analysis and interpretation of data so collected from different sources in specific format. Various tools and techniques were used during this process for creation of complete electrical and spatial dataset in shape file format. After data creation, development for web-based SDSS was done using ArcMap, ArcGIS Server, open source Flex Builder etc. The development phase includes various modules for implementation of numerous system features. After completion of design, development and implementation phase for SDSS, research coverage moved towards testing the developed application on real data.

Advanced capabilities such network monitoring, Network tracing, Query shell and Analysis can go far in giving utilities the power to be successful in competitive environment. These various tools, technologies, and systems used in the developed SDSS can play a crucial role in optimal working of power sector. By integrating the key functions from separate systems so used in development of this SDSS i.e. ArcGIS Desktop engine, ArcGIS Server, Open source Flex builder etc., improvement of visualization of all the required information on Network Map with respect to location leads to better management.

Objectives

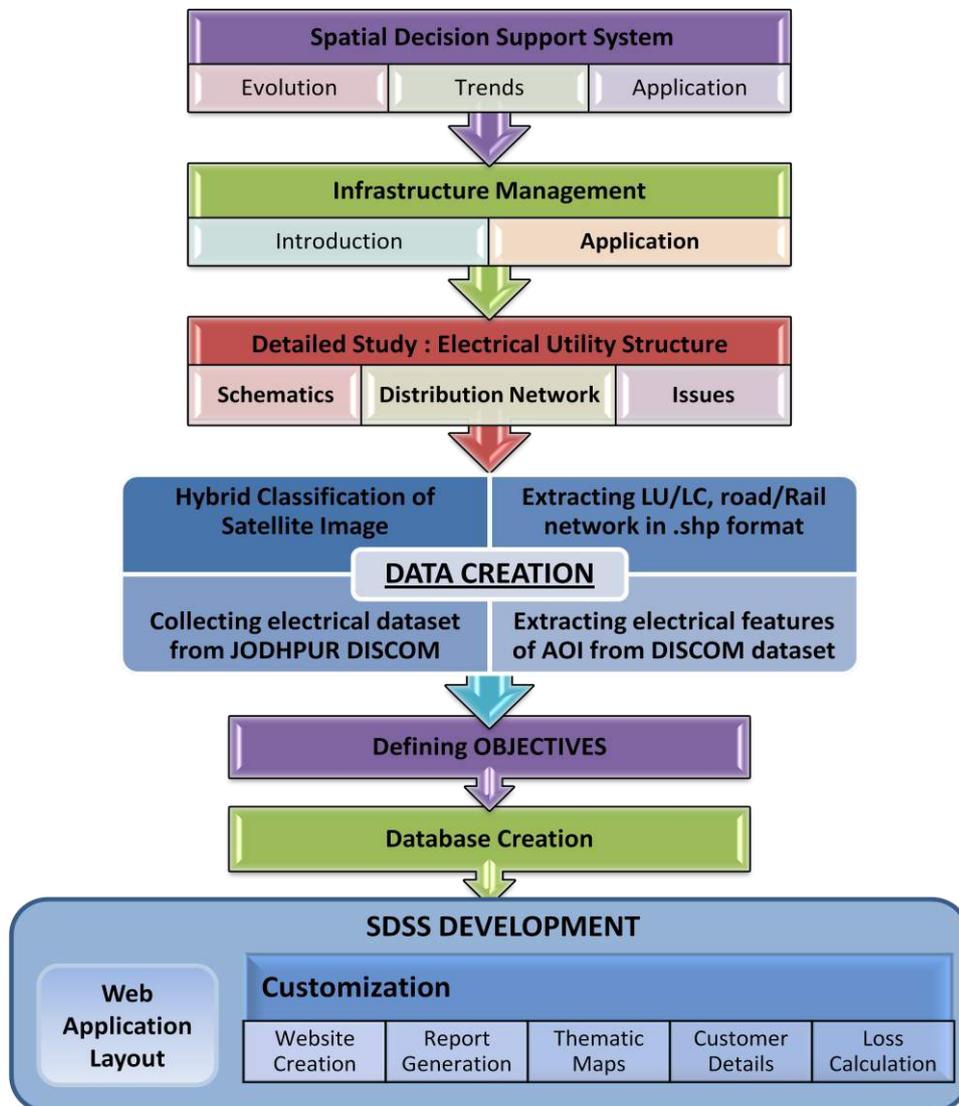
- a. To study Infrastructure Management and its various applications identified, also to investigate the major technological drivers so developed.
- b. To study Spatial Decision Support System together with its evolution and trends over the last several decades.
- c. To highlight the variety of SDSS application examples from a range of disciplines using a variety of techniques developed nationally and internationally.
- d. To identify main components of a spatial decision support system, including the database, model base, user interface and knowledge components for managing infrastructure together with utility structure for the area.
- e. Review the existing electrical utility structure of the area.

- f. To make efficient design, develop and implement the domain level spatial decision support system (query shell) for infrastructure management of the area using various technologies such as, programming languages & development environments, Geographical land-base and overlaying electrical distribution network.

Methodology

As the research comprises of various individual elements / systems and their integration, so methodology for the research comprises study of Spatial Decision Support.

Figure 8. Methodology



System together with its evolution and trends over the last several decades with variety of SDSS application examples from a range of disciplines using a variety of techniques developed nationally and internationally. Also include study of Infrastructure Management and its various applications. Geographical area of Investigation i.e. study area for research is Jodhpur city. Detailed study of the existing electrical utility structure of the study area with understanding of complete electrical network and schematics will be conducted, which later in turn, will help in identifying the main components of a spatial decision support system for design and development of utility infrastructure management, including the database, model base, user interface and knowledge components for managing utility structure for the area. Data creation will include extraction of landbase dataset from satellite image by hybrid classification. Electrical dataset will be collected Jodhpur DISCOM. SDSS development will include web application layout with its customization for various modules like report generation, customer details, thematic maps, loss calculation etc.

Conclusion

This research and development effort can build on the powerful analysis capabilities that GIS is bringing to public works infrastructure management.

Advantages of SDSS for Utility Infrastructure Development:

- Consumer indexing and asset codification for Efficient network management and Accurate data management
- Geo reference network display enables easy identification and setting up new connections
- Provides necessary information on land use pattern for planning optimum expansion of network and enables more systematic network operation and maintenance
- Sorting of consumers based on feeder which helps in fault identification and energy auditing
- Aids in planning and analyzing future expansion of the utility network
- Decreases turnaround time for servicing complaints
- Improves efficiency by means of periodic scheduled assets maintenance
- Decreases the outage levels of assets and increases operational efficiency of the system
- Provides facility to conduct energy auditing, load forecasting and voltage regulation based on feeder
- Provides facility to reconfigure network as per requirement
- Power pilferage analysis by determining the amount of power consumed by a particular Transformer against the load sanctioned
- Analysis of Power flows and load balancing

- Virtually reconfiguring / replacing conductor types / placing capacitors, voltage regulators to analyze the voltage regulation for system improvement
- Integration with billing system and Energy audit study, gives the information about total energy losses (technical and commercial) in the system.

References

1. Ashour, 2006 : Considerations for designing spatial data for a multi-purpose GIS system ; Map Middle East
2. Bali, 2009 : Role of GIS in Power Distribution, Map World forum
3. Bannur, Rolta, 2006 : Advanced Geospatial Solution for Utilities and Network Management : Map Middle East
4. Bergey, Ragsdale, Hoskote, 2003: A decision support system for the electrical power districting problem Decision Support Systems
5. Ferreira and Duarte, Portugal, 2005 : TS37.9 A GIS-Based Integrated Infrastructure Management System, FIG Working Week 2005 and GSDI-8.
6. Ghose, 2005: GIS & RS Based Planning For Power Projects ; Map Middle East
7. Kale and Lad, Reliance Energy Ltd, 2005 : Data Model "Heart of Geographical Information System" in Electrical Utility, Map India
8. Kale and Lad, Reliance Energy Ltd, 2006 : GIS integration with SCADA, DMS & AMR in Electrical Utility, Map India
9. Lemer, USA, Progress toward integrated infrastructure-assets management systems: gis and beyond, APWA International Public Works Congress NRCC/CPWA Seminar Series "Innovations in Urban Infrastructure"
10. Patil, Map World Forum 2009: Implementation of Technology: GIS based Electrical Distribution Network Management, Monitoring and Analysis System UGVCL Experience.
11. Ramachandra, George, Vamsee and Purnima, 2006 : Energy Education Science and Technology: Decision Support System for Regional electricity planning
12. Ramanathan Sugumaran and John DeGroote, 2010 : Spatial Decision Support Systems Principles and Practices
13. Rinner, 2007: A geographic visualization approach to multi-criteria evaluation of urban quality of life International Journal of Geographical Information Science 21(8):907–919.
14. Stuart Rich and Kevin H. Davis, 2010 IFMA Foundation: Geographic Information Systems (GIS) for Facility Management

INFLUENCE OF WATER RESOURCES ON AGRICULTURE IN USKOPALJSKA VALLEY, BOSNIA AND HERZEGOVINA

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Abstract: *This paper contains valuable information about current state of water resources and their vulnerabilities with special attention to erosion, floods and irrigation. This analysis is very useful for agricultural planning and water management in Uskopaljska valley. Area of Uskopaljska valley is not a homogeneous in respect of topography, slope, temperature and other resource endowments. The important farm survey of use of water resources was conducted on almost 25% of farms to find out main actors of irrigation. During the survey to the sample farms in various settlements spread over the Uskopaljska valley, it is noticed that most of the farmers are uneducated and unaware the proper irrigation methods. The west part of the Uskopaljska valley is under intense pressure of erosion while eastern hilly region is under the pressure of deforestation, erosion, unsuitable cultivation and overgrazing. An effort in this paper is done to explore and understand main groundwater and surface water processes. The study of stage of development of water resources is essential for better planning and sustainable development of the any agricultural area.*

Key words: *water erosion, groundwater, Vrbas river, standardized precipitation index*

Introduction

The efficiency of irrigation methods is relatively small and amounts to, on average, less than 50%, which means that more than half of the applied water is not used by the plants, but rather percolates into the groundwater, runs off the surface, or evaporates. With special irrigation techniques, however, the quantity of water lost and, hence, the quantity of water used may be reduced (Martin, Sauerborn, 2013). Water is an important physiological condition of life and possible limiting factor of agricultural production. Insured and regulated water supply from groundwater and surface resources is a basic and essential aspect on which depends any future planning of irrigation of agricultural land. The deficit of water in soil slows down normal development, reduces the volume and quality of yield or leads to the extinction of agricultural crops. On the other hand, a surplus of water in soil has a negative effect on culture. Certain agricultural cultures have different needs for water during the growing season, so that hydrological conditions determine the structure of crop production. (Singh, 2004). Besides, water is an important factor of location of rural settlements. The values of standardized precipitation index (SPI), hydrothermal

coefficient (HTC) and the referential potential evapotranspiration (ET_0) indicate a deficit of moisture during the growing season. Therefore, agricultural crops during the summer months should be provided with additional quantity of water by irrigation. A necessary prerequisite for determining the amount of water available for irrigation is the analysis of the basic hydrological characteristics of groundwater and surface water in the area Uskopaljska valley. Water is also very important for livestock. In particular, cattle (bovine) are demanding, because they need 50-100 liters of water in the most ordinary everyday care. Sheep are less demanding, they spend 2-6 liters of water per capita a day. Favourable grazing may take even a few days without water. This is the main reason that cattle farming is the most developed in the humid and semi-humid areas, while sheep are strong also in colder regions (sheep type merino) (Vrišer, 1995).

The withdrawal of large amounts of ground water by mechanical means is potentially very important for agriculture of Uskopaljska valley, which is currently not used. Therefore, to keep the appropriate watertight layer in its perennial form, the use of groundwater should be done very carefully. The main objective of optimum utilization of limited water resources is to increase agricultural production and to protect and conserve water resources for other irrigation purposes. For a successful conjunctive use of ground and surface water, as well as rational exploitation and use of water resources is necessary.

Study Area

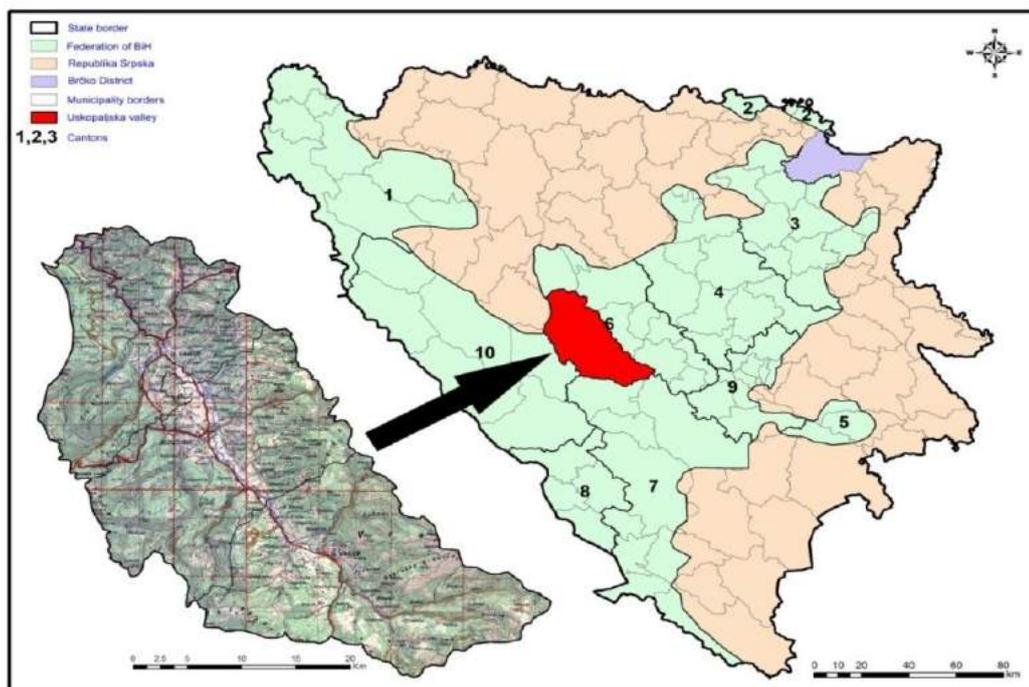
Geographically, the Uskopaljska valley has is situated in the 43°51' Northern latitudes and 44°15' North latitude, and between 17°16' East longitude and 17°51' East longitudes. The Uskopaljska Valley mostly belongs to the geotectonic complex of Central Dinarides, and only a small southwestern part enters the geotectonic complex of external Dinarides. The Uskopaljska valley spans in to the two structural-facial zones of Mesozoic predominantly triassic limestone and dolomite with Central Bosnia schistose mountains in the core to which belong the largest part of the Uskopaljska valley. The higher limestone-dolomite zone of high karst with slight development of flysch in Palaeozoic sediments, which covers only the furthest southwestern part of the municipality. The separated zones have Dinaric direction and were being pushed to the southwest, which created overthrust of tectonic structure. In the structures of the lower order, there are creases and faults highlighted by the Voljevac fault whose lowering created the Uskopaljska valley.

In term of relief, there is negative form of relief presented by Uskopaljska valley, which covers the central part of the municipality, and mountain areas in which massifs which are raised by tectonic movements interchangeably revolve, and are later modified by erosion, especially denudation, with surfaces that are actually spacious plateaus in those mountainous areas slightly dissected and broken down by erosion. All areas with altitude of 400-600 m cover 80.4 km² or 7.4 % of the municipality's surface. The second hypsometric level is of 601-900 m and it covers 360.9 km² or 33.2 %, and the third level is above 900 m with 645.9 km² or 59.4 % of the surface. Terrain configuration of the Bugojno's area

conditioned the way of usage of agriculture land and its today's structure, in which meadows and pastures cover 19.1 %, and arable lands and gardens cover 16.3% of the territory. We must underline here that in the last 30 years, due to migrations of younger and active population, great number of old households in villages, due to impossibility of land cultivation , constantly spreads their area under meadows and pastures (Gekić, 2013). This area belongs to pre-mountain moderate continental type climate or, as per V. P. Keppen's climate classification, this region has Cfb climate (moderate warm and wet climate with warm summer), while in the mountain areas especially in the east, northeast and west, is found Cfc climate as well (moderate warm and wet climate with fresh summer). On high mountain system of Vranica Dfb and ET types of climate are present. Summers are moderate warm here, winters moderate cold with snow precipitation. Average annual air temperature amounts 8.8°C. Average monthly temperatures for period of several years of following up are positive for all months except January which has negative mark of -0.3°C. The most hottest month is July with average temperature of 17.8°C.

The territory of Uskopaljska valley is very rich in waters, rivers, streams and springs. That enables the irrigation of larger areas and development of growing fruits and vegetables. The main hydrographic skeleton of the Uskopaljska Valley area is presented with the Vrbas River and its tributaries. That is why this area, from hydrographic point of view, belongs to the Black Sea's river basin. In the space between Gornji Vakuf and Donji Vakuf in the Uskoplje valley, the Vrbas River flows through its central part named Bugojno valley. Administratively, the Uskopaljska valley is situated in the state of Bosnia and Herzegovina, the entity of the Federation of Bosnia and Herzegovina, and within it, in the Middle-Bosnian Canton (Figure 1). Topographically, it belongs to the Mountain-Valley macroregion, and the Upper Vrbas-Pliva mesoregion of Bosnia and Herzegovina. In Uskopaljska valley there are three municipalities: Bugojno (34559 population), Donji Vakuf (14739 population) and Gornji Vakuf-Uskoplje (22304 population) and road transport accessibility is satisfactory. By roads, Uskopaljska Valley is almost equally away from the cities of Banja Luka, Sarajevo, Mostar, and Split (around 140 km). The total length of border of Uskopaljska valley towards the neighbouring municipalities is 259 km and in those borders the Uskopaljska valley around 1087.2 square kilometers in area. According to the Census 2013 in Uskopaljska Valley lives 71.602 people.

Figure 1. Location of Uskopaljska Valley in Bosnia and Herzegovina



Groundwater Resources

Groundwater fluctuations of the upper - free level of phreatic aquifer depends on rainfall, temperature and infiltration inflow of river water (Dinić, 1991). Phreatic groundwater is spatially related to sand and gravel river alluvium, that is alluvial plains of rivers and terrace sediments. It was formed mainly along the river Vrbas and lower flows of the left tributaries (Trlica, Trnovača, Trunta, Gračanica, Veseočica, Prusačka River) and lower flows of the right tributaries (Crnodol, Bistrica, Vileški stream, Vitina, Drvetinska river, Čehajićka River). Groundwater with free surface in rocks and inter-granular porosity (phreatic aquifer) that have greater permeability are the characteristic of the alluvial plain of the river basins.

In the territory of Bugojno there was found the average depth of the first level (1.7 - 2.5 m) of the phreatic aquifers in the alluvial plain which showed a very big and continuous development. The second level was recorded at a depth of 2.7 to 4 m and it is characterized by isolated reservoirs that have caused clay or marl deposits. The third level of groundwater at depths between 4.5 to 6.6 m belongs to the deepest phreatic aquifers and it occurs in large reservoirs. Phreatic aquifers reach its monthly maximum levels in February and March, and a minimum in September. Therefore, the minimum level of phreatic aquifers occurs after a hot summer. Shallow depth of the upper water level in phreatic aquifers of alluvial plain makes this water readily available for use, so using motor pumps those are used for irrigation of agricultural crops (rainwater irrigation). Therefore, in the Uskopaljska valley, the most common way of compensating the deficit of moisture during the growing season should be by using these groundwater. Phreatic aquifer in terrace sediments is at significantly

smaller area and is located at a greater depth which, together with a small abundance, limits the use of this aquifer for irrigation. Moreover, groundwater are suitable for irrigation from the aspect of physical and chemical composition which does not significantly affect the normal development of agricultural crops, soil salinization and alkalization.

Artesian, subartesian aquifer, especially karst aquifers are very numerous in the area of Uskopaljska valley and they are of the various water abundance. The largest distribution of karst aquifers in the region of carstified areas is stronger especially in Vranica mountain range in the east dominated by devonian sediments especially layered dolomites and limestones. Karst aquifers in less carstified areas are most prevalent in the wider area of mountains Kalin, Rudina and Hum in the east and in the space of Skrtska mountain and Sapčenica in the west dominated by triassic sediments layered limestone and dolomite. Significant karst aquifers are only in east of Bugojno, within the limestone malma on Radovan mountain and palaeozoic on the western slopes of Vranica. These aquifers are discharged through two springs of Bistrica, whose variations of abundance amounts to 6/0.3 and 2.5/0.3 m³ /s with a significant and rapid fluctuations (COWI, 2012). Fissure (shattered) aquifer was formed in crystalline schists and igneous rocks. Intense surface runoff and slight infiltration of precipitation into the ground do not allow the creation of large reserves of groundwater in these rocks. Fissure aquifer supplies numerous springs that are poor in water. Despite the small and variable abundance, springs generally do not dry up, and observations from the field indicate that fissure aquifer is not used for irrigation of agricultural crops. Spaces with fissure aquifers are most common in the west from Koprivnica to Pršljanica, Voljički stream, and in the space of Vranica, Hum, Rudina and Kalin in the east. It should be noted that the areas with no groundwater are most abundant in the area of Uskopaljska valley (almost everywhere where triassic and permian deposits dominate).

Surface Water Resources

Surface waters in relation to agricultural production can be assessed in terms of its use for irrigation and in terms of protection of agricultural land from flood waters. The necessary precondition for the assessment is the knowledge of the basic properties of river networks and river regime. The main hydrographic backbone of the area of Uskopaljska valley is the river Vrbas and its tributaries, hence hydrographically, this space belongs to the Black Sea basin. The Vrbas basin in this area is presented mainly by waterproof series of sediments. Most of the catchment area of Uskopaljska valley and the river Vrbas is presented by surface flows, and only the bottom of the valley is characterized by a shallow aquifer. The Vrbas river rises by smaller springs in the area of Zec mountain to the southeast, at an altitude of 1.715 m and then flows westward up to Voljevci where it bends towards the north and flows in the north-western direction along the whole Uskopaljska valley with a total length of about 75 km. The Vrbas river in this area receives numerous tributaries from the left and from the right side which are, however, characterized by a small length of its course. It has the character of a typical mountain-depression river with big falls in the

mountainous areas in the southern and northern part and small falls in the middle part of the flow in the area of Uskopaljska valley. Due to the small fall in the area of Bugojno, meanders, unstable and shallow bed, the Vrbas and its larger tributaries outflow, flood and backfill lower parts of the alluvial plain with drift. Consequently, the coastal areas of the alluvial plain are not suitable for intensive agricultural production.

The most important right tributaries of the Vrbas in the area of Uskopaljska valley are: Kruščica (3 km), Bistrica (15 km), Goruški stream (9 km), Vileški stream (14 km), Vitina (11 km), the Drvetinska river (10 km), the Čehajička river (12 km) and the Oboračka river (15 km). By length, the left tributaries are not far behind: Drugiščina (8 km), Trnovača (7 km), Voljišnica (12 km), Gračanica (14 km), Veseočica (27 km), Poričnica (15 km), the Prusačka river (13 km) and Semešnica (15 km). All larger left tributaries flow mainly to the northeast, while the right flow westward which indicates the exposure of the region. The springs of individual streams are quite high, often above the vegetation, and they overcome great height on shorter strokes, so they flow in the form of rapids. In geographical terms basins of major tributaries of the Vrbas can basically be divided into the valley and mountainous part of the basin. Mountainous areas of the basin of the Desna, Voljišnica, Bistrica, Veseočica, Semešnica, Vileški stream and Vitina are characterized by large declines in the longitudinal profile and torrential character. It is similarly with the aforementioned river tributaries. In contrast, flows in the valley part of the basin have small drops in the longitudinal profile (for example, the Drvetinska river, Goruški stream, Odžački stream, Kruščica, Krupa, Gračanica, Poričnica, Lubovo, the Čehajička river), so there are the intense accumulation of sediment in the basin.

The total length of all watercourses in Uskopaljska valley is 1.720 km, while the total length of only permanent watercourses is around 850 km. The catchment area of the river Vrbas in this area corresponds to the surface of Uskopaljska valley in the broader sense, that is 1087.2 km². The Vrbas river basin is complex geologically and geomorphologically, and depending on these two factors there have been established certain hydrographic relations, with a very characteristic outflow (surface and underground) and with characteristic outflow indexes. Rainwater from the catchment of the river Vrbas, due to the high energy of relief, are quickly pouring and flowing into the main stream. The Vrbas river basin is the widest in the area of Bugojno and there it is almost symmetrical. The total length of all watercourses in Uskopaljska valley is 1.720 km, while the total length of only permanent watercourses is around 850 km. The catchment area of the river Vrbas in this area corresponds to the surface of Uskopaljska valley in the broader sense, that is 1087.2 km². Drainage water flowing out in an average speed, are crossing 1.58 km to get to the main stream. The density of the river network is somewhat higher, because the basin is built mostly of impermeable rocks or hydrological insulators and storm water in not so large amount plunge from the surface into the underground area. However, if one considers only the length of permanent watercourses, then the density of river network is twice lower, that is 0.78 km / km².

The density of the river network is different in mountainous and plain part of the basin and it is significantly higher in the mountainous region. Adverse morphological and climatic characteristics, and a lot of water absorption in the mealy river and lake sediments, contribute to the low density of the river network in the plain part of the valley. The structure of river network is also very important in terms of agricultural production, since it can be adopted as an index of water erosion of soil. The structure of river network is the result of river network density and frequency of watercourses. Thus, during the field research in the area of mountains Kalin and Rudina, it was noticed that, on the upper slopes, there are developing short streams that are becoming longer by lowering down the slope and meeting other tributaries, which confirms that the length of watercourses in the area of Uskopaljska valley can be seen as an index of water erosion. Although the precise relationship has not been established, the scientific studies agree that the density of the river network in some space can be taken as an index of soil erodibility.

The critical value of the density of the river network on km^2 of the surface which can cause erosion of soil by water is 0.90 km/km^2 . Leopold had already confirmed in 1969 that average 2.59 km^2 of catchment area is sufficient to keep the length of watercourse of 2.24. The lower values of density of the river network are therefore safer and vice versa higher values will automatically affect the appearance of greater soil erosion which negatively impacts on agricultural production. The studies that are of agricultural geographic importance, and are related to such index of soil erosion were made for the space of Uskopaljska valley. The total length of all watercourses is 1.720 km, while it is by hypsometric levels segregated on the basis of index of water erosion of soil and based on the importance of agricultural production the following (Figure 2):

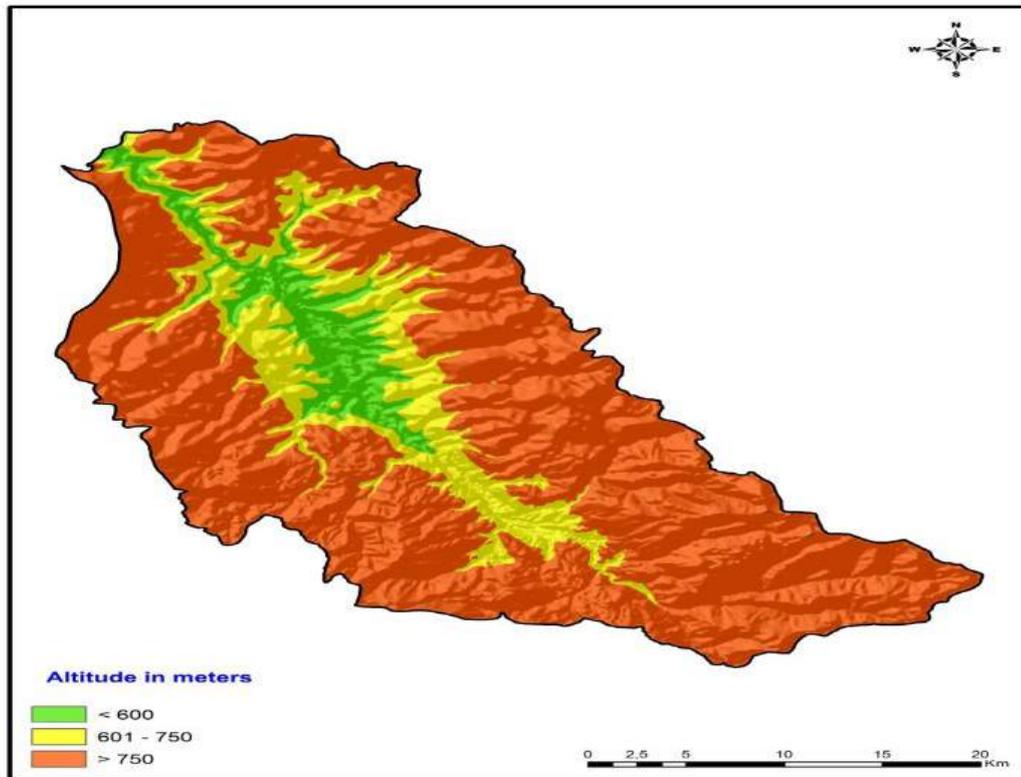
1. On the first level to 600 m above the sea level, which covers about 8.7% of the Uskopaljska valley, there is a little more than 149 km of watercourses which ultimately gives the index of soil erosion of 1.87 which is the highest value and it can be concluded that the risk of water erosion in this region is the largest. However, if we take into account only permanent watercourses, the erosion index value falls to around 0.8 which is the value in the normal range.

2. In the second level of 601-750 m above the sea level which covers more than 18% of Uskopaljska valley, the value of the index of soil erosion is 1.82 if we take into account all watercourses, and it is only for 0.05 lower than the value at the previous level, but still represents excessive zone. As in the previous level when one takes into account only permanent watercourses, the value of erosion index decreases and is slightly more than 1, so in this area a risk of soil erosion is increased.

3. The third level consists of the area more than 750 m that has no intensive agricultural production and which covers even 73.3% of the total Uskopaljska valley. The length of all watercourses is about 1.261 km which gives the index

of soil erosion from 1.5. Taking into account only permanent watercourses, index of soil erosion also declines to 0.7 in the limits of the normal range.

Figure 2. Hypsometric levels as basis of index of water erosion



Therefore, the risk of water erosion of soil is the largest in the hypsometric level of 601-750 m, and therefore on those areas where there are intensive agricultural production as is the case especially upstream from the mouth of Gračanica into the Vrbas, one should take account of the possible occurrence of water erosion, which can threaten agricultural crops. According to its looks, the Vrbas river network in the area of Uskopaljska valley is of dendroid type that is characteristic of the basins that are located in areas of hydrological insulators, with high rainfall and high energy relief. The density of the river network is distributed evenly, and petrographic and geological relations affect the surface inflow. The catchment area is mostly forested, which is very important for hydrographic observations. Vegetative cover reduces the speed of inflow by their roots and biological needs, but it is also an important factor in a positive way because it slows down evaporation and lessens torrent regime. Inflow speed into the river Vrbas is quite large, it causes changes in the annual cycle of water levels as well as flows. The wave of high water is quickly transferred by the Vrbas river. Especially characteristic are tributaries, in this case, which bring plenty of fluvial material in the form of alluvial fans on the stretch from the mouth of Voljišnice in the south all the way to the Čehajička river in the north. Plenty of material comes from the mountainous part, with big falls, from where inundated material is transported.

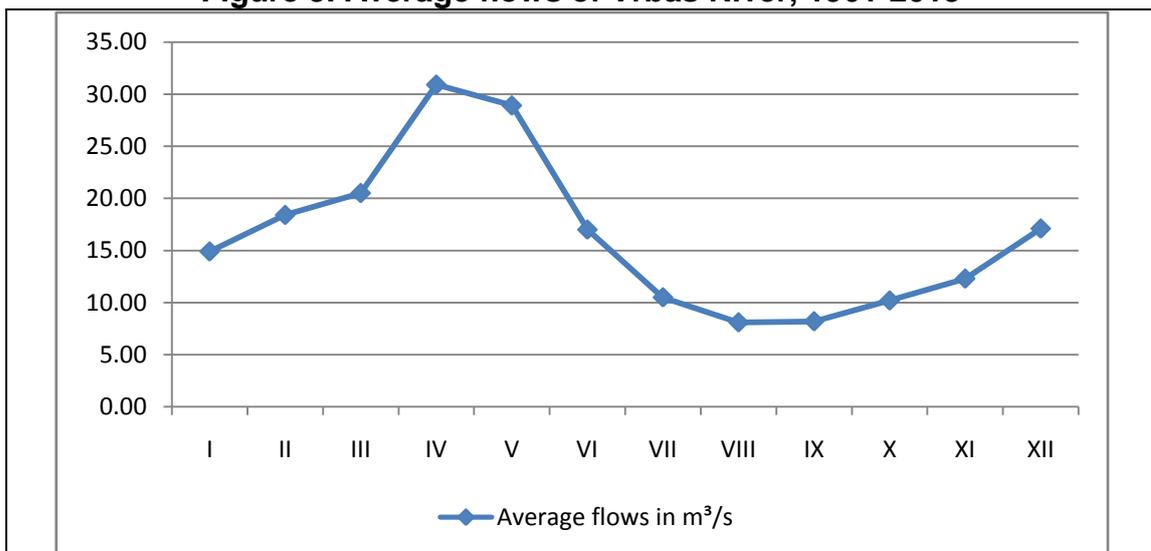
The study of the river regime in Uskopaljska valley, basically, is focused on the Vrbas river. All storm water, which is surface or groundwater flow, mainly flows through the Vrbas. In Uskopaljska Valley there are two hydrometric stations Daljan (Donji Vakuf) and Gornji Vakuf. There is no matching of high rainfall with high water levels, which can be clearly seen if we compare the data on average monthly amount of rainfall with the data of water levels. Therefore, the backlog of maximum water levels with the maximum rainfall, occurs primarily due to the impact of nival. The minimum water levels which occur in July, August and September, are a direct consequence of climate impacts, geological structure and morphometric characteristics of the basin. The minimum of average water levels on the watermeter of Gornji Vakuf occurs in September (43 cm), and in the Daljan in September (a little more than 38 cm). The difference between the water levels in August and September is negligible. Elevated water levels occur in late autumn months as a result of increased precipitation, and they are the largest in late spring months due to the appearance of snow retention. Prevailing distribution of watertight sediments, great energy of the relief, which is particularly strong in the further southern, eastern and western parts of the basin, improve surface inflow, which reflects negatively on the feeding of underground reservoirs. Thus, evaporation is one of the very important factors in the warmer part of the year, for July, August and September water levels.

Maximum to minimum water levels are in relation 2:1. In the annual cycle of water levels, it is observed that high water levels last from December to early June, ie. six months, and according to the water levels, hydrological year may be divided into two parts. The first is from December to June, as the period of elevated water levels, and the second is from June to early December, as a period of low water levels. Fluctuations between the low and high water are about 30 cm (Gornji Vakuf) and 59 cm (Daljan), and maximum 108 cm in December (Daljan). Daily fluctuations of water levels on the river Vrbas are very common. Depending on climatic factors, water levels are rapidly changing during the day in a positive way. The waves of high waters are quick and short-lived. Knowledge of low and high water levels is significant from the aspect of agricultural production. At extreme maximum water levels, on unregulated and unprotected parts of the riverbeds, rivers outpour and flood agricultural land. This is especially evident on the left tributaries of the river Vrbas in the plain part where in the previous years, the outpouring of the river Veseočica was the most pronounced. Maximum water levels are directly related to snowmelt (March-April), or with increased rainfall (May-June). Flood wave usually lasts a few days. Extremely minimal water levels are associated with the summer months and as stated they do not match the minimum rainfall. Both on the left and on the right tributaries of the Vrbas in the plain part, they are long-lasting and expressed. In addition to pluviometric regime and precipitation character, the occurrence of extreme minimum water levels are affected by air temperature, soil infiltration capacity, porosity of sediments from the bottom of basin which is high, evapotranspiration, etc.

As the water flows are very dependent on the water level, they show similar characteristics in the annual distribution with water levels. At the hydrological station Daljan, on average per year flows through 16.64 m³/s of water, mostly in the spring months. The lowest flows occur in the summer, July 7,5 m³/s, August and September by 6.6 m³/s and October 6.7 m³/s as a result of temperature conditions and high evapotranspiration. The largest flows occur in the spring months due to snow melting, in April 53.2 m³/s and May 47.6 m³/s and winter in December 47.4 m³/s and February 48.9 m³/s. A similar situation is recorded at the hydrological station Gornji Vakuf whose flows are the result of a far smaller number of tributaries and rainwater with smaller areas (Hydrological yearbooks of Bosnia and Herzegovina, 1961-2013). That is why during the summer low flows are below 1 m³/s, and high in the spring months of 10-17 m³/s. The value of average flows is from 1-2 m³/s in summer, and from 5-10 m³/s in the spring months. The flow of the river Vrbas and the water level are constantly growing since the beginning of September until the beginning of June when it starts to decrease. It should be noted that differences in flow rates between Daljan and Gornji Vakuf are the result of the increase of flow rates which is received by the Vrbas river from the basin, because the confluence of the Vrbas to Daljan is higher about 4 times then the basin of Gornji Vakuf.

On the hydrograph of the Vrbas river at Daljan, one clearly see a period with increased values of average flows (underwent conservation) which lasts from February to July, and which is primarily a result of snow melting. During this period elapses 59% of the total annual discharge. The biggest flood waves in the rivers of Uskopaljska valley are related precisely to this period. Therefore, most water in the rivers of Uskopaljska valley elapse in the period when crops (except vegetables) have enough moisture from atmospheric precipitation and water from the active rhizosphere (Figure 3).

Figure 3. Average flows of Vrbas River, 1961-2013



After June up to November is the period of equable lower flow. During the three summer months, in a period when crops may require an additional amount of moisture for normal growth and bearing of fruit, only about 14% of the total annual flow runs through the river Vrbas. The Vrbas, from the Gornji Vakuf widening to the Donji Vakuf widening, flows through the bottom of porous valley and has far fewer falls in the longitudinal profile than on the rest parts of the flow which affects the intensity of the absorption of river water into the substrate and its evaporation. Therefore, the western part of the Uskopaljska valley in this part in summer is much poorer in surface waters than the eastern.

Accordingly, the use of river water for irrigation is spatially and temporally limited. By comparing the moisture deficit and average monthly flows during the growing season, it is noted that the timing of the available quantities of river water in relation to the needs of agriculture is unfavorable. The disproportion between the amount of available river water and the required amount of water for irrigation is linked to the July and August. Besides, many rivers are drying up in this period or they flow beneath the biological minimum, so a deficit of water for irrigation is somewhat more pronounced. The use of river water directly from the river beds is in places more favorable due to the proximity to the river bed.

In order to balance the flow of the rivers of Uskopaljska valley in the summer months, it is necessary to reduce surface run-off and to keep groundwater longer in the basin. By applying different agricultural practices (plowing, plowing along the contour line and the like.) and by the construction of reservoirs, the flow of rivers can be improved. The construction of reservoirs on major tributaries of the Vrbas would provide the additional quantities of water for irrigation, and balance the flow of rivers and groundwater regime. The most favorable geomorphological, geological and climatic conditions for the construction of water accumulations are related to the middle part of the rivers flow, and the highlands basin rim. From these reservoirs, it would be possible to irrigate agricultural land in a natural way (by gravity), as it would have a higher hypsometrically position in relation to arable land in the alluvial plain and river terraces (COWI, 2012). Similar or nearly identical conclusions about the regime of the Vrbas can be obtained on the basis of data for specific runoff and the amount of runoff. Specific runoff shows how much rainwater expressed in liters with each km² of the catchment areas in every second flows to the mainstream or to its cross section. Finally, it can be concluded that the river Vrbas in the area of Uskopaljska valley has nival-pluvial regime. Not even the tributaries of the Vrbas in this area depart from this regime. Based on these criteria, it can be concluded that the risk of flooding is very large in the coastal area of many watercourses in Uskopaljska valley. For the last twenty years in Bosnia and Herzegovina, there were no higher waves of high water recorded, which led to the encouragement for approaching the rivers, and even the construction of buildings in the floodplain of watercourses. All this changed in the course of 2014, when the great flood affected area of Bosnia and Herzegovina. However, the area of Uskopaljska valley was not largely affected by the flood.

According to the degree of capacity of self-purification and concentration of harmful substances, water basins of major rivers of Uskopaljska valley belong to II and III class. The degree of contamination of river water is determined by the pace of wastewater discharge during the year and fluctuations in flow of watercourses. In this sense, there are especially critical periods of minimum flows in rivers when their ability to self-purification is reduced to a minimum. Therefore, depending on the water flow of the Vrbas, they are classified in II and III class. Despite the increased amounts of nitrite and phenol, the river water of Uskopaljska valley are suitable for irrigation of agricultural crops (average concentration of nitrite of 0.2 g/m³ upstream from Gornji Vakuf to 1 g/m³ downstream from Donji Vakuf; the average phosphorus concentration is from 0.06 g/m³ upstream from Gornji Vakuf to 0.09 g/m³ downstream from Donji Vakuf). The tributaries of the Vrbas that rise in high mountain areas and which do not pass through major settlements are characterized by I class of water. In particular, this applies to Semešnica in the northwest and Bistrica and Kruščica in the east.

Table 1: Parameters of moisture regime in vegetative period in Uskopaljska valley, 1961-2013

Annual Precipitation	Precipitation in vegetative period	Vegetative period		
		ET ₀	Deficit	HTC
827 mm	411 mm	556 mm	-145 mm	1.6

Source: calculated from Meteorological yearbooks of Bosnia and Herzegovina, 1961-2013.

In months of vegetative period (April-October) the deficit of moisture is approximately 145 mm in areas of alluvial plains and river terraces up to 650 m above sea level, and in this period, for agricultural crops, it is necessary to provide around 1450 m³/ha of water. The deficit of moisture during the growing season according to calculations done using CROPWAT 8.0 in the lower parts of Uskopaljska valley is around 1450 m³/ha. With an increase in altitude, the deficit of moisture during the growing season is gradually reduced. This way of calculating the moisture deficit does not take into account the reserves of water in the active rhizosphere and use of ground water by plants, so it can be concluded that the deficit of moisture in the spring months is slightly lower than these values of potential evapotranspiration (Table 1). There is a risk of drought, which can potentially get the scale of a natural disaster in the short term. Particularly high risk is left to the production spring field crops (corn, potatoes, clover etc.), where due to the slope and the lack of water, the use of irrigation is limited or impossible. Despite the previously mentioned, thanks to irrigation and even modern agrotechnical measures, yields in vegetable and crop production are stable.

Table 2: Values of SPI in Uskopaljska valley, 1961-2013

	I	II	III	IV	V	VI	VII	VIII	IX	X	XI	XII
SPI	-1.52	-1.10	-0.67	-0.42	0.26	0.69	-0.50	-0.42	0.18	0.43	2.22	0.86

Source: calculated from Meteorological yearbooks of Bosnia and Herzegovina, 1961-2013; Doesken, 1993

The value of a standardized precipitation index (SPI) during July and August (-0.50 and - 0.42) indicate a slight lack of rain in these months and it is necessary and justified to irrigate crops. With increasing altitude value, the SPI value increases, so the need for irrigation is reduced. Benefits for the irrigation of agricultural land in the Uskopaljska valley are different. They are primarily determined by the amount of available water, morphometric predisposition, morphological, physical and chemical properties of soil types. In view of the above, only the areas of hypsometric level to 700 m above sea level have moderate suitability for irrigation. Suitability for irrigation decreases with increasing altitude (Table 2). The greatest need for irrigation in the month of July and August is when it is both the lowest level of water and minimum flows in rivers, but also a low level of ground water. Temporal distribution of the available quantities of water in relation to the needs of agriculture is unfavorable. However, the contrast is favorable spatial distribution of available water for irrigation in areas of intensive agricultural production. In relation to the morphometric characteristics of the relief, the most favorable areas for irrigation in Uskopaljska valley are the alluvial plains and river terraces.

Slope angles determine the way of the irrigation of agricultural land. Irrigation by spillover can be used on agricultural land whose slope is less than 3 degrees, while artificial rain, drip and sub-irrigation along with undertaking anti-erosion measures is used on the slopes of 3-6 degrees. Therefore, if one takes into account that slopes up to 3 degrees affect 23.5%, from 3 to 6 degrees 10.3% of the total Uskopaljska valley, it can be concluded that in relation to the morphometric characteristics of the relief it is possible to irrigate 20,000 hectares of agricultural land. Irrigation of agricultural land with a slope of 6 degrees requests previously terracing. Therefore, the most suitable areas for irrigation in the Uskopaljska valley are related to plain land of gentle slope. These are the spatial units in which there occur deep and medium deep permeable soil types (fluvisol, eutric cambisol, etc.). The best properties for irrigation has land of I and II cadastral class that in Uskopaljska valley takes only 2.382 ha of agricultural land. In addition to taking anti-erosion measures (terracing, drip irrigation, etc.) it is possible to irrigate more about 11.896 ha. Optimal irrigation of agricultural lands makes it difficult to fragment plots. Therefore, the functioning of major irrigation systems previously require re-parcelling of agricultural lands. Particularly large amounts of water for irrigation should be provided in the second half of the growing season when the rainfall is reduced, and evapotranspiration is maximum. During this period, many agricultural crops complete their vegetative development, and thus have an increased need for moisture. Irrigation is a very costly measure. Although it undoubtedly affect the yield increase (field crops by 20-30%, forage crops for 80-100%, fruit by 15-25%), the construction of irrigation systems can be

economically justified only in the case when one makes a good choice of crops, crop rotation and enables better use of irrigated areas (Žurovec, 2012).

The most common type of irrigation of arable land in Uskopaljska valley is linked to the use of shallow groundwater of phreatic aquifers. Shallow depth of groundwater level of phreatic aquifer of alluvial plains and technical and operational characteristics of motor pumps allow this water to be extensively used for irrigation. In 2013, there was a total of 260 motor pumps for irrigation. In the technique of irrigation, instead through channels, today are mostly used sprinklers and water guns (artificial rain). About 80% of larger farmers use sprinkler irrigation as a technique. It is better because it allows more efficient use of moisture by vegetable crops. If one takes into account that the vegetable crops need additional amount of moisture during the growing season, there can be concluded that the water from the alluvial aquifer irrigates about 1,000 ha of arable land.

Table 3: Use of water resources in irrigation of arable land, 2014

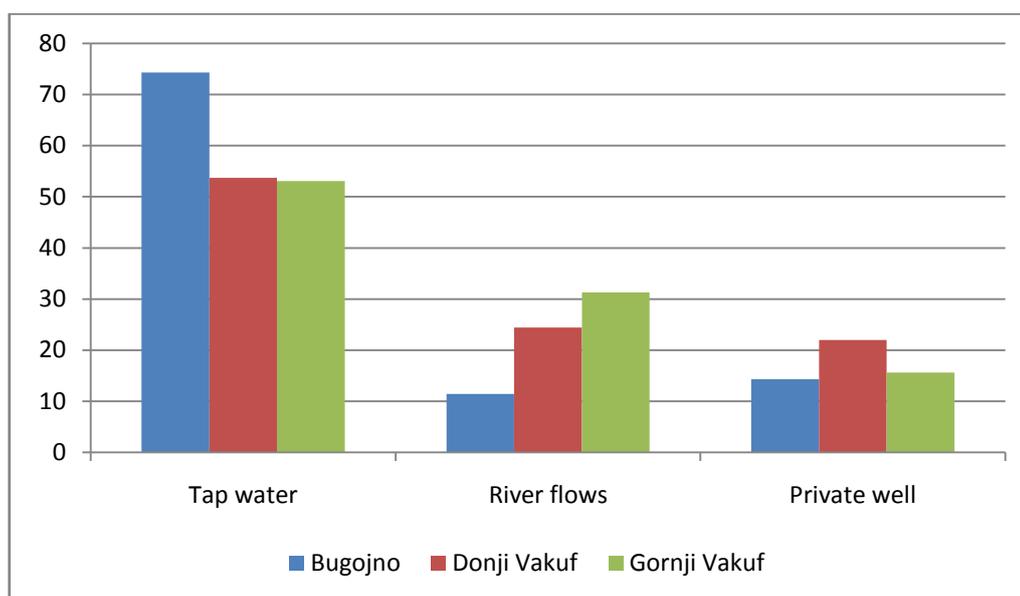
	Tap water	River flows	Private well	No irrigation
Bugojno	74,3	11,4	14,3	36,4
Donji Vakuf	53,7	24,4	22,0	18,0
Gornji Vakuf	53,1	31,3	15,6	44,8
Uskopaljska Valley	60,2	22,2	17,6	33,7

Source: Farm survey in Uskopaljska valley, 2014

Water from river flows are far less likely to be used for irrigation of agricultural crops. According to municipal data in Uskopaljska valley and field research carried out in 2014, only about 4% of farmers use flooding, while about 12% use a drip system or drip irrigation. Because of the high river banks, reduced river flow during the summer months and distance of most parcels of riverbeds, the use of river water for irrigation directly from the river bed is difficult. These waters are used for irrigation of agricultural crops in those parts of the alluvial plain where the coasts are more accessible and the plots closer to the river bed.

According to the Farm survey in Uskopaljska valley (2014), most irrigation is done using tap water even 60.2% of farms use this way that significantly harm the reserves of drinking water serving households which causes the occurrence of frequent reduction of water in Uskopaljska valley. Even 33.7% of the respondents said that they do not irrigate thier land, which is surprising. At the municipal level even 74.3% of farmers of Bugojno as a source of water for irrigation uses tap water, and only 11.4% uses river flows. Almost equal situation is in the municipalities of Donji Vakuf and Gornji Vakuf with the difference that they increasingly use groundwater by 6.4% (Table 3, Figure 4).

Figure 4 : Use of water resources in irrigation by municipalities, 2014



Source: Farm survey in Uskopaljska valley, 2014

Conclusion

As basic measures in protection against high water, there stand out: construction of reservoirs on rivers, construction of embankments and regulation of the riverbed of the lower river flows. In Uskopaljska valley, the previously given measures did not completely meet their goal. There are almost no embankments along the river Vrbas. Strategies of the management of water resources need to have the support in the physical environment. These strategies should include the protection of rivers and watersheds, control over agricultural activities in terms of soil fertilization and irrigation, purification of polluted water, etc.

- we should protect all water resources
- we should avoid projects, measures and any impacts (the introduction of harmful substances) that may result in reduction in groundwater quality
- it is fundamental to significantly reduce the ever-growing gap between the coverage of water supply and the coverage of sewerage network and purification units, considering that this gap is seriously threatening the quality of groundwater

There is an urgent need for integrated strategies for the management of water resources which should have the support in spatial planning (the protection of rivers and watersheds, control over agricultural activities in terms of soil fertilization and irrigation, purification of polluted water, etc.). Water supply at a distance should be considered only if there is no appropriate locally available water resources, or if it is not possible to use water resources. Contribution to the protection of water resources through taking action of large scale at the level of river basins includes the cooperation of municipal authorities, and if necessary the extension of this cooperation beyond the

cantonal borders. Spatial planning should also play a role in flood protection and the implementation of protective measures, in determining patterns of land use, and in helping to coordinate and reconcile different interests. In this respect, protection and re-establishment of floodplains is useful, as regards the fight against floods, as well as with the protection of environment.

Irrigation as measure aims to compensate for the lack of water that occurs in growing crops, that is the correction of natural water regime of moistening artificially adding water at the time suitable for the proper development of plant to raise the threshold achieved in the production of field crops and in the years that are the dry – that is all frequent occurrence in the last 20 years. Besides, irrigation allows better utilization of land by introducing another harvest. Irrigation to some extent compensate for the negative effects of reducing fertilising by chemicals for returns, and allows the production of "healthy food". The tendency of decrease in annual precipitation, especially during the growing season, has led to increased interest in irrigation in the Federation of BiH. Securing water for irrigation according to the needs of agricultural production is the main task of water management organizations in addressing the problems of irrigation (Fundamentals of Land Development, 2011).

References

1. COWI, 2012. Integralna vodno-energetska studija razvoja sliva rijeke Vrbas.vodni resursi. Svjetska banka. NTFSPI, Banja Luka.
2. Farms survey in Uskopaljska valley by Gekić, H. 2014.
3. Gekić, H., 2013.Agricultural Geography of Bosnia and Herzegovina: A case study of Bugojno.Geo-Analyst, Geographical Society of North Bengal.Alipurduar
4. Hydrological Yearbooks of Bosnia and Herzegovina. 1961-2013. SHMZ Sarajevo.
5. Leopold, L.1969.Fluvial Proesses in Geomorphology, Indian Eurasia Publishing House, New Delhi
6. Martin, K., Sauerborn, J., 2013. Agroecology, Springer, Dordrecht.
7. McKee, T.B., N.J. Doesken, Kleist,J., 1993.: The Relationship of Drought Frequency and Duration to Time Scales. Preprints, 8th Conference on Applied Climatology, 17-22 January, Anaheim, California
8. Meteorological Yearbooks of Bosnia and Herzegovina. 1961-2013.SHMZ Sarajevo
9. Osnove uređenja zemljišta - program navodnjavanja i program okrupnjavanja posjeda u Federaciji Bosne i Hercegovine.2011.Agronomski i prehrambeno-tehnološki fakultet Sveučilišta u Mostaru.Mostar
10. Vrišer, I., 1995. Agrarna geografija.Filozofska fakulteta v Ljubljani.Oddelek za geografijo.Ljubljana
11. Žurovec, J. 2012. Melioracije i uređenje poljoprivrednog zemljišta.Univerzitet u Sarajevu.Poljoprivredno-prehrambeni fakultet.Sarajevo.

4

LOCAL PEOPLES' PERCEPTIONS TOWARD TOURISM: A CASE STUDY OF MORNHILLS (HARYANA)**Prem Chand**

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Abstract: *This study examines the local people perceptions towards tourism of Mornhills in Haryana. The study focused on residents in the vicinity of popular heritage attraction on the Mornhills. An attempt has been done to study the positive and negative impacts of tourism towards the local people. Among the impacts the positive social impacts of tourism were most favourably perceived by the local people. The finding of semi-structured interviews with residents supported the survey results.*

Key words: *Local People, Tourism impact, Perceptions, Mornhills.*

Introduction

Although there is an increasing community understanding of the benefits, tourism brings to communities, there are still many who are yet to appreciate the significance of tourism, including policy makers and the general public. Because community support, or lack of it, can have a significant effect on the success or failure of a tourist destination, awareness-raising activity about the significance of tourism play a crucial role in the future development of the industry. Tourism simultaneously portrayed as a destroyer of culture, undermining social norms and economic, degrading social structures, stripping communities of individuality, and as a saviour of the poor and disadvantaged, providing opportunities and economic benefits, promoting social exchange, and enhancing livelihoods. "Multiplier effects" are often cited to capture secondary effects of tourism spending and show the wide range of sector in a community that may benefit from tourism. Community support is important for tourism as it is an activity that affects the entire community. Tourism businesses depend extensively on each others well as with other businesses, government and residents of the local community. Community decisions over tourism often involve debates between industry proponents touting tourism's economic impacts (benefits) and detractors emphasizing tourism's costs. Sound decisions

rest on a balanced and objective assessment of both benefits and costs and an understanding of who benefits from tourism and who pays for it.

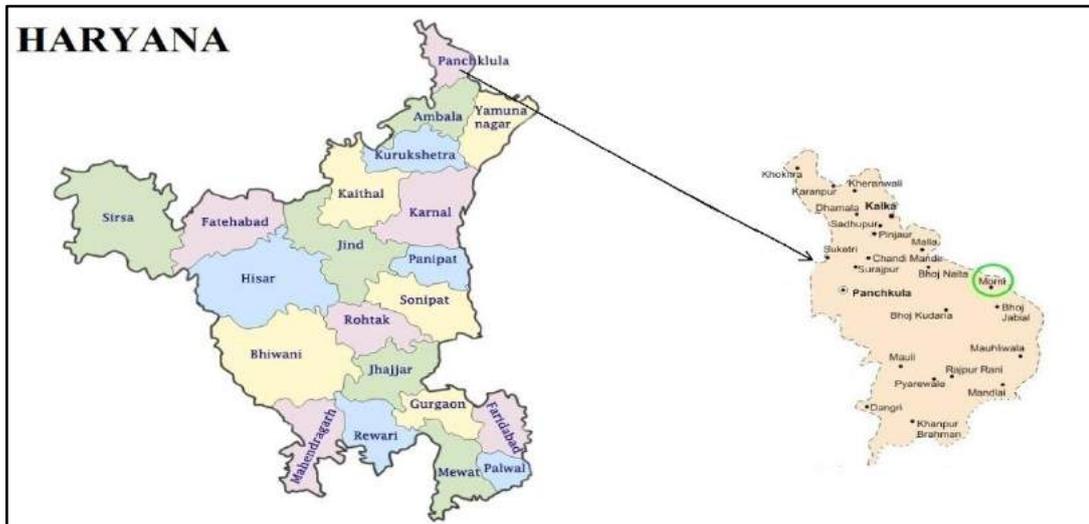
The present day tourism is not the same as the travels of the early period of human history. Tourism is the temporary movement of people to destinations outside their normal place of work and residence. Such a pleasure-seeking tourist is a traveller moving from place to place or visiting the same place repeatedly. Tourism includes all economic activities, which are organised to fulfil the needs of such travellers. Any travel for holidaying, business or professional trips become a part of tourism if it is temporary, undertaken voluntarily and does not aim at earning any livelihood the tourism is travel for recreational, leisure or business purpose. Tourism has different meaning in different languages and different regions and can be defined in different ways. The word 'tourism' was first used in 1811 and 'tourist' in 1840. Tourism word is composed of two words- 'tour' and suffix 'ism', the word tour is derived from the Greek, 'Tornos', meaning thereby 'a circle; the movement around a central point, 'ism' is defined as the action of movement around a circle, i.e. the act of leaving and then returning to the original starting point. Ziffer (1989) defined "Tourism involves travelling to relatively undisturbed or uncontaminated natural areas with the specific object of studying, admiring and enjoying the scenery and its wild plants and animals, as well as any existing cultural aspect (past and present) found in these areas".

In today's world, tourism is an important socio-economic activity. Tourism now recognised as an international industry, generating a number of social and economic benefits. It promotes national integration and international understanding, helps an improving infrastructure, creates employment opportunities and augments foreign exchange earnings. Thus, tourism is as much a part of social- economic development as any other related activity.

A Case Study: Morni Hills

Morni, the hill station in Haryana around 45 kilometres from Chandigarh, 35 kilometres from Panchkula as its district and is known for its Himalayan views, flora, and lakes. The name of Morni believed to derive from a queen who once ruled the area. The Morni Hills are offshoots of the Shivalik range of the Himalayas, which run in two parallel ranges. A hill divides the two lakes, but there is theorised to be a hidden channel linking them, as the water level of two lakes remains roughly the same. Morni locale looks upon the lakes as sacred.

Figure 1. Location of Morni Hills



As Morni hills are relatively unexplored, they offer a rich opportunity for adventure seekers and explores. Trek to the lakes named Tikkar Tal, are sure to be a source of pleasure. Trek to Ghagger offers another chance to explore the unknown. Morni is a splendid green hillside dotted with flowering trees. The low hill tracts of Morni filled with neem, pepal, jamun, dhak, amaltas, jacaranda trees and yes, the delightful pine. The pine or 'chill' as the locals call it, crowns the hill tops and is one of the most delightful sights of the Morni Hills. Lakes of Morni afford an opportunity for wonderful camping and relaxing amidst nature. The flora and fauna are there to give company and serenity of the lake to bless you. When the flowering trees blossom, the hillsides are awash with colour, presenting a delightful sight. Morni is paradise for wildlife enthusiasts and birdwatchers with its teeming population of birds like quails, partridges, sand grouse and common doves as well as animals like jackals, hare, hyenas, Neel gai, sambhars and even leopards. Although some initiatives for the development of tourism in Morni have been taken by the Govt. Of Haryana, but the real tourist potential of Morni yet has not been explored. The Haryana government has also developed the hill resort to facilitate the tourists. The government has laid roads connecting Morni hills with state highway near Panchkula, to help visitors have a smooth ride to Morni Hills. Forest tourist huts, rest houses like Lal Munia and a PWD rest house have been built for the convenience of visitors and trekkers.

The Morni hills divide a lake into two and has hidden channel underneath which helps in maintaining the water level of the lakes the same, around the year. Both the lakes are considered very sacred. The inhabitants perform many religious ceremonies in these lakes. On the banks of a lake, is a small temple,

which has a Trimurti idol belonging to the twelfth centuries. A few years ago, this place said to have had a Shiv Mandir also. The sceneries all the way to Morni is no less beautiful than Morni Hill. The climate in Morni Hills is salubrious. Above all, Morni hills are unpolluted and presents a wide range of attractions to all who love nature, birds, animals, lakes, gardens and hills to add fun from trekking, mountaineering and rock climbing to simple travel over mountains.

Main Aspects of Tourism

Economic Aspects

- Increases employment opportunities.
- Improves transport infrastructure.
- Increases opportunities for shopping.
- Creates new business opportunities.
- Contributes to income and standards of living.
- Economic (direct, indirect, induced spending) is widespread in the community.

Environmental Aspects

- Protection of selected natural environments or prevention of further ecological decline.
- Improvement of the area's appearance (visual and aesthetic).
- Pollution (air, water, noise, solid waste and visual)
- Loss of natural landscape and agricultural lands to tourism development

Social and cultural Aspects

- Excessive drinking, alcoholism, gambling.
- Crime, drugs and prostitution.
- Negative changes in values and customs.
- Unwanted lifestyle changes.
- Displacement of residents of tourism development.
- Exclusion of locals from natural resources

Objectives, Data Source and Methodology

- To assess socio-economic and environmental aspects, perceptions of the local people towards tourism in Morni.
- To examine the perception of people towards tourism with respect to initiatives taken by Govt. for the promotion of tourism in Morni.

To achieve the above stated objectives the primary data have been collected from a sample of 36 residents drawn out of the population of Morni hills based on convenient sampling by interviews scheduled. The responses were noted

down on a well-designed questionnaire comprising of ten questions. The data regarding various socio-economic indicators such as age, education, occupation, gender, etc. was also taken under consideration. Simple statistical tools such as averages, percentages were used. Cross-tabulation was used where ever need to arrive at the results.

Research Findings

With regards employment opportunities it has noted that 66.7 percent respondents agreed with the fact that tourism in Morni has given the boost to employment opportunities. However, surprisingly, the employment opportunities were mostly availed by daily wage earners. The labourer person had a more number of days to work than before, the time when the government has not recognised Morni as a tourist place. From fieldwork, it has found that 86.11 per cent respondents were literate, whereas only 14 per cent were illiterate. Among the literate respondent, 87.5 percent had a positive view regarding increased employment due to tourism. Twenty-four respondents out of 36 i.e. 67 per cent replied that their business has expanded because of tourism. Among the shopkeepers, 8 out of 14 respondents i.e. 57.1 per cent responded that the employment opportunities have increased and their business ha expanded. Out of the sample, eight were students. All of them were of the view that employment and business has increased due to tourism. Even the non-resident have established their business in Morni.

A particular question pertaining to the improvement in infrastructure facilities by govt. was ask to seek the opinion of people whether there has been any improvement or not. Forty-six percent responded that they are satisfied with the government spending, i.e. investment made or cost incurred by the government on the infrastructure whereas 64 per cent were of the view that there is a lack of infrastructural investment. However, the real potential of Morni is yet unexplored which needs further investment by the government. 55.6 percent of the respondents reported that tourism has contributed to the increased incidence of parent child conflict. The educated respondent (86 percent) from the sample relied that tourism has led to unwanted lifestyle changes. 40 per cent shopkeepers were of the view that the tourism has increased parent child conflict.

From the findings, it was concluded that 69.4 per cent respondents said that tourism has contributed towards moral degradation among local youth. While interviewing the respondents, the majority of them highlighted the negative impacts of tourism viz. Tourists especially the females are not properly dressed, they consume alcohol and drugs and create nuisance thereafter leading to a negative impact on the children. With the tourism activities in Morni Hills, they're found increase in the crime rate. 52.8 percent of the respondents

emphasized that there were insufficient police personnel to control crime. Among the respondents, 94.7 percent educated respondents, 73.7 percent male and 36.8 percent shopkeepers endorsed the viewpoint that tourism has posed a threat to the safety of women in the area.

From the analysis, it is inferred that 6.11 percent respondent agreed that tourism had led to environmental degradation of Morni. Among the 31 educated respondents, 28 have opined that there has been a loss of landscape and agricultural land due to tourism development. Seven out of fifteen shopkeepers stressed that tourism has increased traffic congestion. Analysing the data gender wise, the fact was further strengthened by 16 out of 23 males (68.2 percent) who responded positively that tourism has increased pollution in the area.

Further Suggestions

The government should make more investment towards the promotion of tourism in Morni Hills. More police personnel should be deployed. Proper laws regarding the construction of tourist hotel /places should be implemented in the area.. More business and job opportunities should be created for the local residents. There should be proper solid waste management and a proper check on property dealers.

References

1. Ateljevic, A. And Harris and Collins (2000): "Getting Entangled: Reflectivity and the Critical Turn in Tourism Studies," *Tourism Recreation Research*, Vol.30, No.2, pp.9-21.
2. Awang, K.W. (2009): "Tourism Development- A Geographical Perspective", *Asian Social Science Journal*, Vol.5, No.5, pp.67-76.
3. Bhushan,R. (2006): "Jharkhand: Unexplored Heaven for Eco-Tourists", *Journal of Tourism Development*, Vol.4, No.1.
4. Britton,R.A. (1979): "Some Notes on Geography of Tourism", *Canadian Geographer*, Vol.23, No.3, pp.276-282.
5. Cater,C. (1995): "Environmental Contradictions in Sustainable Tourism", *The Geographical Journal*, Vol. 161, No.1, pp.21-28.
6. Chadda, S.K. (1990): "Himalayan Ecology, Ashish, New Delhi.
7. Chowdaiah (2002): "Growth of Tourism in and around Mysore City- A Geographical Analysis", Ph.D. Thesis, University of Mysore, Mysore-6, Karnataka.
8. Christaller, W. (1955): 'Beitrage zu einer Geographie des fremdenverkehrs" (contribute to Geography of Tourism)', *Erdkunde*, Vol. 4, No. 1, pp. 1-19.
9. Deniels,G. (1949), "Central Place Theory and Sport Tourism Impacts" *Annals of Tourism Research*, Vol.34, No.2, pp.332-259.
10. Gunn, C. A. (1988): *Tourism Planning*, Taylor and Francis, New York.
11. Harashwanti,B. (1994): *Tourism in Garhwal Himalaya, Indus*, New Delhi.
12. Holden (2008): *Environment and Tourism*, Routledge, New York.
13. Jafari, J. (1977): Editorial, *Annals Of Tourism Research*, Vol.3,pp.6-11.
14. Mitchell, I.S. (1979): "The Geography of Tourism- An Introduction", *Annals of Tourism Research*, Vol. 9, No.3, pp.235-244.

15. Oglive, F.W. (1933): "The Tourist Movement, Stapless", London.
16. Pritcharda, A. (2011): "Hopeful Tourism: A new transformation perspective", *Annals of Tourism Research*, Vol.38, No.3, pp941-963.
17. Roy, A.M. (1970): Bridging the Information gap for Attracting Foreign Tourist, *Capital* Vol. CLXV, No.4137, pp. 793-795.
18. Sapna, L.K. (2012): 'Impact of Tourism on Indian Economy', *International Journal of Marketing Financial Services and Management Research*, Vol., No. 4, pp. 70-75.
19. Sandeep, K. & Vinod, K. (2014): 'Perception of Socio-Culture Impacts of Tourism: Sociological Review', *International Research Journal of Social Sciences*, Vol., No.3, No.2, pp. 40-43.
20. Selke, A. (1936): "Geographical Aspects of the German Tourist Trade", *Economic Geography*, Vol.12, pp.206-221.
21. Single, M. (2014): 'A Case Study on Socio_Cultural Impacts of tourism in the city of Jaipur, Rajasthan: India', *Journal of Business Management & Social Sciences Research*, Vol. 3, No. 2, pp. 22-30.
22. Taylor, P.J. (1971): "Distance Transformation and Distance Decay Function", *Geographical Analysis*, Vol.3, No.3. pp.221-238.
23. William (2009): *Tourism Geography: A New Synthesis*, Routledge, New York.
24. Ziffer, Karen A. (1989): *Ecotourism: the uneasy alliances*, Conservation International's series of working paper's on ecotourism.

5

WE THE CUSTODIANS OF THE ENVIRONMENT AND GLOBAL RESOURCES: AN OVERVIEW**Malti P. Sharma**

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Abstract: *Environment is the totality of our surroundings. It includes the whole global ecosystem and natural resources. The environment came to us as a gift from the Supreme force, but , its maintenance was absolutely in the hands of all the living beings that inhabited the liveable areas. It has been given as a legacy to be taken care of. Many circumstances influenced Man's relation with his surroundings. They compelled Man to think in favour of saving the treasure received, as well as, misuse his talents and despoil the valuable gift. The paper will deal with the positive and negative roles played by Man in the handling of the natural resources. Man was and is the angel as well as the devil. So, it is in our hands as human beings to safeguard the interests of the whole human community by taking care of the environment and all the natural resources. Some resources are irreplaceable, so we have to be conscious of keeping them safe so as to be able to hand them over to progeny. We have to be absolutely committed to the fact that we are the custodians of the environment and we owe it to our children to give them a better place to live in with as much overall growth and enhancement in all resources as possible.*

Key words: *Environment, Ecosystem, Natural Resources, Community, Custodian Legacy Progeny*

Introduction

When Man first appeared on this earth, he was not aware of the surroundings and environment that he was supposed to live in. He explored his surroundings, but, he was able to understand very little about the environment. Consequently, he was not able to use or misuse his surrounding resources exhaustively. Gradually, he developed awareness and things started changing. His knowledge played a very positive role in enhancing many aspects of life and the general environmental issues. At the same time, this knowledge, accelerated by greed, played a very devastating role and things started going downslide. Man has played both types of roles, positive as well as negative, regarding the environment and available resources. There have been a number of factors in

the past, which affected his behaviour towards these resources. Most prominent ones are:

Bang and Blast of the Populace

The improvement in the living conditions resulted in good health and enhanced breeding. The population multiplied in leaps and bounds. This is generally understood as 'Population Explosion'. This created a revolutionary change in the use of natural resources because increased populace meant increased consumption of natural resources and accumulated energies. As Thomas Robert Malthus says in *An Essay on the Principle of Population*, "Population, when unchecked, increases in a geometrical ratio. Subsistence increases only in an arithmetical ratio. A slight acquaintance with numbers will show the immensity of the first power in comparison of the second". This had an immediate and direct effect on the natural resources. Man consumed agricultural products many times more than he used to in earlier times and dependence on animals for various purposes increased largely. He required more space for himself. To create more living space, he shaved off the green forests and replaced them with rock forests. The jungles which were a natural habitat for numerous animals, were cut down. This way, deforestation deprived them of their natural habitat, hence, their species began to extinguish. Re-developing jungles with the help of promotional remedies like fertilizers and insecticides created large pools of toxic chemicals and increased over-all pollution. Animals of all sorts; those living on land, water or air; all were equally threatened. To maintain their number, efforts to raise crops on a large scale were made. This demanded many other resources. Use of chemicals multiplied, resulting in pollution. Animals were reared on a large scale which resulted in the manifestation of many more diseases and dearth of fodder. The waste produced by these animals again became a nasty source of pollution. It was challenging to produce various varieties of animals. Man applied his brain to produce only the productive species of animals and plants. This went against the demands of bio-diversity. Moreover, after producing a single produce, it was essential to transport it to areas where it could be used more efficiently.

Prosperity is Top Priority for Man

We all have a tendency to work our way towards a comfortable life. At the initial stage, we were content with whatever nature had endowed us with and restricted our consumption in proportion with the available quantity. We were content with the limited resources and bare minimum comforts. In our search for a higher level of comfort and prosperity, we have made many manipulations. Scientific development and improved social scenario made our pursuit for comforts very easy. The more they came our way, the more grew our greed for them. We accelerated the production and distribution of goods at a fast pace.

We have started using raw material recklessly to create comfort for ourselves. This is telling heavily on our resources. It is also causing plenty of pollution on land, water and in the air. Depletion of resources is taking place rapidly and regeneration of sources is not sufficient to compensate for the quantity being consumed. This way, prosperity being the priority, makes us forget the maintenance of the quantity of natural resources and other aspects of the environment. American President, Theodore Roosevelt, once said, "The conservation of natural resources is the fundamental problem. Unless we solve that problem it will avail us little to solve all others". Hence our tendency to opt for prosperity and comforts should include the safeguarding of other aspects.

Man's the Most Detrimental Species on Earth

No other living being causes harm to the environment as much as Man does. He damages the environment in a number of ways. The automatic natural system of compensating for the losses has been introduced by nature in some form or the other. The environment balances its losses in its own way but man's impatience is spoiling things out of proportion. The population is very large and all human beings are hell bent on destroying the productivity of resources in as many ways as can be, hence the earth is suffering a heavy loss.

Harmful Impact of Man's Irrational Behaviour

Man's vitiated brain has caused many harmful effects on his surroundings. Creating waste in abundance makes recycling and improvised techniques impossible. He pollutes the atmosphere in a number of ways. The soil is under perpetual threat from pesticides and herbicides, the garbage and other forms of waste thrown by man, chemical wastes and residues of the industries, all mitigate the productivity and cleanliness of the soil by mingling in between the soil particles. In a similar manner the industrial waste which is released in rivers and canals, the human excreta and dead bodies of both human beings and animals which are flown in rivers owing to religious rituals, the unsafe and unguarded surroundings that connect unhygienically to the water bodies, chemical wastes released in water during domestic, industrial, and commercial activities, pollute the water and tend to be a threat for men as well as all other water animals. These aquatic animals are a natural resource and contribute in a long way to the benefit of the ecosystem but man destroys the whole system and deprives all living beings of safe and hygienic drinking water.

Air pollution is another harm caused by man to the environment. During industrial production a huge amount of harmful gases are released in the atmosphere creating a poisonous effect for all inhabitants on the globe. This pollution is caused on many levels ranging from very small domestic sources to very big industrial ones. They cover almost every area on the globe resulting in

creating a very dangerous atmosphere for all. Man's use of innumerable chemicals for various commercial purposes is depleting the ozone layer at a very fast pace. This layer shields the upper crust of the earth on which all living beings are placed from the harmful ultra-violet rays. By harming the ozone layer, man is creating a grave threat to the environment.

Man as the Saviour of the Environment and Resources

As man is ruining the atmosphere and depriving mankind of many vitally important resources, in the same way, very contrastingly, he is playing a very important role in saving the environment from depletion. By our behaviour and lifestyle, we are contributing to the maintenance of the nature in a big way. American President Theodore Roosevelt has very rightly said, "If in a given community unchecked popular rule means unlimited waste and destruction of the natural resources—soil, fertility, waterpower, forests, game, wild-life generally—which by right belong as much to subsequent generations as to the present generation, then it is sure proof that the present generation is not yet really fit for self-control, that it is not yet really fit to exercise the high and responsible privilege of a rule which shall be both by the people and for the people. The term "for the people" must always include the people unborn as well as the people now alive, or the democratic ideal is not realized". A thought similar to this concern has prevailed in Man's mind and he has made many positive and constructive efforts in the direction of saving the environment and natural resources. Some very important efforts made by Man in this direction are:

- **Saving the Rare Species From Extinction:**

Many rare species of animals are facing extinction. Some conscious environmentalists who are committed to the cause of saving the atmosphere, are making conscious efforts to save these rare species. They are creating natural and protected environment which is favourable for the breeding of these animals. Once they successfully breed them in large numbers and the animals are big enough to survive on their own, they release them in their natural surroundings. When they comfortably establish themselves in their wild habitat, they increase their numbers on a natural breeding basis. This way they are saved from extinction. The zoos maintained by environmentalists are a very big contribution to mankind. The same is the case of vegetation. The variety which is useful but being exhausted rapidly is being cultivated and maintained by nature lovers. Thereby they save the productive trees, plants, herbs and other forms of vegetation from being washed out from the earth's surface. During this process, many times, some new species of animals and plants also get introduced intentionally or inadvertently. Some of them conform to the surroundings very well. This way, they start developing as a newly introduced species in the area. Man makes efforts to counter such species which have

invaded these areas and replace them by the local and indigenous ones. The overall impact of such efforts is that the environment is enriched.

- **Protecting Native Animals and Flora and Fauna:**

Some native species of animals and plants are very difficult to breed and cultivate. They are under perpetual threat of extinction. They breed only in certain areas and under a certain set of circumstances. Efforts are made to reserve their conducive areas and living conditions for their enhancement so that they are able to breed and grow rapidly. This way their numbers will grow at a faster pace and their breed will be saved from extinction. This holds value for animals as well as plants, because the native vegetation has a great value of its own.

- **Conscious Efforts to Control Jungle Holocausts**

Jungles which are rich in vegetation accumulate plenty of dry vegetation from dead and dry trees. Sometimes when these are perpetually neglected, the dry heaps of plants catch fire which culminates into huge destructive holocausts. Huge amount of wood, precious vegetation and wildlife is gutted in such wildfires. Man has made efforts to keep an eye on such jungles and prevent ignition of the valuable natural resources. Damage prevented in this way, helps to save a lot of natural resources and lives. This exercise on a conscious level is a commendable contribution towards saving the natural jungles.

- **Sustaining Natural Ways of Living :**

Industrialization has changed the lifestyle of man to such an extent that everything around him has gradually started becoming unnatural and artificial. Man has become habitual of living on these artificial means. This has brought many ill-effects too. Industrial food system has ruined the system of living on natural foods, concrete forests have taught us to live in artificial houses, but man has again made efforts to save it through permaculture. The ordinary man does not comprehend the technical meaning of permaculture. Permaculture is an ecological design system for sustainability in all aspects of human endeavour. It teaches us how to build natural homes, grow our own food, restore diminished landscapes and ecosystems, catch rainwater, and build communities. Man is trying to appreciate and introduce the natural ways of living and introduce natural methods on a large scale. This has not only enhanced the environment but also shown a very positive impact on human health. It is a call which says, "back to Nature" and connects us to the productive ways of using existing natural resources.

- **Multi-dimensional Efforts by Man:**

When Man paid attention to all his surroundings, he found that a lot of attention was required to mend the errors lying in a number of natural situations. The natural wastes and dense vegetation knit a net in the water bodies which results

in clogging of the waterways. When waste is dumped in such places, the situation worsens. If such spots are cleaned and attended to regularly, then, clogging will not take place and the eco-system will be hygienic and healthy.

Consistent cutting of jungles for wood and clearing land for making colonies, shaved off the earth's surface to a great extent. This is generally known as deforestation. Man has made efforts on a large scale to re-cultivate barren and shaved off land with indigenous species of vegetation.

Energy Resources and their Multiplication are also a big contribution. Oil reserves are a very delicate issue because the consumption over the globe is large and depleting resources will again be a source of great trouble for future generations. Man has made a large feat in generating bio-fuels to support the fast depleting oil reserves. Solar energy run equipments and wind turbines have been developed to replace the other resources so that they can be saved to feed mankind for a longer time. Biogas and other innovative energy sources have also been developed recently.

Small Scale Indigenous Food Creating Systems have also been developed. Food produced for commercial purpose is a prominent trade commodity. Its production and consumption both are done on a large scale. Looking into the commercial aspects of this industry, many rural families have started producing and supplying their own food products on their own limited resources. This gives rise to a happy and healthy local economy. Local market brings success to the local producer as well as the local consumer. The quality of the produce is also far better than the commercial one. This contribution is very significant because it affects life and economy on daily basis. Local food not only ensures good health, but also adds to the economy and well being of the society. Man has also made substantial efforts to use technological knowhow to mitigate all forms of pollution in the atmosphere. The various filtration systems of nanotech , the various methods of treating air, water, soil etc with chemicals, are the efforts which have contributed a lot in controlling pollution.

- **Routine Lifestyle as the great contributor:**

The willingness of Man to become the custodian of the environment can bring about substantial and meaningful changes. The consumable resources which are under a threat of being exhausted can be used at a lower speed and in lesser quantity. Minor changes in the lifestyle can bring about major changes. If we move in a group and use one big vehicle to carry all moving in the same direction, rather than each one using his own small vehicle, can be very helpful. In big cities people use carpooling to do the same.

The practice of using running tap water or running shower to bathe, can be replaced by a tub or bucket. This can save a lot of water. Using water in chain pattern can also be very productive. For example, first washing vegetables in a tub of water, then using it to water plants in the kitchen garden. Keeping windows and ventilators open can save electricity used in cooling gadgets and lights. Lesser use of washing machines, mixers, and other daily equipments can save a lot of electricity. Solar energy can be used in many ways in domestic work in place of electricity. All positive changes in lifestyle should be implemented and advocated and passed on to the progeny. Many institutions and individuals are actively working in this field.

Conclusion

Many things which we use in our daily life can be recycled for multiple use. This can help us to reduce the overuse of natural resources as well as save the environment in many ways. Many disposable things which we dump as useless, can be used in a novel form before disposal. This is more the case with household things. Cartons, wrappers, old clothes, waste material, all can be used creatively and constructively. The good aspect about this attitude is that each and every person on the planet can do his or her bit to contribute towards saving the environment and make the world a livelier and better place to live. Every small action will contribute immensely to the betterment of living conditions on the earth.

References

1. Bates. Marston. From Horace M. Albright Conservation Lectureship Berkeley, California (23 Apr 1962), 'The Human Environment', collected in *Conservators of Hope: the Horace M. Albright Conservation Lectures* (1988), 44.
2. Malthus. Thomas Robert, *An Essay on the Principle of Population* (1798). In E. A. Wrigley and David Souden (eds.), *The Works of Thomas Malthus* (1986), Vol. 1, 9.
3. Roosevelt. Theodore, In *A Book-Lover's Holidays in the Open* (1916), 319
4. Roosevelt. Theodore, 'Our National Inland Waterways Policy', Address to the Deep Waterway Convention, Memphis, Tennessee, 4 Oct 1907. In *American Waterways* (1908).

6

WHY ARE RIVER BASINS CONSIDERED THE BEST AREAL UNIT FOR MORPHOMETRIC ANALYSIS: A TECHNICAL PERSPECTIVE**Prashant Kumar and Payal Srivastava**Research Scholars, Centre for the Study of Regional Development,
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Abstract: *Physical landforms seen around our social environment are formed and designed with a peculiar process of geomorphism by the constitution of natural elements. Study of the shape, volume and size of these landforms has been attempted by humans since the evolution of the streams like geography, mathematics and physics. These practices have been polished and refrained by the time and by the development of morphometry. Many geomorphologists and other scientists have attempted to comprise the proper definition of morphometry. According to known Geomorphologist A.N. Strahler (1964) "Measurement of the shape or geometry of any natural form – be it plant, animal or relief features – is termed as morphometry". In fact, morphometry incorporates quantitative study of the area, altitude, volume, slope, profiles of the land and drainage basin characteristics of the area concerned. This study is carried out in the basin of River Suswa of Doon Valley to analyse its various morphometric characteristics including areal, linear and relief properties. These collaboratively give the proper idea of basin. Latest remote sensing and GIS techniques have been incorporated to fetch out the proper matrix of the area. It helped to delineate the river basin out of the bunch of many other small rivers clearly.*

Key words: *Delineate, Drainage, Texture, Ruggedness, Remote Sensing & GIS*

Introduction

The technique of Morphometric Analysis has become important in evaluating hydro-geomorphological parameters of drainage basins. Now the old methods of this analysis have been associated and replaced accordingly by Remote Sensing and Geographical Information System (R.S. & GIS) techniques which help a researcher to produce high yield data with more precision and options of rectification. A detailed description of the methods of morphometric analysis of the basin characteristics is given by Horton (1932), Chow (1964), Doornkamp & King (1971), and Zavoianre (1985). According to Gardiner (1982), 'morphometry is potentially an important approach to geomorphology, since it affords quantitative information on large scale fluvial landforms, which make up the vast majority of earth's configuration'.

Morphometric techniques are applied in character as well as integrated in approach. It provides a clear picture of the topography of a region. Physiography and physiographic environment of a particular region directly

influence socioeconomic conditions leading to spatial variations. Therefore, one has to take into account certain parameters which influence physiography. Relief characteristics of a particular region are important in terms of their influence over one another, which are independent. Researchers are able to evolve rationale for simulation or uniqueness occurring throughout the region with the help of morphometric parameters.

Why a River Basin?

The search of an ideal unit of the earth surface for the study of landforms has been the key query before geomorphologists. 'Physiographic atoms' and 'drainage basins' had been selected as ideal areal units to serve the purpose. But, of late, fluviially originated drainage basin has gained as a hydrological unit (S. Singh and R. Srivastava). The limited, convenient and clearly defined and unambiguous topographic unit available in a nested hierarchy of sizes on the basis of stream ordering and an open physical system in terms of inputs of precipitation and solar radiation of the drainage basin convinced most of the geomorphologists and scientists to accept it as the fundamental geomorphic unit for the Morphometric study of drainage basin characteristics.

River basins which are believed to be the most widely spread phenomena on the earth surface are responsible for the formation of distinct shape of the earth's surface. Fluvial morphometry in general considers linear, areal and relief aspects of a fluviially originated drainage basin. The *linear* aspect deals with the hierarchical orders of streams, numbers and lengths of stream segments and various relationships among them and related morphometric laws e.g. Law of Stream numbers and Law of Stream length. The *areal* aspect includes the analysis of basin perimeter, basin shape (both geometrical and topological), basin area and related morphometric laws viz. Law of Allometric growth, stream frequency, drainage density and drainage texture. The *relief* aspect incorporates besides hypsometric, clinographic and altimetric analysis, the study of absolute and relative relief, relief ratios, average slope, dissection index, ruggedness index etc.

Study Area: Suswa River Basin as a case

The study area constitutes the watershed of the Suswa River falling in the administrative district of Dehradun (Uttarakhand). It is one the three significant river basins of Doon Valley. The basin of Suswa covers a large part of Dehradun City. A group of the geographers and hydrologists claims that the Suswa River is a right bank tributary of the Song which eventually joins the Ganga. On the other hand, the second group calls it a separate tributary of Ganges The origin of the river is near Khattapaani village in north eastern Duns. It joins the Song River at eastern edges of Kansrao Reserve Forest near

Banbaha village, Doiwala. It drains the mid eastern part of Dun valley towards the south which is very fertile, well-irrigated and densely populated. The river is perennial in the upper mountainous region where as it dries up in the lower part because of base flow. The region is more or less an alluvial tract marked with tropical climate.

Morphometric Characteristics

A quantitative approach is adopted here to show the morphometric characteristic of the region. Various sources such as satellite imagery and topological sheets have been used as database for this purpose. Master basin has been demarcated based on Survey of India topographical sheets on 1:50000 scale. A hundred meters contour interval has been taken to produce the elevation map of the area (Fig.1). Various GIS techniques are used to prepare maps and calculations. Sub-watershed delineation for the Suswa basin is based on delineation devised by Central Ground Water Board as per National Watershed Atlas. Three basins of Doon valley – Suswa, Song and Jakhan are further subdivided into twenty-five sub-watersheds in total. The area under study forms the whole basin of river Suswa consisting of eight sub-watersheds namely 7A1, 7A2, 7A3, 7A4, 7A5, 7A6, 7A7 and 7B2 (Fig.2).

The drainage pattern of the Suswa river in the upper basin is more or less dendritic. This type of drainage pattern is commonly found in which irregular branching of tributaries happens in any direction and in almost any angle, although usually at considerably less than right angle characterizes it (Fig.2). Dendritic patterns are most likely to be found upon nearly horizontal sedimentary rocks of uniform resistance or in the areas of massive igneous rocks, but also could be seen on the folded or complexly metamorphosed rocks (Thornbury, 1969). The fingertip tributaries are quite closely packed and make the pattern very dense in the higher reaches.

Linear Properties

Stream Ordering. It was first introduced by Horton in 1945 and later modified by Strahler (1952, 1964). This scheme is more universally accepted. The basis of the Horton-Strahler approach is a method of classifying segments of channel in terms of stream order. In Horton's stream ordering, all unbranched streams are designated as first order; two first order streams combine to make a second order and so on. Subsequently, Strahler (1964) suggested slightly different method and according to him, the first order streams are those that have no tributaries. When two first order streams meet, the second order streams are formed, and two second order streams form the third stream and so on. The trunk stream through which all the water and discharge pass is the segment of the highest order. The basin is named after the highest order stream. The basin

of river Suswa consists of a total number of 512 perennial and non-perennial streams that spread over an area of 248 sq. km (Table 5) and stretches for a total length of 610.66 km (Table 1 & 2). Of all the sub-basins, 7A1, 7A2 and 7A7 together contain approximately three-fourth of the total streams. Nearly one third of the total streams come under first order. Only 7A7 is a fifth order basin, 7A1, 7A2, 7A4, 7A6 and 7A7 are fourth order basins. 7A1 and 7A7 together account for more than half of the total stream length. 7A1 is the sub-basin with maximum number and length of streams.

The count of stream channels in each order is known as stream number. According to Horton's law the number of streams, counted for each order, are plotted on logarithmic scale on the y-axis against order number on arithmetic scale on x-axis. Horton noted that the number of streams of different orders in a watershed decreases with increasing order in a regular way. When the logarithms of the number of stream order are plotted against the order, the points lie on straight line.

Table 1: Order wise total number of Streams in Sub-basins

Sub-basin	First Order	Second Order	Third Order	Forth Order	Fifth Order	Total
7A1	132	38	13	3	0	186
7A2	60	20	3	1	0	84
7A3	4	2	1	0	0	7
7A4	33	10	2	1	0	46
7A5	43	10	2	0	0	55
7A6	19	6	1	1	0	27
7A7	80	22	3	1	1	107
Total	371	108	25	7	1	512

Table 2: Order wise total Stream Length in Sub-basins (in Km)

Sub-basin	First Order	Second Order	Third Order	Forth Order	Fifth Order	Total
7A1	128.57	50.27	36.17	6.19	0	221.2
7A2	58.38	20.41	5.5	2.27	0	86.56
7A3	2.95	1.58	1.84	0	0	6.37
7A4	32.98	15.29	14.35	0.73	0	63.35
7A5	31.99	21.44	17.82	0	0	71.25
7A6	16.73	7.64	1.07	7.31	0	32.75
7A7	60.8	30.86	13.95	3.24	20.33	129.18
Total	332.4	147.49	90.7	19.74	20.33	610.66

Both the variables are found to have high negative correlation. As one moves from lower to higher order (i.e., 1, 2, 3 and so on), the number of stream

segments decreases with highest order having just one stream that is the master consequent stream.

Fig.1: Contour Map of Suswa Basin

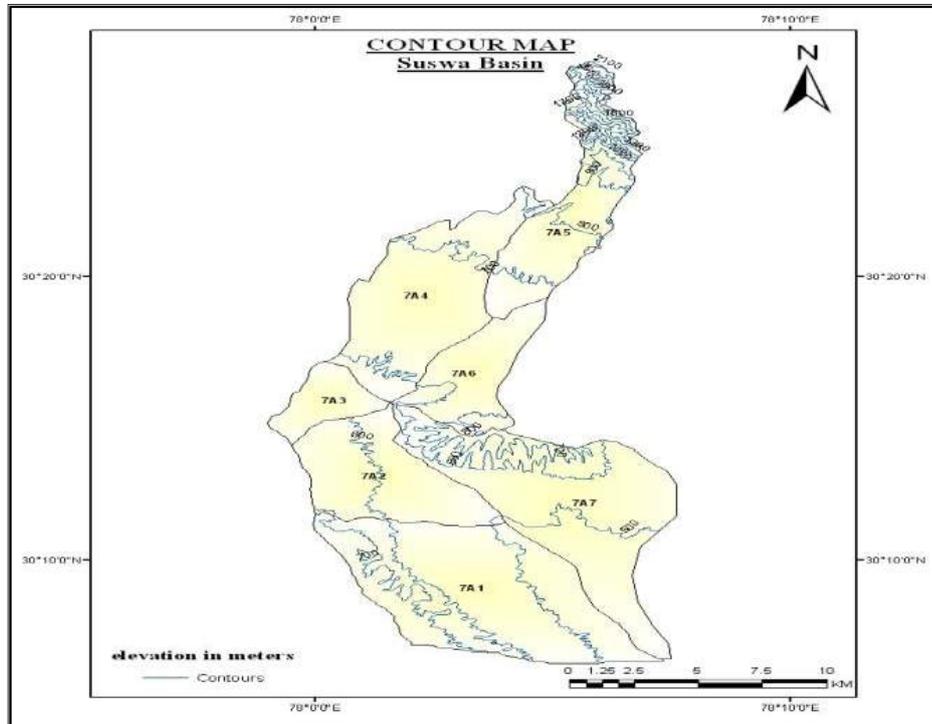
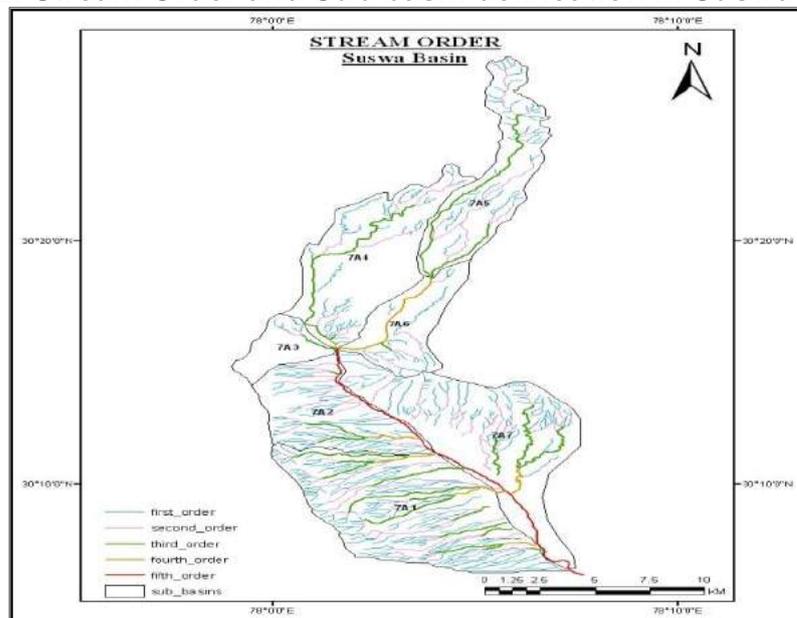


Fig. 2: Stream Order and Sub basin delineation in Suswa Basin



Bifurcation Ratio. Bifurcation ratio is the ratio between the numbers of stream segments of any given order to the number of stream segments of the next

higher order (Schumm, 1956). Its irregular tendency is seen from one order to the next order.

$$R_b = N / (N+1)$$

Where **N** is the number of streams in the given order,
And **N+1** is the number of steam in the next higher order.

Bifurcation ratio, a dimensionless property of the drainage basin is supposed to be controlled by drainage density, stream entrance angles (junction angles), lithological characteristics, basin shapes, and basin areas etc (Strahler, 1964)⁴. It ranges from 3.0 to 5.0 for watersheds where the influence of geological structure on the drainage network is negligible. The relative constancy of R_b is due to drainage systems in homogenous materials tend to display geometrical similarity. Abnormal bifurcation ratios usually have marked effect on maximum flood discharges. In areas of active gullies and ravines, the bifurcation ratio between first and second order streams may be considerably higher than R_b of higher order streams. This is indicative for a state of accelerated erosion. This is clear from the table 3 that the values of bifurcation ratios are relatively higher for second order streams in most of the sub-basins. It is highest with 7.33 in sub-basin 7A7 followed by 6.67 in 7A2 and 6 in 7A6. While these values generally have ranged between 2 and 3 for other stream orders in all basins. This is lowest with value 1 in forth order in sub basin 7A7.

Table 3: Total Number of Streams (S.N.) and Bifurcation Ratio (B.F.) for sub-basins

Order	7A1		7A2		7A3		7A4		7A5		7A6		7A7	
	SN	BF	SN	BF	SN	BF	SN	BF	SN	BF	SN	BF	SN	BF
1.	132	3.47	60	3	4	2	33	3.3	43	4.3	19	3.17	80	3.64
2.	38	2.92	20	6.67	2	2	10	5	10	5	6	6	22	7.33
3.	13	4.33	3	3	1	-	2	2	2	-	1	1	3	3
4.	3	-	1	-	0	-	1	-	0	-	1	-	1	1
5.	0	-	0	-	0	-	0	-	0	-	0	-	1	-

Stream Length

Horton's Law of Stream Length states that the average length of streams of each of the different order in a basin tends to approximate a direct geometric series in which the first term is the average length of the streams of the first order. The total stream length of various orders decrease as the order increases. Mean stream length is a dimensionless property, characterizing the size aspect of drainage network and its associated surfaces (Strahler, 1964). It is calculated as:

$$AL_\mu = \Sigma L_\mu / N_\mu$$

Where, AL_μ = Mean stream length of given order

ΣL_{μ} = Total stream length of given order
 N_{μ} = Number of streams of given order

The relationship between cumulative mean stream length and the stream order reveals more or less a straight line regression of positive exponential form as postulated by Strahler (1964). Stream length ratio is the ratio between the mean length of streams of any two consecutive orders (Horton 1945). It is obtained by:

$$R_L = AL_{\mu} / AL_{\mu-1}$$

Where, R_L = Length Ratio

AL_{μ} = Mean stream length of given order

$AL_{\mu-1}$ = Mean stream length of lower order

Table 4 clearly indicates that length ratio tends to deviate very much within a sub-basin. As per Horton's Stream Length Ratio it should revolve around a constant in an ideal basin. Broadly, it tends to be consistent towards lower order and fluctuates highly towards higher orders basically due to less number of streams and small observation units. The values of stream length for Suswa basin visibly confirm the Horton's Law of Stream length.

Table 4: Mean Stream Length (M.L.) and Length Ratio (L.R.) for sub-basins

Order	7A1		7A2		7A3		7A4		7A5		7A6		7A7	
	ML	LR	ML	LR										
1.	0.97	-	0.97	-	0.74	-	0.99	-	0.74	-	0.88	-	0.76	-
2.	1.32	1.36	1.02	1.05	0.79	1.07	1.53	1.54	2.14	2.89	1.27	1.44	1.40	1.84
3.	2.78	2.11	1.83	1.79	1.84	2.33	7.17	4.69	8.91	4.16	1.07	0.84	4.65	3.32
4.	2.06	0.74	2.27	1.24	0	0	0.73	0.10	0	0	7.31	6.83	3.24	0.70
5.	0	0	0	0	0	0	0	0	0	0	0	0	20.33	6.27

Areal Properties

Basin Shape. The geometry of basin shape is of paramount significance as it helps in the description and comparison of different forms of the drainage basins. The ideal drainage basin is usually of pear shape. But since it is dependent on the size (of the basin) and length of the master stream of the basin and basin perimeter, which are themselves dependent on other variables such as absolute relief, slopes, geologic structure and lithological characteristics etc., a wide range of variations in basin shape is bound to evolve.

According to Miller (1953), the **Circularity Ratio** of a basin is the ratio of basin area to the area of a circle having the same perimeter as the basin. It is also a dimensionless index to indicate the form outline of drainage basins (Strahler, 1964). The value ranges from 0 (a line) to 1 (a circle). Higher the value, more circular the shape of basin and vice versa. The ratio is influenced

by the length and frequency of streams, geological structure, vegetation cover, climate, relief and slope of the basin.

$R_c = \text{Area of basin} / \text{Area of the circle with same perimeter as the basin}$

Where, R_c = Circularity Ratio

Table 5: Basin Shape for sub-basins of Suswa Basin

S.No.	Sub Basin	Area	Perimeter	Total No. of Streams	Total Stream Length	Circularity Ratio
1.	7A1	60.81	35.28	186	221.20	0.61
2.	7A2	28.99	24.68	84	86.56	0.60
3.	7A3	9.41	13.99	7	6.37	0.60
4.	7A4	41.86	34.60	46	63.35	0.44
5.	7A5	31.68	39.87	55	71.25	0.25
6.	7A6	19.01	22.30	27	32.75	0.48
7.	7A7	56.20	42.71	107	129.18	0.39
	Total	247.96	213.43	512	610.66	-

In the case of sub basins of Suswa, the values of circularity ratio range between 0 and 1. This is highest for three sub basins 7A1, 7A2 and 7A3 with 0.6 that shows more rectangular or pear shapes of these basins. While it is lowest for 7A5 with 0.25 that indicates more elongated or banana shape of the basin.

Drainage Frequency

Drainage frequency is defined as the total number of stream segments per unit area. The occurrence of stream segments depends upon the nature and structure of rock, nature and amount of rainfall, vegetation cover and infiltration capacity of soil.

$$\text{Stream frequency} = \Sigma N / A$$

Where, ΣN is the total number of streams segments

And A is the area which is usually in Km².

On an average drainage frequency or stream frequency is high in south-west part of the basin (Fig.3) which is due to high relief that leads to more of gully and rill erosion and numerous ephemeral streams originate. Maximum area is covered by 1 to 2 km per sq. km of streams (Table 5).

Drainage Density

Drainage density is length of the stream channels per unit square area. Horton (1945) defined drainage density as a ratio of all stream segments in a given drainage basin to the total area of that basin. It is expressed in kilometers of channel length per sq. km. High drainage density represents the fine texture

and low, the coarse structure. It is measured for the degree of dissection of basin.

$$\text{Drainage density} = \Sigma L / A$$

Where, ΣL is total length of stream segments in Km.

And A is the area which is usually in Km².

The areas of high density of streams more or less correspond to areas of high frequency, i.e., southern part of the basin (Fig.4). Almost half the area of the basin is occupied by class 2.00 - 3.00 (Table 7). Middle basins i.e., 7A3, 7A4 and 7A6 have less density mainly because of less frequency there.

Table 6: Drainage Frequency For sub basins of Suswa Basin

Drainage Frequency		
Class	Total Area (in sq. km.)	% of Area Occupied
0 – 1.00	9.41	3.79
1.00 – 2.00	148.75	59.99
2.00 – 3.00	28.99	11.69
3.00 – 4.00	60.81	24.52

Table 7: Drainage Density for sub-basins of Suswa Basin

Drainage Density		
Class	Total Area (in sq. km)	% of Area Occupied
0 – 1.00	9.41	3.79
1.00 – 2.00	60.87	24.55
2.00 – 3.00	116.87	47.13
3.00 – 4.00	60.81	24.52

Figure 3: Drainage Frequency for sub-basins of *Suswa Basin*

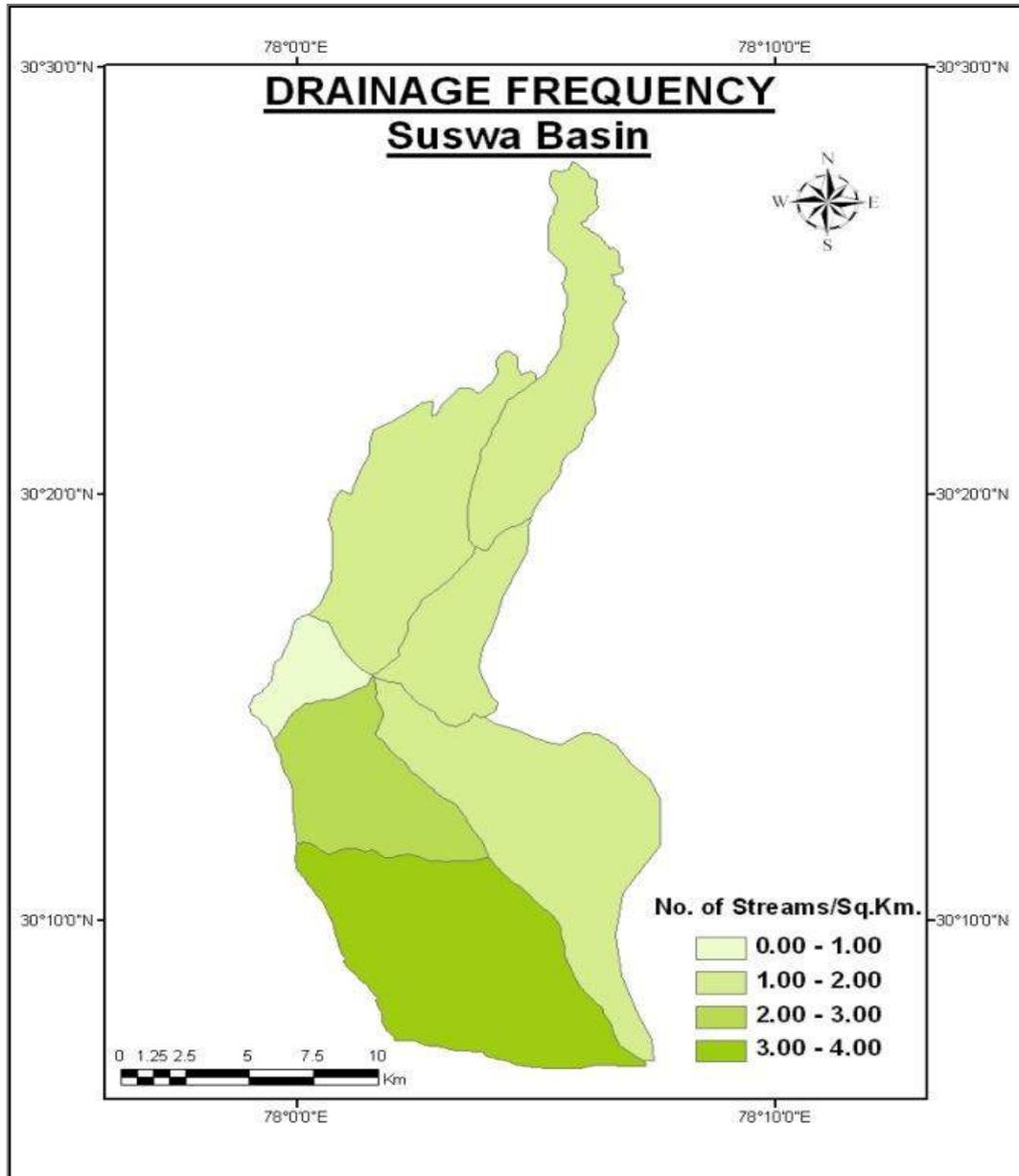


Figure 4: Drainage Density for sub-basins of Suswa Basin

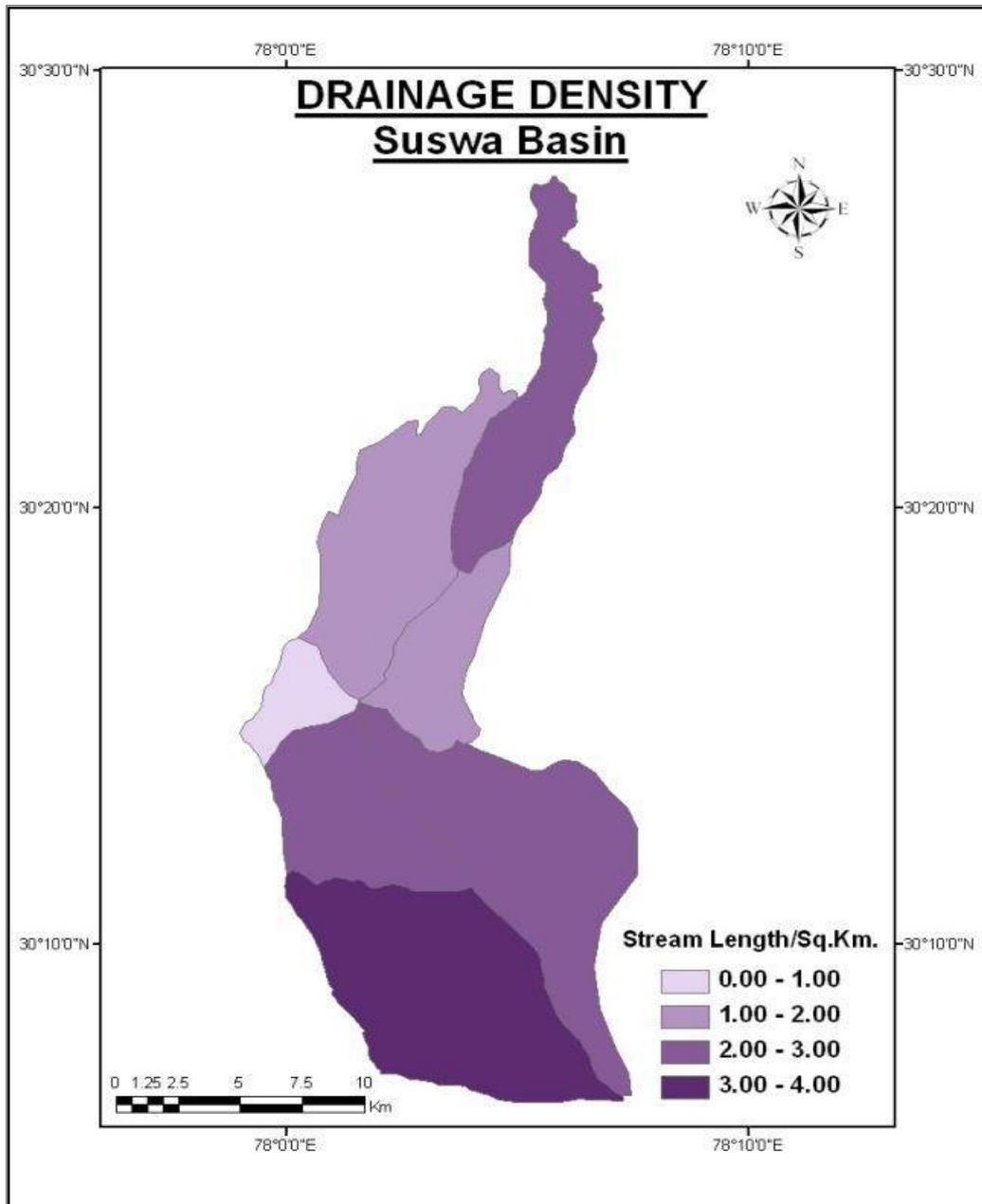


Figure 5: Drainage Texture for sub-basins of Suswa basin

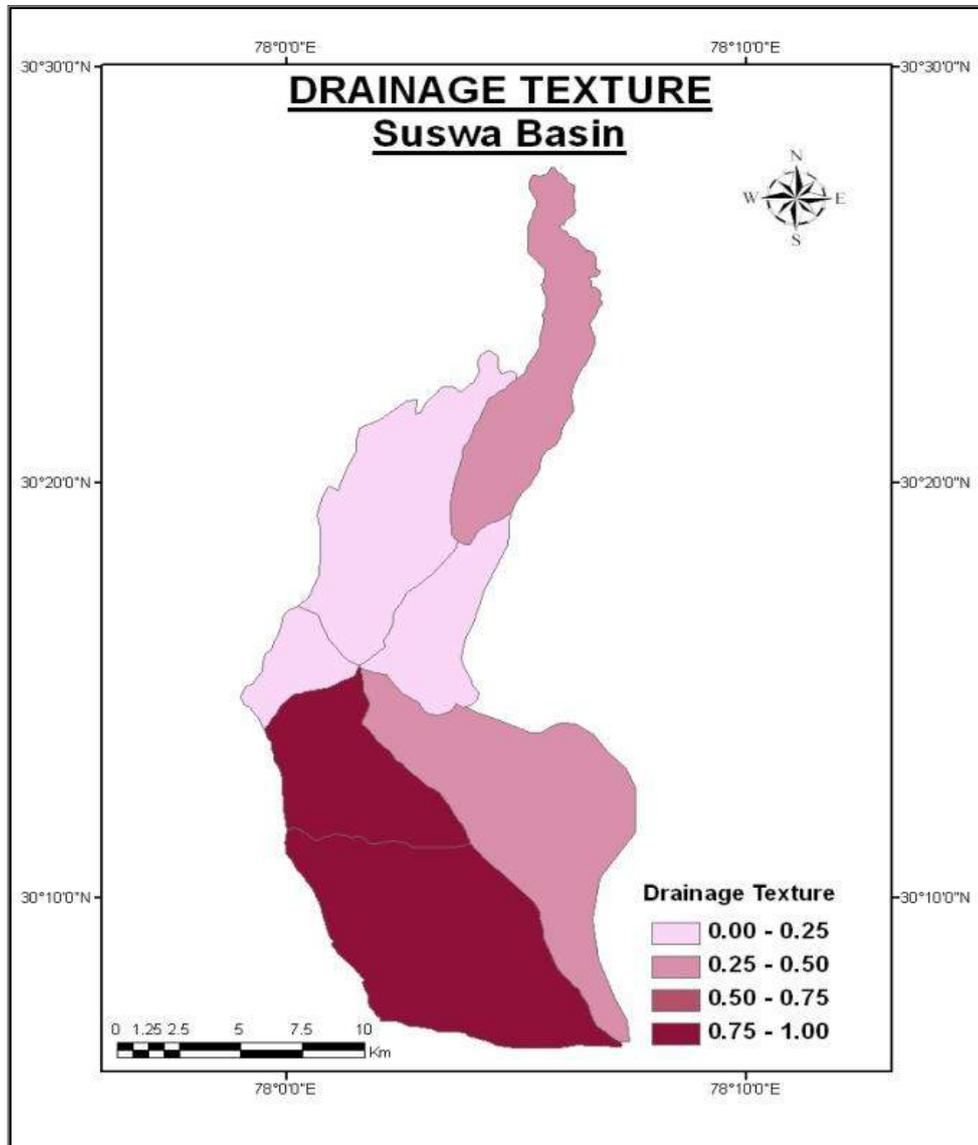


Table 8: Drainage Texture for sub-basins of Suswa Basin

Drainage Texture		
Class	Total Area (in sq. km)	% of Area Occupied
0 - 0.25	70.28	28.34
0.25 - 0.50	87.88	35.44
0.50 - 0.75	28.99	11.69
0.75 – 1.00	60.81	24.52

Drainage Texture

'An important geomorphic concept is drainage texture by which we mean the relative spacing of drainage lines' (Smith, 1950). It has advantage over stream frequency and drainage density, as it is a combination of both. Drainage texture is a function of both frequency and density, thus higher the drainage density and frequency, finer will be the drainage texture.

$$\text{Drainage texture} = \text{stream frequency} * \text{drainage density}$$

Fine texture is found in fragments in the southern and west parts of the basin that is marked with a dense network of streams (Fig 5). A major section of the basin in middle part has comparatively coarser texture due to little number of streams found there (Table 8). Upper part also possesses high density has a relatively moderate texture.

Relief Properties

Absolute & Relative Relief. The actual elevation of any point above the mean sea-level gives the absolute relief of that point. It provides a clear picture of the nature of terrain and undulations of the surface. Relative relief is defined as the differences in height between the highest and lowest point in a unit area. It is also termed as amplitude of 'available relief' or 'local relief' (W.S. Glock 1932). Higher the degree of dissection, greater is the relative relief.

$$\text{Relative relief} = \text{Highest contour value/ Spot Ht.} - \text{Lowest contour value/ Spot Ht.}$$

The absolute relief mapping for the Suswa basin is done by plotting contours on an interval of 100 meters. On an average, absolute relief ranges from 600 meters to 2100 meters. Upper part of the Suswa basin i.e., 7A5 has comparatively higher elevation ranging from 700-2100 meters (Table 9). While the rest part of the basin including other six sub basins are of low and medium elevation ranging from 500–800 meters (Table 9). Very high relief is found towards the northern part that forms a part of the Lesser Himalayas.

Moderate to high relative relief is found in the area towards the upper reaches in sub basin 7A5 where numerous closely packed first and second order tributaries are found that have highly dissected the surface (Fig.6). Due to this, greater undulations have been created over the facade. Extreme northern part of the area has a higher relative relief i.e., 1400 meters. Southern part possesses low relative relief (Table 9). Maximum area of the basin comes under moderate relative relief ranging from 100-200 meters.

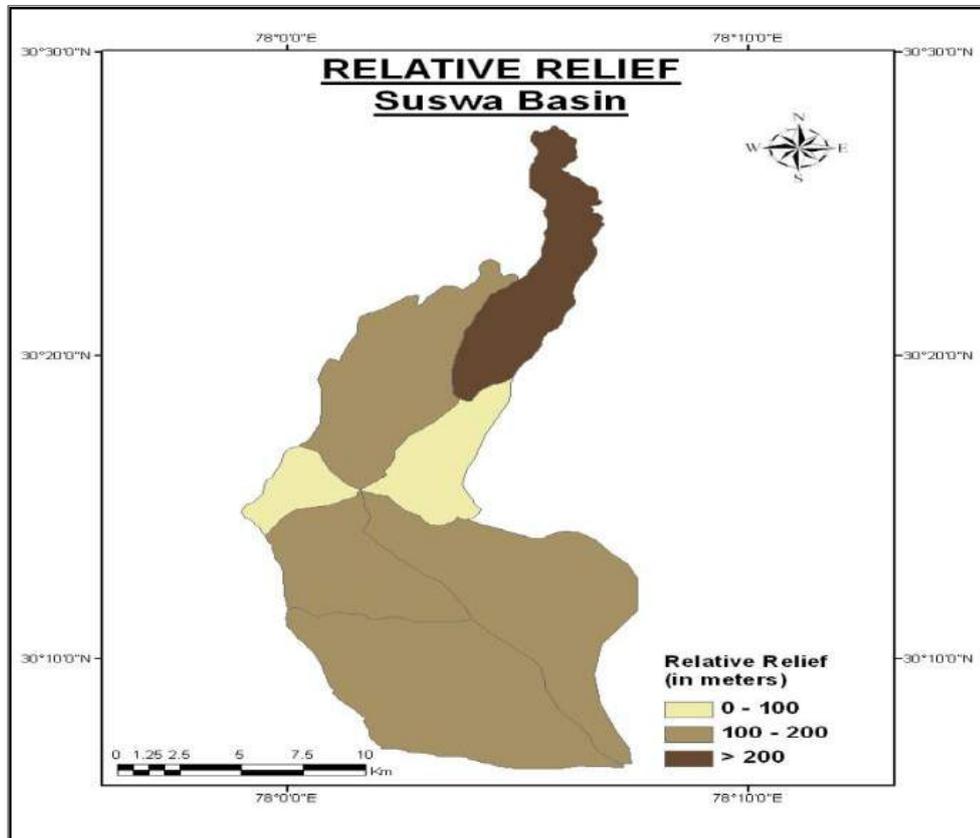
Table 9: Absolute and Relative Relief For sub-basins of Suswa Basin

Sub Basin	Absolute Relief (in meters)		Relative Relief (in meters)
	Maximum	Minimum	
7A1	700	500	200
7A2	700	500	200
7A3	600	500	100
7A4	800	600	200
7A5	2100	700	1400
7A6	700	600	100
7A7	700	500	200

Table 10: Relative Relief for sub-basins of Suswa Basin

Relative Relief		
Class	Total Area (sq. km.)	% of Area Occupied
0 – 100	28.42	11.46
100 – 200	187.86	75.76
> 200	31.68	12.78

Figure 6: Relative Relief for sub-basins of Suswa basin



Dissection Index

Dissection index, expressing a ratio of the maximum relative relief to the maximum absolute relief, is an important indicator of the nature and magnitude of the dissection of terrain (Slaucitajas 1936). Dissection index is also used as morphometric determinant of the stage of cycle of erosion wherein old, mature and young stages are related to dissection indices of less than 0.1, 0.1 - 0.3, and more than 0.3 respectively.

$$\text{Dissection index} = \text{relative relief} / \text{absolute relief}$$

Highly dissected areas are those that lie in the zones that have a dense system of a number of streams actively involved in under-cutting. Around 13 percent area in the basin is highly dissected (Table 11). About 11 percent area of the basin is very less dissected including sub basins 7A3 and 7A6. This is because very less flow of streams in these areas (Fig.7).

Ruggedness Index. Ruggedness is a derivative of long standing interaction between available sharpness of local relief and the amplitude of available drainage density and other environmental parameters. It is a measure of surface unevenness (Chorley, 1971).

$$\text{Ruggedness index} = (\text{relative relief} * \text{drainage density}) / 1000$$

Table 11: Dissection Index for sub-basins of Suswa Basin

Dissection Index		
Class	Total Area (sq. km.)	% of Area Occupied
0 – 0.20	28.42	11.46
0.20 – 0.40	187.86	75.76
0.40 – 0.60	0.00	0.00
0.60 – 0.80	31.68	12.78

Figure 7: Dissection Index for sub-basins of Suswa Basin

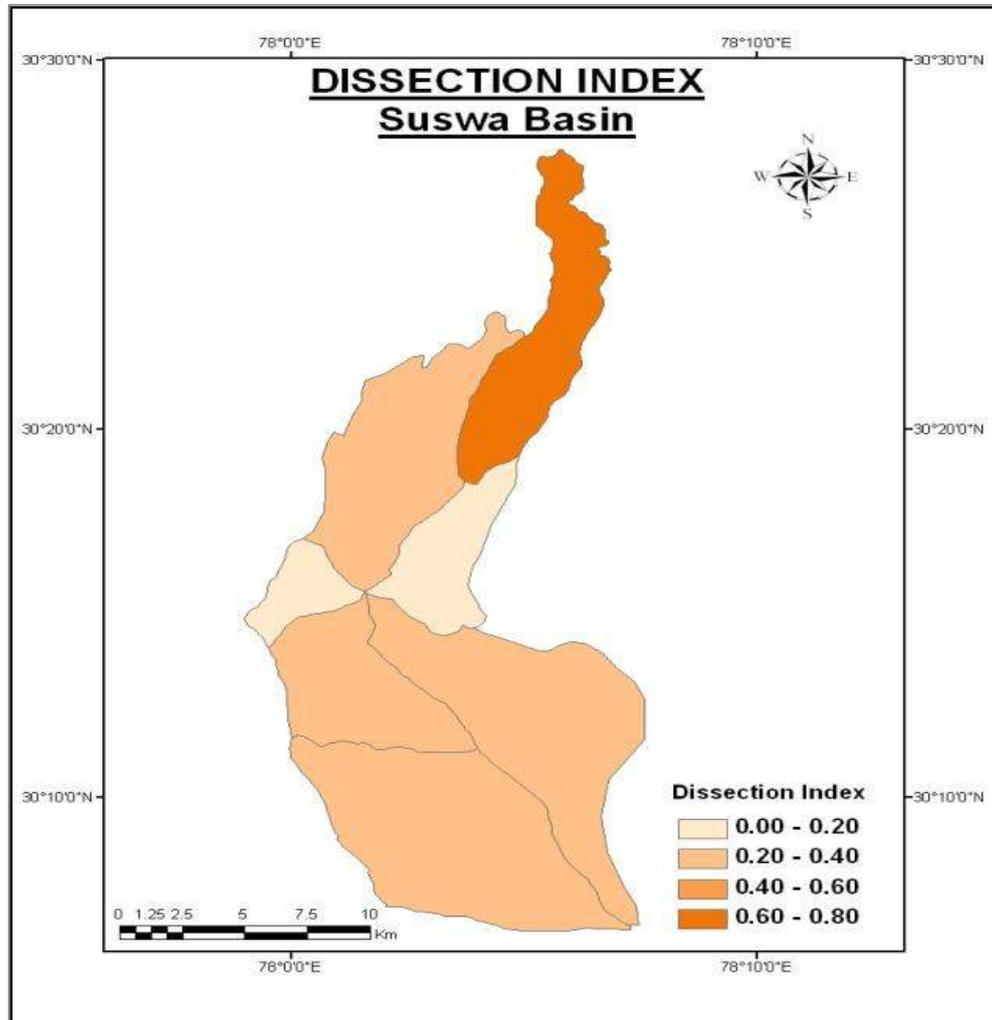
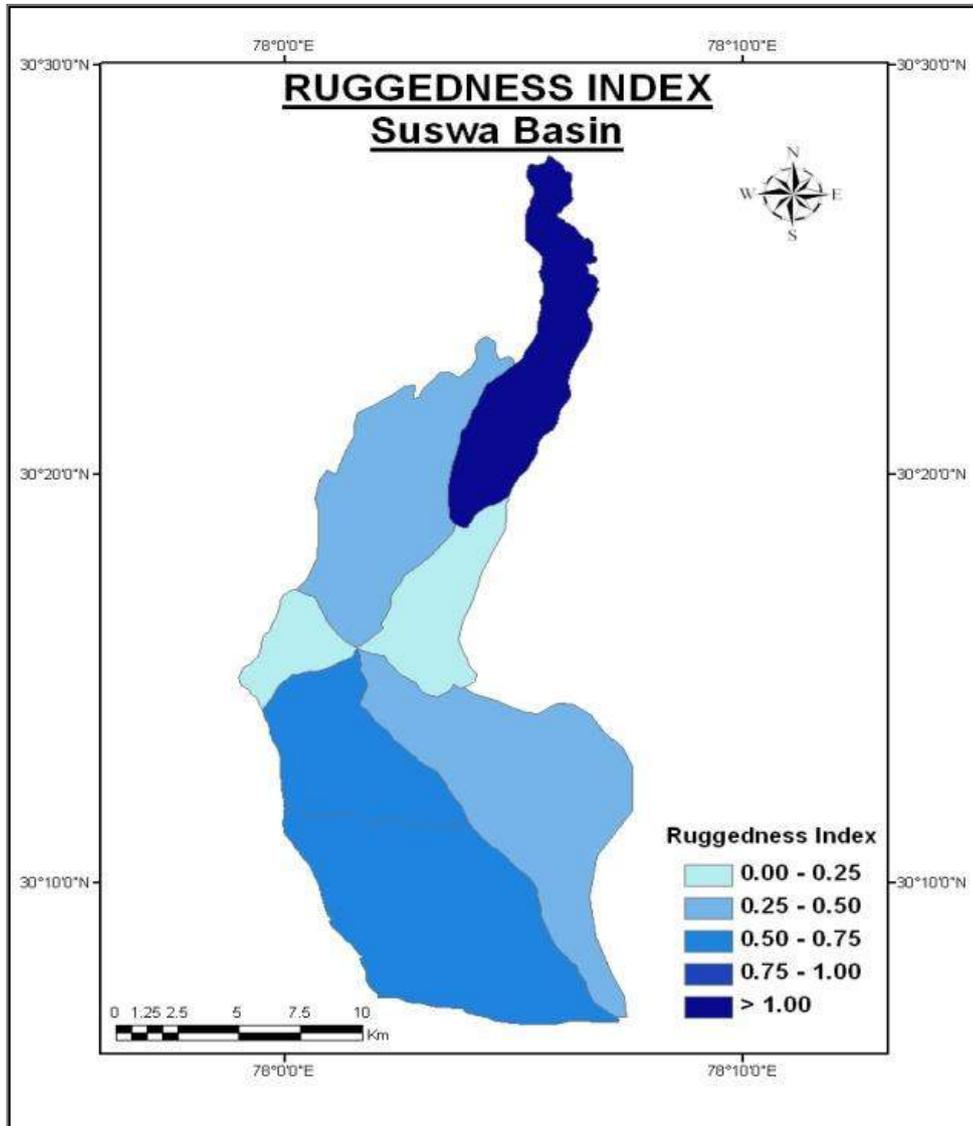


Table 12: Ruggedness Index for sub-basins of Suswa Basin

Ruggedness Index		
Class	Total Area (Sq. Km)	% of Area Occupied
0 – 0.25	28.42	11.46
0.25 – 0.50	98.06	39.55
0.50 – 0.75	89.80	36.22
0.75 – 1.00	0.00	0.00
>1.00	31.68	12.78

Figure 8: Ruggedness Index for sub-basins of Suswa Basin



High ruggedness is found in the upper reaches of the basin where relative relief and drainage density are high as ruggedness is directly influenced by both (Fig.8). Around three fourth of the total area is low to moderately rugged. Thus the basin has rugged terrain in a contiguous unit in the southern part and certain non-contiguous units in the northern part where high relief is found. Some of the area in the basin is not as rugged in nature as the relief and density are low (Table 12). While sub basins 7A3 and 7A6 are very less rugged.

Thus, morphometry proves its soundness in being significant for getting a basic understanding of the study area which happens to be a drainage basin. It is thus a fundamental step in any sort of regional planning which is done through watershed approach. With the application of morphometric techniques, the nature of terrain, slope, elevation, surface characteristics like texture,

ruggedness, dissection etc. have been calculated for the study area. All these parameters would further help in the evolving conservation methods for the management of the land resource in the area as these are directly related to the geomorphic processes transforming the physiography of the region.

References

1. Strahler, A.N., (1964), "*Quantitative Geomorphology of drainage basin and channel networks in V.T. Chow (ed.)*", Handbook of Applied Hydrology, pp. 439-76.
2. Thronbury, W.D., (1969), "*Principles of Geomorphology*", John Wiliey & Sons, New York, pp. 594.
3. Singh, Savindra, (2000), "*Geomorphology*", Prayag Pustak Bhavan, Allahabad, pp. 353-84.
4. Singh, R.L., (1997), "*India: A regional geography*", National Geographic Society of India, Varanasi, pp. 475-77.
5. Horton, R.E., (1945), "*Erodional development of streams and their drainage basins: Hydrophysical approach to quantitative morphology*", Geol. Soc. Amer. Bull., 56, pp. 275-370.
6. Horton, R.E., (1932), "*Drainage Basin Characteristics*", Trans. Amer. Geophys. Union, 13, pp. 350-61.
7. Green, K., Kempka, D., & Lackey, L., (1994), "*Using remote sensing to detect and monitoring land-cover and land-use change*", Photogrammetric Engineering and Remote Sensing, 60, pp. 331-337.
8. Chorley, R.J. (ed.), (1971), "*Introduction to Physical Hydrology*", Methuen & Co. Ltd., Britain, pp. 153-161.
9. Bouma, J., (1997), "*The land use systems approach to planning sustainable land management at several scales*", Proceedings of the International Conference on Geo-Information for Sustainable Land Management (SLM), ITC Journal, pp. 237-42
10. Dhinwa, P.S., Pathan, S.K., Sastry S.V., & Rao, (1992), "*Landuse change analysis of Bharatpur distt. Using GIS*", Photonirvachak, JISRS, vol. 20(4), pp. 237-249.
11. Toll, D.L., Royal, J.A. & Davis, J.B., (1980), "*Urban area update procedures using Landsat data*", In Proceedings of the fall technical meeting of the American Society of Photogrammetry held in Niagara falls, Canada, 1980, edited by ASP (Falls Church, Virginia: ASO), pp. RS-E1-17.
12. Traeger, H.K., Steiner and Herring, A., (1997), "*Indicators of Sustainable Land Management - A Literature Review*", GTZ, Farming Systems Research, Eschbom, Germany.
13. Jaiswal, R.K., Saxena, R., & Mukherjee, S. (1999), "*Application of Remote Sensing technology for landuse/landcover change analysis*", Photonirvachak, JISRS, vol. 27(2), pp. 123-128.
14. Kumar, Sujit and Singh, U.C., (1993), "*Drainage basin morphometry of the Lomti Nala, Distt. Rajnandgaon (M.P.)*", Bulletin of Pure and Applied Sciences, Vol. 12F (1-2).
15. Khadri, S.F.R., and Rao, P. Sreenivas, (1995), "*Morphometric analysis of the Beda river basin exposed near the south of Narmada river, M.P.*", National Geographical Journal of India, Vol. 41(4).
16. Upendran, N., George, Abe, and James, E.J., (1998), "*Morphometric analysis of small watersheds in the Western Ghat region of Kerala*", National Geographical Journal of India, Vol. 44(1-4), pp. 190-200.

STUDY ON PHYSICO-CHEMICAL PARAMETERS OF SILISERH LAKE ALWAR DISTRICT, INDIA

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Abstract: *This Lake is picturesque and it is a home to a large number of migratory birds. The tranquil waters of the Lake twined with the Arcadian ambiance moisten the bareness of the golden deserts. During the study period eight different Physico-chemical Parameter were studied, water sample temperature was $26^{\circ}\text{C} \pm 1.414973^{\circ}\text{C}$ to $25.8333^{\circ}\text{C} \pm 1.41218^{\circ}\text{C}$ and Ph was found from 7.3 ± 0.863323 to 7.25 ± 0.860338 . during the study period and DO ranged from 3.35 ± 0.525 mg/l to 3.05 ± 0.484 mg/l., Free CO_2 of lake water sample was ranged from 1.216 ± 0.0851 mg/l to 1.2 ± 0.0791 mg/l the current study find out that the free CO_2 was lesser it may converted into Carbonates (CO_3) and Bicarbonates. Carbonates value ranged from 3.4666 ± 0.5399 mg/l to 3.3 ± 0.5185 mg/l and Bicarbonates was from 53.666 ± 1.7297 mg/l to 52 ± 1.7160 mg/l. values was fluctuating due to the time of sampling, Total hardness was from 42.33 ± 1.6266 mg/l to 41.1666 ± 1.614 mg/l. Hardness of water is mainly imparted by alkaline earth metallic cations and highest value found in the month of September Total Phosphates was from 1.3266 ± 0.1227 to 1.1933 ± 0.07676 . Lake water was use full for drinking purpose and fish culture activity.*

Key words: Siliserh Lake, Physico-chemical parameter.

Introduction

Fresh water habitats are located in different parts of the country especially in rural areas, and are mainly used as a source of drinking water, irrigation and for fish production by the local fisherman communities. However, tropical climate of the region create an environment conducive for fast growth of fish. Fish is most important bio-product of fresh, marine and brackish water ecosystem contributing as an essential and beneficial food item to mankind since ancient time. India's total potential for fish culture is about 3.5 million hectares of which fresh water ponds cover 1 million Hectares (Shrivastava, 1988). The area under ponds and tanks are holding potential of fish production would provide employment opportunities to about two million people (Dwivedi, 2000). In aquatic habitats, environmental factors include various physical properties of water such as the solubility of gases and solids, light penetration, temperature and density. Chemical factors such as hardness, phosphate and nitrates are very important for growth of primary productivity. Tropical and sub-tropical

reservoirs are known to be more productive than temperate reservoirs and shallow smaller reservoirs are generally more productive than large reservoirs due to their high primary production.

The relationship between the physicochemical parameters and plankton production of pond water and their relation with monthly fluctuation of zooplankton are of great importance and basically very much essential in care of fish culture. Fishes are more dependent on water temperature, pH, dissolved oxygen, free CO₂, alkalinity and some other salts for growth and development (Nikolosky, 1963.). Any change of these parameters may affect the growth, development and maturity of fish (Jhingran, 1985). Different causal influences, which determine the quality of water, show a characteristic change from season to season (Munwar, 1970; Chowdhury and Mazumder, 1981.)

A good management practice is essential for any aquatic system used for fish production. Within the recent past decades, there has been considerable interest in the relevance of limnological information to the productivity, development and management of aquatic environments often times, limnological studies involve different approaches and objectives. While on the one hand Zabbey *et al.*, (2008) highlighted studies which involved regular or periodic investigation into the ecology of water to provide insight into the status of the physical and chemical indices for monitoring purposes, on the other, focused on the availability of natural food as an important factor governing fish recruitment and production in the wild. Studies have shown that there is a close link between the quality of water and the composition in any aquatic system. Ovie (1995) reported that among others, physico chemical factors are known to be major factors influencing zooplankton species richness of different ecosystems. Knowledge of the fish population dynamics of both commercially exploited as well as currently unexploited species is essential. This has three applications: to assess the levels of current exploitation relative to maximum sustainable yield, to assess the potential of harvesting additional species (subject to practicability and socio-cultural acceptability), and to assure biodiversity conservation.

Material and Methods

Siliserh Lake is a beautiful lake, Spread in 7 sq Kms area, Lake is located just 165 Kms from Dhaula Kuan Delhi and 110 Kms is Jaipur, This lake is situated in north eastern part of Rajasthan, This was built by maharaja Vinay Singh in year 1845. The lake and reservoir of Siliserh was created by Maharaja for people of Alwar, because water can be channeled to Alwar city. A beautiful lake palace was also built by Maharaja for his beloved wife Shila, It was used as Lake palace and hunting lodge. This Lake is situated just 13 Kms from Alwar city and

also can be used as stop over before you move on Sariska Tiger Reserve / Sariska National Park, *Siliserh lake* is the minor project which is constructed on aravali ranges in Alwar district near about 15 km. It is situated in 27°31'27"N latitude and 76°31'56"E longitude. Irrigation is the main purpose of the reservoir but presently it has been used for fish culture and main source of drinking water supply. Two sampling stations will be selected along the periphery of the *Siliserh lake* and will be named as Site I and Site II. Water samples will be collected monthly in the early hours for one successive six month from July 2013 to Dec 2013. Water samples will be collected at the time from all the selected sites following the instructions of APHA (1998) and will be analyzed for physicochemical parameters. The data collected will be analyzed statically.

Results and Discussion

The data on physico-chemical analysis of Siliserh Lake has been given in Table No.1. Water Temperature is a most important factor for aquatic life. During the study period it was varied from $26\text{ }^{\circ}\text{C} \pm 1.414973\text{ }^{\circ}\text{C}$ to $25.8333\text{ }^{\circ}\text{C} \pm 1.41218\text{ }^{\circ}\text{C}$. Salve and Hiware (2006) , observed that during month of October, water temperature was high due to low water level and clear atmosphere. Similar results were obtained in the present study. The pH values ranges from 7.3 ± 0.863323 to 7.25 ± 0.860338 The maximum pH value was recorded in the month of August (monsoon) . pH was slightly neutral throughout the study period. The values of DO fluctuate from $3.35 \pm 0.525\text{ mg/l}$ to $3.05 \pm 0.484\text{ mg/l}$ mg/l. The maximum values were recorded in the month of October and minimum values in the month of August. The high DO in Month of October is attributed to increase in temperature and duration of bright sunlight.

The long days and intense sunlight during October seems to accelerate photosynthesis by phytoplankton, utilizing CO₂ and giving off oxygen. This accounts for the greater quantity of O₂ recorded during October. The quantity is slightly less during August as reported by Masood Ahmed and Krishnamurthy. The values of free Co₂ range from $1.216 \pm 0.0851\text{ mg/l}$ to $1.2 \pm 0.0791\text{ mg/l}$ mg/l. The maximum value was recorded in the month of December and absent in the month of October. High carbon-dioxide is due to increase in the decomposition of organic matter, low temperature and photosynthetic activities of phytoplanktons. Absence of free carbon-dioxide is due to its utilization by algae during photosynthesis or carbonates present. Total alkalinity of carbonate ranges from $3.4666 \pm 0.5399\text{ mg/l}$ to $3.3 \pm 0.5185\text{ mg/l}$. The maximum value was recorded in the month of August. Total alkalinity of bicarbonate ranges from $53.666 \pm 1.7297\text{ mg/l}$ to $52 \pm 1.7160\text{ mg/l}$. The value of bicarbonate is near about similar for all month.

Total Hardness fluctuate from 42.33 ± 1.6266 mg/l to 41.1666 ± 1.614 mg/l. The maximum value was recorded in the month of December and minimum value in the month of October. Total phosphate was ranged from 1.3266 ± 0.1227 to 1.1933 ± 0.07676 . It was also a very important chemical parameter which can be use by different type of algae as a nutrient.

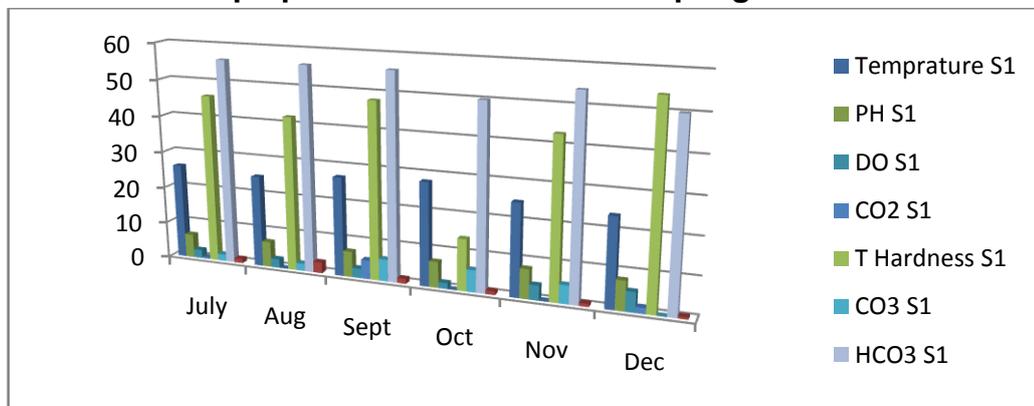
Table 1: Monthly variation of physico-chemical parameter

Physicochemical Parameter		Temp C°	PH	DO	CO2	Total hardness Mg/l	Carbonate	Bicarbonate	Phosphates
July-2013	S1	26	6.5	2.3	0.4	46	1.8	56	1.16
	S2	26	7	2.3	0.6	46	1.8	56	1.2
Aug-2013	S1	25	7	2.4	-	42	2	56	3.01
	S2	26	6.8	2.4	-	40	2	54	2.21
Sept-2013	S1	27	7	2.6	5.2	48	6	56	1.32
	S2	27	7	2.6	4.8	62	6	54	1.45
Oct-2013	S1	28	7	1.6	-	14	6	50	1.02
	S2	28	9	4.8	-	12	6	46	0.92
Nov-2013	S1	25	8	4.0	0.1	43	5	54	0.83
	S2	24	7	4.0	0.2	44	4	52	0.74
Dec-2013	S1	24	8	5.4	1.6	54	-	50	0.62
	S2	25	7	4.0	1.6	50	-	50	0.64

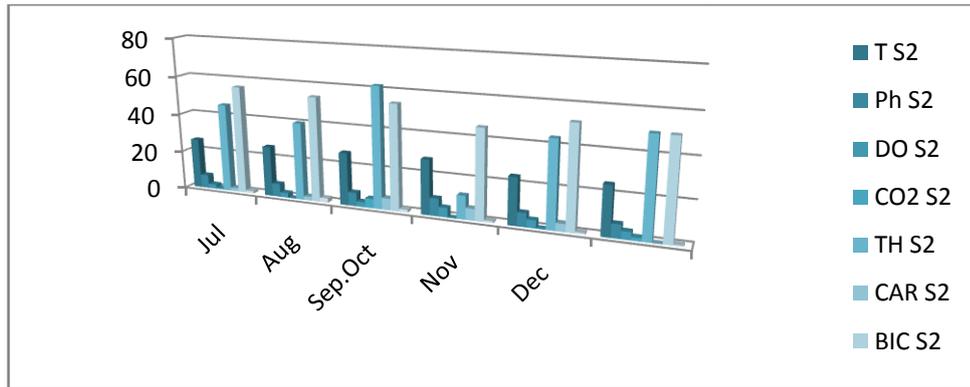
Table 2 : One year observation of Physico-chemical parameter of two sampling site their mean and standard deviation is given in

Site	Temperature	Ph	DO	CO2	Total Hardness	Alkalinity of Carbonate	Alkalinity of Bicarbonate	Phosphates
S1	25.83333 ± 1.41218	7.25 ± 0.860338	3.05 ± 0.4843	1.216667 ± 0.085172	41.16667 ± 1.614546	3.466667 ± 0.539912	53.66667 ± 1.729705	1.326667 ± 0.122762
S2	26 ± 1.414973	7.3 ± 0.863323	3.35 ± 0.52504	1.2 ± 0.079181	42.33333 ± 1.626682	3.3 ± 0.518514	52 ± 1.716003	1.193333 ± 0.076762

**Graphical variation of Physico-chemical parameter:-
Graph plate show results of sampling site S1.**



Graph plate show results of sampling site S2.



References

1. APHA (1998): Standard methods for examination of water and waste water. 20th edition, edited by Lenore S. Clesceri, Arnold E. Greenber and Andrew D. Eaton.
2. Chowdhury, S.H. and A. Mazumder (1981): Limnology of Lake Kaptai,-1. Physicochemical features. *Bangladesh. J. Zool.*, 9(2): 59-72.
3. Dwivedi, S.N. (2000): S and T approach for exponential growth in fish production. (In: souvenir, *The Fifth Indian Fisheries Forum, CIFE*, pp-14-18.
4. Jhingran, V.G. (1985): Fish and Fisheries of India. *Hindustan Publishing Corporation, Delhi, India*.
5. Masood Ahmed and Krishnamurthy R. (1990): Hydrobiological studies of Wohar reservoir Aurangabad(Maharashtra state) India. *J. Environ. Biol.* 11(3), 335-343.
6. Munwar, M. (1970): Limnological studies on freshwater ponds in Hyderabad, India: The Physicochemical complexes. *Hydrobiol.*, 23: 179-195.
7. Nikolosky, G.V. (1963): *The ecology of fishes*. Academic Press. London, UK.
8. Ovie, S.I. (1995): Zooplankton species richness and Sorenson's index of similarity for Asa lake and some other freshwater ecosystem in Nigeria. *National Institute for Freshwater Fisheries annual report*, 57-62.
9. parameters of a minor reservoir, Sawana, Hingoli district, Maharashtra. 14. Salve, B.S. and Salve, B.S. and Hiware, C.J. (2006): Studies on water quality of wan parakalpa reservoir Nagpur, near Parli Vaijnath Dist. Beed. Marathwada region. *J. Aqua biol* . 21(2):113-117.
10. Seasonal distribution and behaviour of nutrients with reference to tidal rhythm in the Mulki estuary, southwest coast of India. *J. Mar. Biol. Ass. India*, 42, 21-31 (2000).
11. Shrivastava C.B.L. (1988): *A text book of fishery science and Indian fisheries. Kitab Mahal ageancies Allahabad,Pp.* 17-18.
12. Zabbey, N., Sikoki, F.D. and Edoghotu, J.(2008): Plankton assemblages and environmental gradients in the middle reaches of the Imo river, Niger Delta, Nigeria. *African Journal of Aquatic Science*, 33(2):241-248.

GREEN ACCOUNTING: A SYSTEMATIC APPROACH FOR MANAGING NATURAL RESOURCES

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Abstract: *'Green accounting' is the popular term for environmental and natural resource accounting, which incorporates environmental assets and their source and sink functions into national and corporate accounts. It is broadly defined as the identification, collection, analysis, dissemination, and use of physical flow information (materials, energy and water flows), environmental cost information, and other monetary information for both conventional and environmental decision-making. This definition of Green Accounting is similar to the definition of conventional natural resources management methods, but has several key differences: It places particular emphasis on identifying environmental costs, including the costs of producing waste; It includes information on physical flows and use of materials, water, and energy, as well as cost information; Its information is particularly useful for activities and decisions with environmental impacts. Environmental accounting will also serve as a solid foundation for an Environmental Management System (EMS) which increases the effectiveness of an existing one management system not only for developing countries but also for developed ones.*

Key words: *Green Accounting, Physical Flow Information, Environmental Costs, Environmental Management System.*

Green Accounting- A Green Step for Sustainable Future

Growth can no longer be measured in strictly economic terms such as the monetary value of output, income or expenditure per head. Additional criteria are needed for green growth. According to UK economist Tim Jackson: "Prosperity consists in our ability to flourish as human beings -- within the ecological limits of a finite planet. The challenge for our society is to create the conditions under which this is possible." Green growth will come from applying green public procurement and green research and development. Appropriate penalties such as making the polluter pay for pollution and incentives like tax breaks for investment in green R&D are required. However, measuring green

growth will need additional criteria such as sustainability, greenness, happiness or well-being.

In its 2009 Communication "GDP and Beyond: Measuring progress in a changing world," the European Commission proposed five actions as part of the EU roadmap for the development of indicators relevant to the challenges of today:

1. Complementing GDP with environmental and social indicators;
2. Near real-time information for decision making;
3. More accurate reporting on distribution and inequalities;
4. Developing a European Sustainable Development Scoreboard; and
5. Extending national accounts to environmental and social issues.

Green accounting incorporates environmental assets and their source and sinks functions into national and corporate accounts. It is the popular term for environmental and natural resource accounting. Conventional national accounts largely ignore:

1. New or newly observed scarcities of natural resources, which threaten to undermine the sustainability of economic performance and growth, and
2. Environmental degradation as an 'external' (social) cost of economic activity.

Green Accounting is similar to the definition of conventional natural resources management methods, but has several key differences:

1. It places particular emphasis on identifying environmental costs, including the costs of producing waste;
2. It includes information on physical flows and use of materials, water, and energy, as well as cost information;
3. Its information is particularly useful for activities and decisions with environmental impacts.

Green Accounting or Environmental Accounting is an important function that provides a means to incorporate information to manage and conserve environment in the globalize world. The most compelling reason for practicing green accounting is the growing body of evidence indicating that environmental costs can make up a much larger proportion of costs than any country can realize.

Environmental Accounting		
	Monetary Units	Physical Units
Internal	Environmental Management Accounting Monetary Environmental Management Accounting (MEMA)	Physical Environmental Management Accounting (PEMA)
External	Monetary External Environmental Accounting and Reporting (MEEA) Monetary Environmental Regulatory Accounting & Reporting	Physical External Environmental Accounting and Reporting (PEEA) Physical Environmental Regulatory Accounting & Reporting

Source: eco-efficiently action project.com

Objectives of Green Accounting

1. Segregation and Elaboration of all Environment related Flows and Stocks of Traditional Accounts

The segregation of all flows and stocks of assets related to environment permits the estimation of the total expenditure for the protection of the environment. A further objective of this segregation is to identify that part of the gross domestic product that reflects the costs necessary to compensate for the negative impacts of economic growth, that is, the defensive expenditures.

2. Linkage of Physical Resource Accounts with Monetary Environmental Accounts

Physical resource accounts cover the total stock or reserves of natural resources and changes therein, even if those resources are not affected by the economic system. Thus natural resource accounts provide the physical counterpart of the monetary stock and flow accounts of SEEA.

3. Assessment of Environmental Costs and Benefits

- (a) The use (depletion) of natural resources in production and final demand;
- (b) The changes in environmental quality, resulting from pollution and other impacts of production, consumption and natural events, on the one hand, and environmental protection, on the other.

4. Accounting for the Maintenance of Tangible Wealth

The SEEA (**System of Environmental Economic Accounting**) extends the concept of capital to cover not only human-made but also natural capital. Capital formation is correspondingly changed into a broader concept of capital

accumulation allowing for the use or consumption and discovery of environmental assets.

5. Elaboration and Measurement of Indicators of Environmentally Adjusted Product and Income:

The consideration of the costs of depletion of natural resources and changes in environmental quality permits the calculation of modified macro-economic aggregates, notably an environmentally adjusted net domestic product (EDP).

Main Steps in Green Accounting

There is no single, formal methodology associated with green accounting. The Satellite Economic and Environmental Accounts (SEEA) is a widely discussed effort to compile economic and environmental data into a common framework using green accounting. SEEA (System of Environmental Economic Accounting) is structured as a series of methodological options from which users choose the techniques that are most appropriate to their needs. In addition, the National Academy of Sciences, USA reviewed a system of environmental accounts developed by the Bureau of Economic Analysis (BEA) in 1994 called the Integrated Economic and Environmental Satellite Accounts. However, there has been little progress in developing a standardized system for green accounting. Some of the overarching methods currently in use for green accounting include-

1. Natural resource accounts;
2. Emissions accounting;
3. Disaggregation of conventional national accounts;
4. Value of non-marketed environmental goods and services;
5. Green gross domestic product.

Problems of Green Accounting

1. It does not include comprehensive natural resource accounting because regional natural resource accounts are not reflected in the main accounts.
2. It focuses on the use of natural resource for economic activities and ignores the flows and transformations within the natural resources.
3. The types of data needed are not available in the necessary format. Thus lack of data has been one of the main problems in the SEEA.
4. Another problem arises when environmental data are directly connected with data of existing national accounts for the preparation of the green accounting. They require assigning of environmental pollution loads to the appropriate economic activities. However, the costs of preventing pollution can only be determined if the causes of pollution are identifiable. But the causes of many types of environmental pollution are

not clear. If there are several pollution factors which cause environmental damage, the assignment of this damage will be highly arbitrary.

5. Another problem arises when some of the consequences of environmental pollution become visible after a long time. Estimating only the immediate consequences will lead to wrong policy decisions.
6. There is no simple justifiable valuation system for the green accounting. For different aspects of environmental problems, different valuation problems are used such as prevention and restoration costs and contingent evaluations based on surveys.
7. The pricing of all environmental variables in monetary terms in the green accounting has consequences:
 - i) The accounting system is restricted to those variables which are easily monetized thereby reducing the range of the accounting system,
 - ii) Monetization of environmental variables and their concentration of only a few aggregates results in a drastic reduction of the green accounting system.

Green Accounting Contribute to Sustainability ?

By integrating social and ecological costs and benefits resulting from the natural environment into traditional economic accounting systems, green accounting aims to capture the interdependency and dynamic interactions between the three pillars of sustainability (economy, society, and environment). More accurately valuing natural resources costs and benefits may contribute to the development of more appropriate and sustainable economic, trade, and development policies. Incorporating green accounting into national economic accounts could provide a measure of sustainability; however, considerable advances in methods of measurement and valuation are needed. From a purely accounting perspective, particular forms of capital could be diminished or, in an extreme case, wholly eliminated without decreasing overall welfare if other forms can be substituted for it. There are, of course, no substitutes for the life-sustaining services of nature and the question of when and how to account for this fact is the source of many ongoing debates in green accounting.

References

1. <http://www.epa.gov/sustainability>, United States Environmental Protection Agency (EPA).
2. <http://www.gdrc.org/sustdev/concepts>, Environmental Accounting.
3. <http://www.greenbiz.com/blog/green-accounting-path-sustainable-future>.
4. <http://www.yourarticlelibrary.com/economics/environmental-economics/green-accounting>.
5. <http://www.eoearth.org/view/article/green-accounting>.
6. <http://www.eco-efficiently-action-project.com>.

NATURAL DISASTER MANAGEMENT LAW: AN ANALYTICAL STUDY**S. K. Saini**

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Abstracts: *India has been traditionally vulnerable to natural disasters on account of its unique geo-climatic conditions. Floods, droughts, cyclones, earthquakes and landslides have been recurrent phenomena. About 60% of the landmass is prone to earthquakes of various intensities; over 40 million hectares is prone to floods; about 8% of the total area is prone to cyclones and 68% of the area is susceptible to drought. In the decade 1990-2000, an average of about 4344 people lost their lives and about 30 million people were affected by disasters every year. The loss in terms of private, community and public assets has been astronomical. At the global level, there has been considerable concern over natural disasters. Even as substantial scientific and material progress is made, the loss of lives and property due to disasters has not decreased. In fact, the human toll and economic losses have mounted. It was in this background that the United Nations General Assembly, in 1989, declared the decade 1990-2000 as the International Decade for Natural Disaster Reduction with the objective to reduce loss of lives and property and restrict socio-economic damage through concerted international action, especially in developing countries.*

Key words: *Disaster, Management, Law, Ministry, Policy*

Introduction

The term "Natural Disaster" means a natural disaster is an event that is caused by a natural hazard and leads to human, material, economic and environmental losses, which exceed the ability of those affected to cope. For example: Earthquakes, floods, landslides, etc. Objective of this paper is to analyse various environmental laws in relation to different phases of disaster management in different countries of the world with special focus on Indian environmental legislation. National legislation taking example of Constitutional provisions, Common laws, statutory laws, customary laws and International law (treaty and conventions) Taking example of India, environmental laws can also be broadly grouped Laws on environment protection and conservation, Laws on pollution and waste management, Laws on safety and emergency preparedness. India's National Disaster Management Act, 2005.

Natural disasters affect all nations. However, in lesser developed nations natural disasters cause disproportionate impact, killing thousands and threatening the livelihoods of those who survive. Many nations lack the

knowledge, capacity and resources to deal with natural disasters. After a disaster the public sector is often paralyzed by damaged infrastructure and unable to cover the costs of emergency and relief efforts, let alone reconstruction work. Lack of overall risk planning and investment in physical resilience measures, with too much focus on post-disaster response, leads to increased loss of life, suffering and damage. People in poor countries are generally more exposed to natural disasters, particularly through a higher dependency on agriculture and increased vulnerability to the natural environment. However, these countries are not capable of protecting themselves, due to lower levels of physical and financial preparedness partly due to low income and insurance penetration. Insurance penetration is high in developed countries. In lesser-developed countries, the availability of insurance is limited and premiums are often not affordable. With less coverage, impacts from natural disasters can derail economic growth. Other subdivisions integrated with natural disaster management laws are described.

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Disaster Management - Indian Legal Provisions

In 2005, India passed its Disaster Management Law known as the Disaster Management Act, 2005 which came in to force on 23.12.2005. The Act establishes a National Disaster Management Authority and other authorities at various levels to coordinate their activities in disaster management. The Act defines "disaster management" [Section 2(e)] means a continuous and integrated process of planning, organising, coordinating and implementing

measures which are necessary or expedient for mitigation or reduction of risk of any disaster or its severity or consequences; [Section 2(e) (ii)] preparedness to deal with any disaster; [Section 2(e) (iv)] rehabilitation and reconstruction [Section 2(e) (viii)]. The Act interalia deals with the provisions regarding protection of human rights by virtue of providing specific guidelines with reference to minimum standards of relief to be provided to persons affected by disaster as recommended by the National Authority, which shall include the minimum requirements in relation to shelter, drinking water, medical and sanitation [Section 12]. This is a distinct feature of the Disaster Management Act, 2005. These legal provisions are considered to be the sacrosanct legislative measures as the intent of the legislature in enacting this Act is to provide for the effective management of disasters and to uphold the human rights of the disaster affected people. The Disaster Management Law is a legal umbrella of the country's disaster management implementation that includes a development based approach which ensures better protection of human rights of individuals during disaster situations.

Co-Environmental legislation have been contributing to risk reduction aspects of disaster management and now are emerging to be relevant for disaster preparedness, relief and recovery strategies due to growing recognition of ecosystem functions, livelihood issues, water and sanitation, waste management and environmental health issues, within the DRR agenda in general, and in particular, while integrating climate-change adaptation. A list of laws and policies for environmental protection in India is given in: Laws and Policies for environmental Protection in India Acts:

- The Indian Forest Act, 1927
- Factories Act, 1948
- Factories Amendment Act, 1987
- Wildlife (Protection) Act, 1972
- The Water (Prevention and Control of Pollution) Act, 1974
- Forest (Conservation), Act, 1980
- The Air (Prevention and Control of Pollution) Act, 1981
- Environment (Protection) Act, 1986
- The Public Liability Insurance Act, 1991
- Biological Diversity Act 2002
- Forest Rights Act, 2006 (Ministry of Tribal Affairs)
- The Cultural Heritage Conservation Bill 2010
- Mine and Mineral Act 2010
- National Green Tribunal Act, 2010

Rules

- The Manufacture, Storage and Import of Hazardous Chemicals Rules, 1989
- Manufacture, Use, Import, Export and Storage of Hazardous Microorganisms,

- Genetically Engineered Organisms or Cells Rules, 1989
- Emergency Preparedness, Planning and Response to Chemical Accidents Rules, 1996
- Dumping and disposal of fly ash discharged from coal or lignite based thermal power plants on land, Rules, 1999.
- Bio-Medical Waste (Management and Handling) Rules, 1998
- The Hazardous Wastes (Management and Handling) Rules, 1989
- Environment (siting for industrial projects) Rules, 1999
- The Noise Pollution (Regulation and Control) (Amendment) Rules, 2000
- The Municipal Solid Waste (Management & Handling) Rules, 2000
- Hazardous Waste (Management, Handling and Trans-boundary) Rules, 2008
- Wetlands (Conservation and Management) Rules, 2010
- Guidelines for diversion of forests lands for non-forest purposes under the Forest (Conservation) Act, 1980
- Plastic Waste (Management and Handling) (Amendment) Rules, 2011

Notifications

- Coastal Regulation Zone (CRZ) Notification (revised 2011)
- EIA Notification 1994 (revised 2006)

Policies

- National Forest Policy, 1988
- National Water Policy, 2002
- National Agricultural Policy, 2000
- National Environment Policy 2006
- National Disaster Management Policy, 2009

Other Laws

Disaster Management Act, 2005. (Recognizes damage /destruction of environment as disaster) Law relating to land use zoning, land acquisition, land pooling, resettlement and rehabilitation also have provisions for environmental protection.

Few examples of Case law, guiding laws, standards and codes Case laws

Judgments and directives of the courts, while deciding on a case involving environmental concern, right or violation, are important contributions to environmental jurisprudence and become part of environmental law for reference in future litigation. These also contribute to the development of environmental law and induct the process of amendments in specific contexts. Court's decision on 'The right to live in a healthy and balanced environment' (in cases, viz. Association Para la Protection de Medio Ambiente y Educacion Ecologica '18 de Octubre' v Aguas Argentinas S.A. & others, Federal Appellate

Tribunal of La Plata (2003); Kattan, Alberto and Others v. National Government, Juzgado Nacional de la Instancia en lo Contencioso administrativo Federal. No. 2, Ruling of 10 May 1983, La Ley, 1983-D, 576) are examples of case laws. The clashing interests of forests and agriculture set the stage for Sibaji Waiswa v. Kakira Sugar Work Ltd (High Court of Uganda, Jinja, No. 6/2001). While the main suit over the Butamira Forest reserve was pending, respondent entered the disputed forest reserve, uprooted trees and routinely destroyed seed nurseries, resulting in an irreparable damage to the environment. The Court held that an award of damages alone could not adequately compensate for the alleged environmental damage (Shelton and Kiss, 2005).

Institutional Mandate for Right to Rehabilitation

The role of law in disaster management is prima facie concerned with the enforceable right of a disaster victim to rescue, relief and rehabilitation. The Constitutional concern for social justice is to accord justice to all sections of the society by providing facilities and opportunities to remove handicaps and disabilities from which the poor are suffering and to secure dignity of their person. The Indian Constitution declares that India is a welfare state, i.e., a state that promotes the general welfare of the people. Especially after the Maneka Gandhi Case [AIR 1978 SC 597], courts have expanded the scope of 'life' and 'personal liberty' under Article 21. The Supreme Court has also interpreted the words 'procedure established by law' to include both the procedural and substantive legal requirements of fairness, justness and reasonableness. Article 21["No person shall be deprived of his life or personal liberty except according to procedure established by law."], which guarantees the protection of life and personal liberty, is the repository of all important human rights. From this, the Supreme Court has deduced an affirmative obligation on the part of the state to preserve and protect human life. Right to life being the most important of all human rights implies the right to live without the deleterious invasion of pollution, environmental degradation and ecological imbalances. (S.Shanthakumar, Introduction to Environmental Law (Wadhwa & Co, Nagpur 2007).

A collective reading of judgments will lead to the logical conclusion that the right to rescue, relief and rehabilitation is a fundamental right guaranteed under Article 21. (B.J.Diwan vs. State of Gujarat, 2001) The doctrine of *parens patriae* is the inherent power and authority of a legislature to provide protection to the person and property of persons and property *non sui juris*, such as minor, insane and incompetent persons. The doctrine of *parens patriae* meaning 'father of the country' was applied originally to the king and is used to designate the state referring to the sovereign power of guardianship over persons under disability. The concept of *parens patriae* is explained as the right of the

sovereign and imposes a duty on the sovereign, in public interest, to protect persons under disability who have no rightful protector. The courts in India have applied this doctrine in several cases. Therefore it is construed that, under the doctrine of *parens patriae* the state is obliged to render adequate relief and rehabilitation to the victims of disaster. It is often reiterated that dispute reprisal and protection of human rights need to be treated as an integral part of the disaster management exercise, after a disaster, the enforceable right of the people to get the relief and rehabilitation needs to be recognized.

Rights Based Approach: A Core of Disaster Management Law

In this scenario it is imperative to integrate human rights and other international legal tools laying an inclusive value framework for establishing conditions that restore the dignity of the victims and protect their rights. A rights based approach is not an add on in later stages of disaster management, but should constitute the very core of management practices. This will enable response planners to address systemic injustices that contribute to continuing poverty and social unrest. Disaster management programmes need to be informed of the international legal standards pertaining to key aspects of disaster response including human rights, the rights of vulnerable groups such as women, children, etc. While existing human rights obligations already require nation, states to take measures to mitigate the risks of natural or man-made disasters, it is important to recognize that failing to take feasible measures that would have prevented or mitigated the consequences of foreseeable disasters amounts to a violation of the right to life and therefore incurs the responsibility of the state under international law. These human rights standards play a critical role in empowering actual as well as potential survivors of natural disasters to demand necessary measures to prevent deaths by the state. For humanitarian agencies they highlight the relevance of a rights-based approach to disaster management.

The World Conference on Natural Disaster Reduction was held at Yokohama in Japan in May, 1994 adopted the Yokohama Strategy for a Safer World: Guidelines for Natural Disaster Prevention, Preparedness and Mitigation. As pointed out in the session by the U.N. Under-Secretary-General for Humanitarian Affairs, "Earthquakes and cyclones will happen. There is nothing we can do about that, but we can be prepared for them when they do strike. Disaster reduction can take place at any point in the process which we call disaster. It can comprise prevention and preparedness, relief and development as well as measures to reduce the effects of such disasters." ("Hyogo Framework for Action 2005-2015: Building the Resilience of Nations and Communities to Disasters," Extract from the final report of the World Conference on Disaster Reduction (A/CONF.206/6). The outcome of the

conference affirms that the impact of natural disasters in terms of human and economic losses has risen and society has become more vulnerable to such disasters over the past two decades, earthquakes, volcanoes, landslides, tidal waves, droughts and other natural events had killed some million people and inflicted injury, displacement and misery on countless more. It was pointed out that environmental protection as a component of sustainable development which is an imbibed feature of human rights of individuals is imperative in the prevention and mitigation of natural disasters.

Conclusion

Many laws has been enacted by Indian parliament since implementation of Indian constitution regarding disaster management laws, especially in the last decade but the Indian people still not aware yet so now it is necessary that only law cannot be sufficient but it is also necessary that we people get awared regarding this so that goal can be achieved.

References

1. Diwan, S. & Rosencranz, A. (2001). Environmental Law and Policy in India. Mumbai.
2. Gupta, A. K. (2010). Policies, Strategies and Options for Disaster Risk Reduction.
3. Gupta, A. K. and Yunus, M. (2004). Indian and WSSD (Rio+10) Johannesburg: Issues of National Concern and International Strategies. Current Science, 87(1): 37-43.
4. Gupta, A. K., Misra, J., & Yunus, M. (1999). Environmental-health Assessment of Thermal Power Project within the Scope of EIA and Risk Analysis: Guide view . In Proceedings of National Seminar on Energy & Environment, Lucknow, July 1999, pp 86-95.
5. Gupta, A.K., Kumar,A., Misra, J.,& Yunus, M. (2002b). EIA & Disaster Management: Principles, Methodological Approach & Application.
6. Misra, J., & Yunus, M. (2002 a). Environmental Impact Assessment and Disaster Management: Emerging Disciplines of Higher Education.
7. Practice. In R. Srivastava and D. P. Singh (eds.), Environmental Education. Anmol Publication, New Delhi.
8. Tripathi and Tripathi. Dynes R. (2004). Expanding the Horizon of Disaster Research. Natural Hazards Observer.
9. Y. C. Tripathi & G. Tripathi (2004) Bio-resources & Environment. Campus Books International, New Delhi.

TEMPERATURE VARIABILITY IN INDIRA GANDHI CANAL AREA : PRE AND POST FIVE YEARS ANALYSIS

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Abstract: *Water is a life sustaining natural resource. Land and water are prime components of environment. Protection, conservation and optimum utilization of these basic resources is essential for successful and sustainable agriculture in the arid ecosystem. Availability of canal water through Indira Gandhi Canal has been proved a major factor for changing entire ecology and dimensions of socio-economic development of this desert region. Large-scale intensive canal irrigation in this arid tract has brought revolutionary alteration in the physical and cultural environment of this canal region. The considerable changes in the conditions of micro-climate, soil and moisture conditions, landuse and cropping patterns, biological status and quality of life of the inhabitants have been observed. The subsistence dry farming of rainfed crops has been replaced by commercial irrigated agriculture of cash crops. Therefore, in the present article an effort has been made to study the impact of canal irrigation in this desert ecosystem.*

Key words: *Land and Water, IGNP, Canal, Command Area*

Introduction

Indira Gandhi Canal is generally referred as "Life line of the Thar Desert" and to a large extent it is correct because it supplies the most important life sustaining element, i.e., water. Indira Gandhi Canal, was previously known as the Rajasthan Canal. It is one of the largest canal systems of India. The project was launched on 31, March, 1958. Indira Gandhi Canal originates in Punjab at Harike barrage. The water is supplied by Bhakra Nangal Dam. Planned length of the canal is 9060 km. Construction work of the canal system has been carried out in two stages. The command area of stage-I lies in Ganganagar & Hanumangarh districts and northern part of Bikaner district. The command area of Stage-II extends from southern Bikaner, Churu, Jaisalmer, Barmer to Jodhpur districts.

Irrigation in Stage-I are started in early 1970s whereas irrigation waters in Stage-II was supplied in mid 1980s. The introduction of canal irrigation has transformed the ecology, economy and society of the Thar desert. Irrigation in Thar desert added water vapour in the atmosphere which has transformed the

regional climate to a significant extent. As we know that water vapour is an important green house gas and addition of this gas through evaporation leads to additional greenhouse effect and absorption of solar radiation. Water vapour lowers the surface temperature directly by condensation and evaporation and indirectly by cloud formation, convection, precipitation etc. As we know that the role of water vapour in modifying the climate of a region is very significant. Therefore, there is a need to study the impact of irrigation on "Thar Desert". This research article attempts to study temperature variability in canal area by comparing the pre and post years of irrigation with reference to temperature. For this purpose, two stations (Ganganagar and Jaisalmer) of Indira Gandhi Canal Project were selected from the Stage-I and II respectively.

The second aim is to know the extent of temperature variations in both stations and this is the reason for selection of two stations from two stages (Stage-I received water in 1970s and stage-II in mid-1980s). Before the study of impact of canal irrigation on temperature variability in Indira Gandhi Canal region three important related studies are reviewed. The study "Direct Human Influence of Irrigation on Atmospheric Water Vapour and Climate" done by Boucher O., Myhre G. *et. al.* (2004) discussed the importance of water vapour in modifying climate of the region. According to them human activity significantly increase the amount of water vapour in the atmosphere especially irrigation.

Objective of this study is to determine the significance of irrigation on water vapour and climate. Five different methods have been used to estimate the influence of irrigation on atmospheric water vapour and radiation field. These methodologies include Laboratoire de Mé'té'orologie Dynamique (LMD) and General Circulation Method (GCM). Results of the experiments say that the amount of water vapour in atmosphere is increasing globally. Increase in water vapour is largest near to the surface and the intensity of water vapour increase declines as one moves higher in atmosphere. The results also reveal that water vapour has cooled irrigated continental regions upto 0.8K. There has been a decrease in global lapse rate of 0.03K in lower layers and warming of upper layers of similar magnitude. Results have also shown the fact that addition of extra water vapour in dry, hot region have contributed to an increase in precipitation at a regional scale which is compensated by a decrease in precipitation in other regions through some mechanism which could be related to convection. This research study also questions the applicability of radiative forcing concept.

Conclusions drawn in the study are : (i) water vapour from irrigation has negative climate sensitivity (ii) human can influence atmosphere water vapour content directly through irrigation and vegetation changes. The results of the

study are correct and the conclusions drawn are also very relevant but the authors in this research work does not consider change in vegetation cover which is always accompanied by irrigation and this point has been accepted in the study. The study entitled "Effects of Global Irrigation on the Near Surface Climate" taken up by William J. Sacks, Benjamin J. Cook *et. al.* (2009) introduced the concept of changing land use management and its effect in climate change. Among several land management practices irrigation affects the climate the most. The reason given by them is that irrigation has cooling effect near irrigated areas, which modifies the regional climate. The approach of the study is global.

Objective of the research study is to estimate the effect of irrigation on global climate. Realistic amount of irrigation has been used to calculate the effects on surface water and energy balance. Data source used is global irrigation map, which is based on census data from Food and Agriculture Organization of the United States. Methodology used for the research is (CLM) Community Land Model and Community Atmospheric Model (CAM). The experiment was performed using these models to compare global stimulation in areas with and without irrigation. Offline experiments were done with CLM to know the sensitivity of results to timing and spatial extent of irrigation.

The results show that irrigation effects daily maximum temperature more than the daily minimum temperature. It was also found that, irrigation has its impact more on dry regions in comparison to wet regions in terms of temperature. A decrease of 0.8K was recorded in US and South East Asia whereas an increase in temperature in Northern America was observed due to the development of Aleution Low. Authors have compared their study to different other studies and have included all possible sources of errors which show depth of the understanding of the concept.

In last segment it is concluded that irrigation has negligible effect, if we take worldwide view. However, irrigation has significant effect in some irrigated regions especially dry regions during day time and in the season of heavy irrigation. Effect of irrigation depends strongly on both areas and volume of irrigation and it is the most important conclusion drawn in the study. Results obtained are also correct and logical in the research paper. The research study entitled "The Impact of Agricultural Intensification and Irrigation on Land Atmosphere Interactions and Indian Monsoon Precipitation - A Mesoscale Modelling Perspective" done by Douglas E.M., Beltran A. *et al.* (2009) emphasized role of human activities in altering the pace of climate change by changing landuse pattern. The area of research is Indian subcontinent. Objectives of the paper are to determine the impact of land use change and

irrigation. Methodology used in the research is Regional Atmospheric Modelling System version 4.3. To know the effects of irrigated agriculture land on land atmospheric interactions, authors have devised three land cover data sets (a) Pre agriculture (POT) (b) Rainfed agriculture (CRP) and (c) Irrigated agriculture (IRR). Five day period (16-20 July, 2002) was taken to study the impacts of land surface changes related to agriculture intensification and irrigation. The modelled precipitation was overestimated in some areas, therefore, pre agricultural land cover scenario (POT) was used as a baseline to compare the model output from POT and other scenarios.

The results revealed that irrigation played a major role in suppressing surface energy as compared to the role played by changed land use pattern. The results of the south Asia model domain suggested statistically significant decline in mean sensible heat flux between potential and irrigated agricultural scenarios. Changes in heat fluxes and sensible heat fluxes were also recorded. Sensible heat for the state of Punjab and Haryana declined where irrigation is widely practiced. Irrigation cooled the surface temperature of the region and increased the precipitation of the area by compensating the moisture of other regions. The authors concluded that agricultural changes including irrigation modifies climate. These regional changes in temperature should be used for better weather forecasting.

Objectives

1. To determine the effects of canal irrigation on temperature in two stations namely Jaisalmer and Ganganagar on monthly basis and to see departure from normal temperatures.
2. To determine the extent of temperature variations in stage-I and stage-II command areas.
3. To compare and, if possible, analyze the trend of temperature in post and pre five years of irrigation.

Database and Methodology

For this research paper data of "Indian Daily Weather Reports" were collected by IMD (Indian Meteorological Department) for the time period 1963 to 1967 and 1996 to 2000 of maximum temperature. Analysis of these data was done by statistical techniques of mean, standard deviation and coefficient of variation.

Analysis

The study of Indira Gandhi Canal Project area reveals that if we compare the temperature of different months of Ganganagar for the years 1963-67 and 1996-2000 (Table 1 and 2) and it is observed that there has been decrease in surface maximum temperatures for the months of January, February, March,

June, and November. This could be explained, as these are the months when irrigation is practiced widely. Irrigation releases water vapour by evaporation, which cools the surface temperatures. However, increase in temperature was also recorded for the months of April, May, September, October, July, August and December. For the months of April, May, July, August, September and October, it could be explained that these months observe no irrigation and hence no evaporative cooling of the surface (Table 1 and Fig. 1).

Though cultivation is done in summers but these crops survive in rain water and there is no need of extra water. However, the increasing trend of temperature in December could not be explained because irrigation is done in this month also. Mean of both time periods suggests that there is decline in temperature for years 1996-2000, because of irrigation (Table 1 and 2). Data analysis of Ganganagar station indicates that there is a general trend of decreasing temperature in 1996-2000, if we compare temperatures of both the time periods. For the months of April, September, October and December, there is an increase in temperature for the period 1996-2000 as compared to 1963-67 (Table 1 and 2, Fig. 1). Further data analysis indicates that April, September and October are those months when irrigation is not practiced in Ganganagar.

Table 1 : Maximum & Normal Temperature and Departure of Temperature from Normal (1963-67 and 1996-2000)
I.G.N.P. Stage-I Ganganagar

Month	1963			1964			1965			1966			1967			1996			1997			1998			1999			2000		
	Max	Nor	Dep																											
Jan	21.8	21.1	0.7	17.5	21.1	-3.6	24.0	21.1	2.9	24.9	21.1	3.8	21.6	21.1	0.5	20.3	21.1	-0.8	21.6	21.1	0.5	20.5	21.1	-0.6	17.3	21.1	-3.8	18.5	21.1	-2.6
Feb	26.1	24.2	1.9	22.5	24.2	-1.7	24.9	24.2	0.7	26.6	24.2	2.4	27.2	24.2	3.0	23.7	24.2	-0.5	24.6	24.2	0.4	23.7	24.2	-0.5	24.4	24.2	0.2	21.3	24.2	-2.9
Mar	28.5	29.9	-1.4	31.8	29.9	1.9	30.8	29.9	0.9	30.7	29.9	0.8	28.1	29.9	-1.8	27.5	29.9	-2.4	28.3	29.9	-1.6	27.5	29.9	-2.4	30.8	29.9	0.9	30.2	29.9	0.3
Apr	35.0	36.5	-1.5	36.9	36.5	0.4	32.7	36.5	-3.8	35.9	36.5	-0.6	35.1	36.5	-1.4	37.0	36.5	0.5	32.9	36.5	-3.6	37.0	36.5	0.5	40.1	36.5	3.6	39.8	36.5	3.3
May	38.3	40.6	-2.3	39.3	40.6	-1.3	39.3	40.6	-1.3	40.8	40.6	0.2	40.3	40.6	-0.3	40.5	40.6	-0.1	38.4	40.6	-2.2	42.2	40.6	1.7	42.0	40.6	1.4	43.1	40.6	2.5
Jun	42.1	41.9	0.2	41.8	41.9	-0.1	42.5	41.9	0.6	41.5	41.9	-0.4	42.3	41.9	0.4	39.2	41.9	-2.7	39.2	41.9	-2.7	41.8	41.9	-0.1	40.2	41.9	-1.7	41.4	41.9	-0.5
Jul	40.2	38.5	1.7	35.8	38.5	-2.7	38.0	38.5	-0.5	39.8	38.5	1.3	38.2	38.5	-0.3	38.6	38.5	0.2	38.5	38.5	0.0	38.6	38.5	0.1	39.2	38.5	0.7	37.9	38.5	-0.6
Aug	35.5	37.2	-1.7	36.5	37.2	-0.7	37.9	37.2	0.7	37.3	37.2	0.1	36.6	37.2	-0.6	36.4	37.2	-0.8	35.6	37.2	-1.6	39.0	37.2	1.8	37.9	37.2	0.7	38.1	37.2	0.9
Sep	36.0	36.6	-0.6	36.8	36.6	0.2	38.5	36.6	1.9	34.6	36.6	-2.0	36.3	36.6	-0.3	37.4	36.6	0.8	37.3	36.6	0.7	36.0	36.6	-0.7	38.9	36.6	2.3	37.7	36.6	1.1
Oct	35.0	35.1	-0.1	35.3	35.1	0.2	36.3	35.1	1.2	35.1	35.1	0.0	34.6	35.1	-0.5	33.4	35.1	-1.7	27.8	35.1	-7.3	34.3	35.1	-0.8	36.4	35.1	1.3	38.0	35.1	2.9
Nov	26.3	29.2	-2.9	29.1	29.2	-0.1	30.9	29.2	1.7	39.1	29.2	-0.1	28.6	29.2	-0.6	29.6	29.2	0.4	26.1	29.2	-3.1	30.2	29.2	1.0	31.2	29.2	2.0	30.6	29.2	1.4
Dec	21.5	23.3	-1.8	22.8	23.3	-0.5	24.2	23.3	0.9	23.9	23.3	0.6	20.7	23.3	-2.6	24.1	23.3	0.8	17.3	23.3	-6.0	21.6	23.3	-1.7	25.1	23.3	1.8	25.5	23.3	2.2
Mean	32.2	32.8	-0.7	32.2	32.8	-0.7	33.3	32.8	0.5	34.2	32.8	0.5	32.5	32.8	-0.4	32.3	32.8	-0.5	30.6	32.8	-2.2	32.7	32.8	-0.1	33.6	32.8	0.8	33.5	32.8	0.7

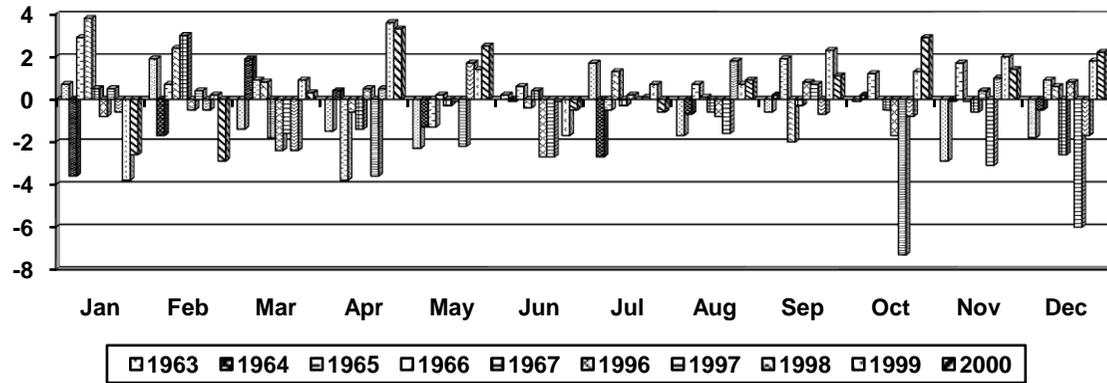
Source : IMD, New Delhi

I.G.N.P. Stage-II Jaisalmer

Month	1963			1964			1965			1966			1967			1996			1997			1998			1999			2000		
	Max	Nor	Dep																											
Jan	25.4	23.6	1.8	21.2	23.6	-2.4	26.4	23.6	2.8	26.5	23.6	2.9	23.2	23.6	-0.4	23.2	23.6	-0.4	23.9	23.6	0.3	23.7	23.6	0.1	23.0	23.6	-0.6	24.2	23.6	0.6
Feb	30.1	27.3	2.8	26.5	27.3	-0.8	28.2	27.3	0.9	29.5	27.3	2.2	30.2	27.6	2.9	27.1	27.3	-0.2	28.4	27.3	1.1	26.3	27.3	-1.0	26.6	27.3	-0.7	26.0	27.3	-1.3
Mar	32.8	32.7	0.1	35.8	32.7	3.1	32.9	32.7	0.2	32.3	32.7	-0.4	30.8	32.7	-1.9	31.5	32.7	-1.3	30.9	32.7	-2.1	31.5	32.7	-1.2	33.9	32.7	1.2	33.2	32.7	0.5
Apr	37.4	38.0	-0.6	39.5	38.0	1.5	35.0	38.0	-3.0	36.4	38.0	-1.6	36.3	38.0	-1.7	39.1	38.0	1.07	36.6	38.0	-1.4	39.5	38.0	1.5	40.8	38.0	2.8	41.2	38.0	3.2
May	41.0	41.5	-0.5	43.0	41.5	1.5	40.2	41.5	-1.3	42.1	41.5	0.6	41.2	41.5	-0.3	40.7	41.5	-0.9	39.8	41.5	-1.8	42.7	41.5	1.2	40.3	41.5	-1.2	41.7	41.5	0.2
Jun	41.7	40.8	0.9	38.8	40.8	-2.0	40.8	40.8	0.0	40.1	40.8	-0.7	41.1	40.8	0.3	39.6	40.8	-1.2	39.2	40.8	-1.7	41.7	40.8	0.9	38.9	40.8	-2.0	41.2	40.8	0.4
Jul	40.4	37.5	2.9	37.0	37.5	-0.5	38.0	37.5	0.5	38.7	37.5	1.2	38.4	37.5	0.9	37.0	37.5	-0.5	38.7	37.5	1.2	38.0	37.5	0.5	38.0	37.5	0.5	36.8	37.5	-0.7
Aug	37.0	36.2	0.8	36.8	36.2	0.6	36.6	36.2	0.4	37.1	36.2	0.9	35.9	36.2	-0.3	37.4	36.2	1.2	36.0	36.2	-0.2	38.4	36.2	2.2	34.5	36.2	-1.7	36.8	36.2	0.6
Sep	36.8	36.4	0.4	36.9	36.4	0.5	38.0	36.4	1.6	37.2	36.4	0.8	36.5	36.4	0.1	38.0	36.4	1.6	37.1	36.4	0.7	36.8	36.4	0.4	37.4	36.4	1.0	37.4	36.4	1.0
Oct	36.8	36.0	0.8	35.9	36.0	-0.1	37.8	36.0	1.8	30.3	36.0	-5.7	36.1	36.0	0.1	35.8	36.0	-0.2	31.5	36.0	-4.5	35.1	36.0	-0.9	37.2	36.0	1.2	38.8	36.0	2.8
Nov	30.8	30.9	-0.1	30.7	30.9	-0.2	32.4	30.9	1.5	30.3	30.9	-0.6	31.5	30.9	0.6	30.1	30.9	-0.8	27.7	30.9	-3.2	31.0	30.9	0.0	32.8	30.9	1.9	30.3	30.9	-0.6
Dec	26.2	25.4	0.8	24.3	25.4	-1.1	24.6	25.4	-0.8	25.9	25.4	0.5	22.4	25.4	-3.0	25.7	25.4	0.3	22.3	25.4	-3.2	27.7	25.4	2.3	27.3	25.4	1.9	27.5	25.4	2.1
	34.7	33.9	0.8	33.9	33.9	0.0	34.2	33.9	0.4	33.9	33.9	0.0	33.6	33.9	-0.2	33.8	33.9	-0.1	32.6	33.9	-1.2	34.4	33.9	0.5	34.2	33.9	0.4	34.6	33.9	0.7

Source : IMD, New Delhi

**Fig. 1 : Departure of Temperature from Normal (1963-67 and 1996-2000)
I.G.N.P. Stage-I Ganganagar**



I.G.N.P. Stage-II Jaisalmer

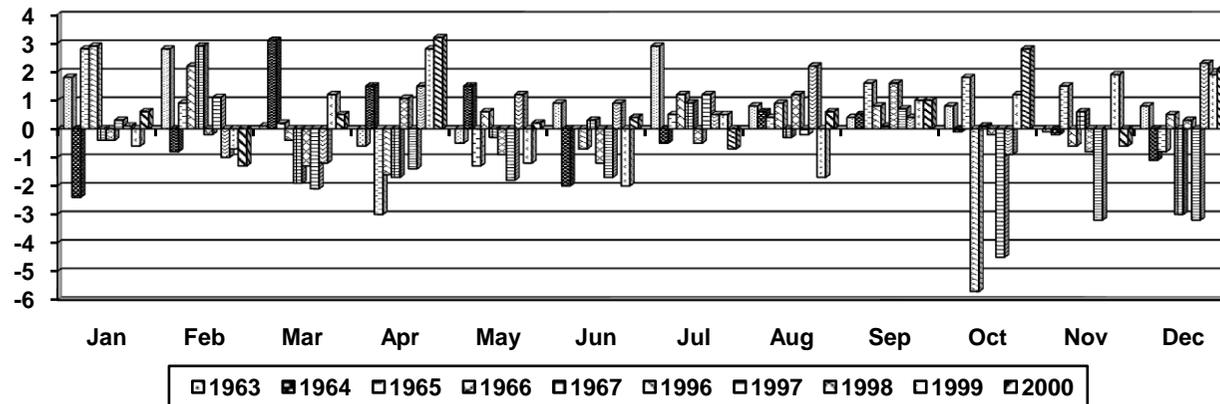


Table 2: Indira Gandhi Canal Project Area Stations : Temperature Departure from Normal Temperature (in °C)

Months	Stage-I : Ganganagar		Stage-II : Jaisalmer	
	1963-67	1996-2000	1963-67	1996-2000
January	0.86	-1.46	0.94	0.002
February	1.26	-0.67	1.6	-0.428
March	0.08	-1.04	0.22	-0.58
April	-1.38	0.64	-1.08	1.44
May	-1.00	-1.54	-	-0.48
June	0.14	0.07	-0.3	-0.714
July	-0.14	0.19	1.0	0.19
August	-0.1	0.85	-0.48	0.41
September	-0.44	-1.12	0.68	0.94
October	-0.16	0.35	-0.62	-0.30
November	-0.4	-0.59	0.24	0.55
December	-0.68	-0.29	-0.72	0.68
Average	-0.151	-0.29	0.20	0.05

Source : IMD, New Delhi

This shows that temperature in time frame from 1996-2000 have become more unstable. But if we compare the results of Ganganagar and Jaisalmer we come to know that Ganganagar shows more unstable temperature because value of coefficient of variation is high in both the cases. The reason is that irrigation started 15 years before in Ganganagar as compare to Jaisalmer (Table 3). Data Analysis for Ganganagar Station shows that there has been deviation from normal temperatures for the period 1996-2000. In 1963-67, the temperatures were more near to the normal temperatures but for period 1996-2000 the values are high. This shows the impact of irrigation on increasing variability of temperature (Table 2 and 3).

Table 3 : Indira Gandhi Canal Project : Maximum and Normal Temperatures (°C) (1963-67 and 1996-2000)

Month	Ganganagar			Jaisalmer		
	1963-67	1996-2000	Normal	1963-67	1996-2000	Normal
January	21.96	18.51	21.1	24.54	23.602	23.60
February	25.46	21.28	24.2	28.90	26.87	27.30
March	29.98	30.22	29.9	32.92	32.11	32.70
April	35.12	39.79	36.5	36.92	39.43	38.00
May	39.6	43.06	40.6	41.50	41.02	41.50
June	42.04	41.24	41.9	40.50	40.08	40.80
July	38.4	40.36	38.5	38.50	37.68	37.50
August	36.76	38.57	37.2	36.68	36.61	36.20
September	36.44	37.98	36.6	37.08	37.34	36.40
October	35.26	33.98	35.1	35.38	35.69	36.00
November	28.8	29.55	29.2	31.14	30.35	30.90
December	22.62	22.71	23.3	24.68	26.08	25.40

Source : IMD, New Delhi

For the months of February, April and December the values are near to normal. The reason behind this trend cannot be explained. The study of Jaisalmer station indicates that the half of the months is showing values of departure greater for 1963-67 and half for 1996-2000. However, average of both time periods shows that 1996-2000 values are more near to the normal (Table 2-4 and Fig. 2). To determine the extent of temperature variations coefficient of variation has been calculated. The coefficient of variation of Jaisalmer for years 1963-67 came out to be 16.02% and for the years 1996-2000, it was 16.78%.

**Table 4 : Results of Trendline Analysis
(a) I.G.N.P. Area Stage-I Ganganagar Station**

Months	1963-67		1996-2000	
	Nature of slope	Sign	Nature of slope	Sign
January	Gentle	Positive	Moderate	Negative
February	Gentle	Positive	Steep	Negative
March	Gentle	Positive	Steep	Negative
April	Gentle	Positive	Gentle	Positive
May	Moderate	Positive	Steep	Positive
June	Very less	Positive	3°C difference (moderate to steep)	Positive
July	Very Less	Positive	Gentle	Positive
August	Gentle	Positive	Moderate (2°C)	Positive
September	Very Less	Negative	Gentle	Positive
October	Less	Negative	Moderate	Positive
November	Moderate	Positive	Steep	Positive
December	Less	Negative		

Source : IMD, New Delhi

(b) I.G.N.P. Area Stage-II Jaisalmer Station

Months	1963-67		1996-2000	
	Nature of slope	Sign	Nature of slope	Sign
January	Very Less	Positive	Gentle	Positive
February	Less	Positive	Moderate	Negative
March	Steep	Negative	Steep	Positive
April	Steep	Negative	Moderate	Positive
May	Almost negligible	Negative	Moderate	Positive
June	Almost negligible	Positive	Gentle	Negative
July	Less or gentle	Negative	Gentle	Negative
August	Less	Negative	Gentle	Negative
September	Very Less	Negative	Gentle	Negative
October	Gentle	Negative	Gentle	Negative
November	Gentle	Positive	Moderate	Positive
December	Moderate	Negative	Steep	Positive

Source : IMD, New Delhi

The coefficient of variation of Ganganagar for year 1963-67 came out to be 19.78% and for year 1996-2000 it was 21.95% suggesting that maximum temperatures over the period of time have become more unstable. For both stations Jaisalmer and Ganganagar trendline shows gentle to moderate trend in 1963-67 and moderate to high in 1996-2000 (Table 2 and 4).

Conclusion

- (i) Temperature near the surface decreases on the application of irrigation due to evaporative cooling.
- (ii) Irrigation modifies the climate and this can be seen in the variability of temperatures. The coefficient of variation of Ganganagar and Jaisalmer both shows the unstable maximum temperature for period 1996-2000. On comparing both the stations we deduct that in Ganganagar where irrigation started much earlier the variability of temperature was more pronounced in comparison to Jaisalmer.

References

1. Boucher O., Myhre G., Myhre A. (2004) : "Direct Human Influence of Irrigation on Atmospheric Water Vapour and Climate", *Climate Dynamics*, Volume 22, Issue 6-7, pp. 597-603.
2. Douglas, E.M., Beltran-Prezekurat A., Niyogi, D., Pielke, R.A., Sr. Vorosmarty, C.J. (2009) : "The Impact of Agricultural Intesification and Irrigation on Land Atmosphere Interactions and Indian Monsoon Precipitation - A Mesoscale Modelling Perspective", *Global & Planetary Change*, Volume 67, Issue 1, pp. 117-128.
3. Indian Daily Weather Reports, IMD.
4. William J. Sacks, Benjamin J. Cook, Nikolaus Buenning, Sameul Levis, Joseph H. Helkowski (2009) : "Effects of Global Irrigation on Near Surface Climate", *Climate Dynamics*, August, 2009, Volume 33, Issue 2-3, pp. 159-175.

SUSTAINABILITY OF TOURISM ACTIVITY IN LADAKH REGION**Malvika Poonia**Research Scholar, Dept. of Geography,
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Abstract: Ladakh is a region in Jammu and Kashmir state of India, being a cold desert, situated in Himalayas known for its natural as well as cultural and religious heritage, opened for tourism in 1974, with a tourist arrival of 527 the first year, Tourist arrival has been recorded 1,78,042 (ending October, 2011) in 2011. Fast Increase in tourists' inflow has left the region highly susceptible to environmental and cultural damage. The paper tries to find out if there is participation in Ecotourism ("Responsible travel to natural areas that conserves the environment and improves the well-being of local people") so as to support sustainable tourism, by assessing the local perception about positive and negative impacts of tourism since its start. Primary survey is base of analysis in this paper, which covers more than 400 households, spreading to different parts of Ladakh, each of them situated near a major tourist destination, i.e. Mulbekh, Chushot, Choglamsar, Hunder, Spangmik and Hanu Yokma. Thereby, paper presents two viewpoints for better understanding, as a tourist and another is of the local residents. Sustainability has been assessed by taking into account the nature and extent of socio-environmental impact of tourism as perceived through general observations and local perceptions, to come out with some real time solutions for sustainability of tourism activity in the region. Ecotourism can be followed by tourists, and trip organizers and entrepreneurs can guide them to adopt sustainable tourism practices.

Key words: Ladakh, Tourism activities, Sustainability, Ecotourism.

Introduction

The quality of the environment, both natural and man-made, is essential to tourism. However, tourism's relationship with the environment is complex. It involves many activities that can have adverse environmental effects. Many of these impacts are linked with the construction of general infrastructure such as roads and airports, and of tourism facilities, including resorts, hotels, restaurants, shops, golf courses and marinas. The negative impacts of tourism development can gradually destroy the environmental resources on which it depends. On the other hand, tourism has the potential to create beneficial

effects on the environment by contributing to environmental protection and conservation. It is a way to raise awareness of environmental values and it can serve as a tool to finance protection of natural areas and increase their economic importance.

Most of the literature talks about physical impact of tourism activity in tourist destination area. Depending on the destination and the type of tourism activity, the impact of tourism varies from place to place. For example tourist incursion in coastal areas will have different impact than in hilly areas. Thereby to be specific this study focuses on one of the cold deserts of India, which is least explored but with due course of time, number of tourists are increasing. The cold deserts of India include Ladakh in Jammu and Kashmir, Lahaul, Spiti, Kinnaur and Bharmour in Himachal Pradesh, pockets of northern Uttaranchal and Sikkim. Ladakh has been the home of many cultures – the Dards, the Mongols, the Tibeto-Burmans, all shut out from the external world. It lay in its seclusion for many decades until the Zojila Pass was opened and tourism allowed sometimes in 1960. Any culture which remained in seclusion over a long period opened to the world faces challenges. Since summer Ladakh has been experiencing the flow of thousands of tourists every year. This uncontrolled mass tourism affects the social behavior, religious settlements and tradition as well as culture of the people. Tourism affects the society in many ways for example Demonstrative effect, Homogenization, Contact effect, Xenophobia, Autochthonic change and cultural confrontation.

Jean Michaud (1991) analyzed tourism activity in the region. According to the study, social effects of tourism on the emergence of enterprises in Ladakh, India. In this case, the article deduces touristic entrepreneurs profit from their activities and how they organize to protect their interests. The relevance of the formal/informal economic sectors approach is questioned, and some broadening of the analysis is proposed on grounds of cultural and political economy. For reasons of methodological strategy, Michaud J. have chosen to integrate the question of tourism into a historical account of Ladakh's economy and development, rather than trying to fit Ladakh into the general problem of tourist development. This assuming that an approach which takes history into account is more methodologically sound than the other alternative. Mountain tourism in developing countries is becoming a growing environmental concern due to extreme seasonality, lack of suitable infrastructures and planning, and interference with fragile ecosystems and protected areas. Another study by Davide Geneletti and Dorje Dawa (2009), devoted to assess the adverse environmental impacts of tourism, and in particular of trekking-related activities, in Ladakh, Indian Himalaya. The proposed approach is based on the use of

Geographical Information System (GIS) modeling and remote sensing imageries to cope with the lack of data that affect the region.

Research Gap- Based on available studies it can be observed that most of the studies accept the activity of tourism is increasing at a much faster rate in Ladakh. Thereby, this mountainous ecosystem which is so fragile, environmentally as well as culturally is getting affected by it. Studies are there which are analyzing the impact of this tourism activity. But need is to come out with more empirical studies which depicts the impact from the prism of local people, how they feel about their environment and culture being affected by tourism. At the same time there is also need of finding out the experience and observation of tourists, are they satisfied or not, are they following the ecotourism in the region.

Statement of Problem

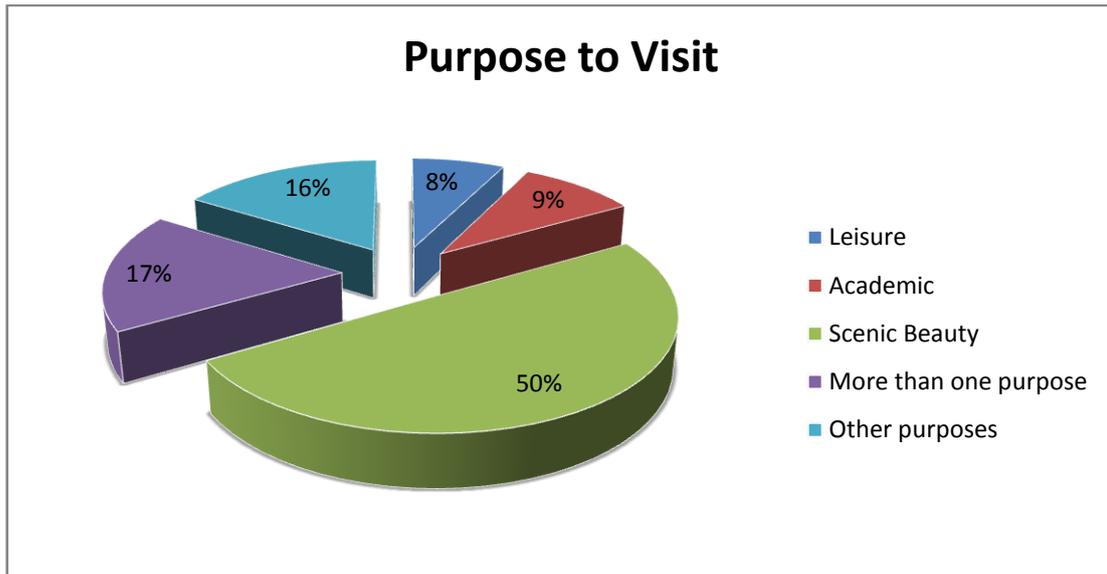
Ladakh, the Cold desert of India, although less inaccessible is turning into a major hub of tourists, is facing consequences of tourism activity in the region. To check the negative impact of this activity on local environment and culture, this study deals with the present status and need and approach which is needed to be followed by tourists as well as locals to experience sustainable tourism.

Methodology

Analysis is based on primary survey which was done by asking questions to local people in Mulbekh, Chushot, Choglamsar, Hunder, Spangmik and Hanu Yokma. 400 households were asked questions related to tourism activity in their area. Whole study is based on this sample population. Along with local perception self observation and visual interpretation has been done as a tourist to Ladakh.

Analysis

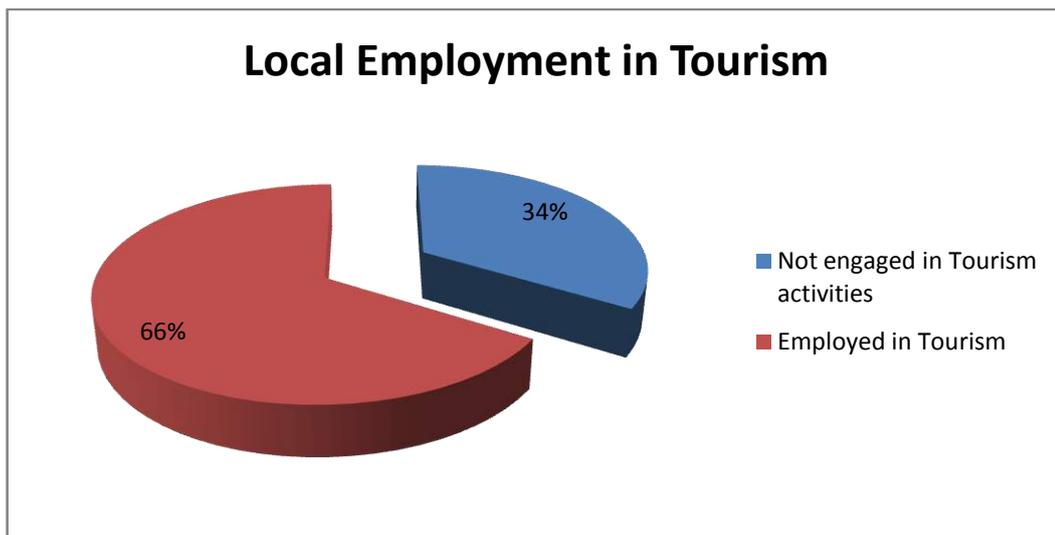
When one talk about the purpose of visit, what one wishes to analyze is the kind of activities that follow a tourist's arrival, his stay, and departure. Each and every tourist comes with a specific purpose; how he will be treating the place depends on what he has come here for. Some purposes are totally self-centered like leisure, recreation, scenic beauty etc. which will definitely involve some sort of negligence from the tourist's behalf. When a tourist has come to a place to make himself happy, he will do everything to accomplish that, without caring so much about the after-effects of it.



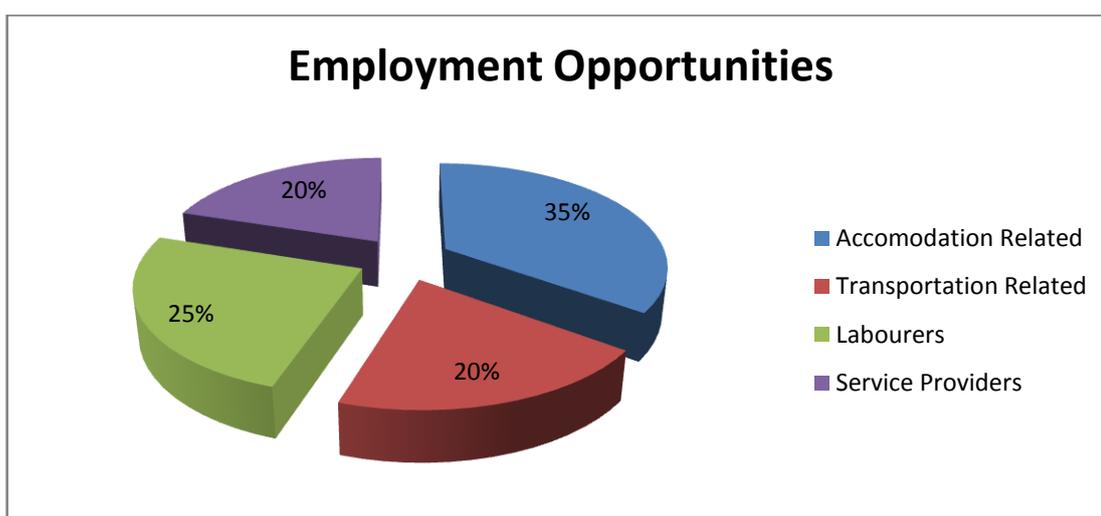
In Ladakh, 50 percent tourist come to behold its scenic beauty, 8 percent for leisure and around 17 percent for more than one purpose which usually includes both leisure and scenic beauty, adventure and recreation combined etc. It is obvious that these tourists will be less bothered about the vulnerability of the region, they won't think twice before throwing out plastic bottles, chips and biscuits' wrappers, poly-ethane bags etc. and why should they....they have come here to have a good time, not to disturb their mood about the environmental issues. They have spent huge amount of money and believe that they have helped the local economy. However, on the other hand, there are almost 9 percent tourists coming for academic purposes. The tourists coming for academic purposes are from different parts of the world, as well as India. They bring out the vulnerability of the region in front of the whole world, suggesting various measures, Ladakh is a favorite research field among geomorphologists, geologists etc. The scholars who are working on the social and cultural aspect of the region try to show the spirit of Ladakh people, their survival skills, traditions and customs, way of life, language, clothing etc. which shows that the precious social and cultural legacy of Ladakh region needs to be preserved. The government should encourage research work in the region by issuing financial grants, fellowships etc.

Tourist activities in Ladakh

Major tourist activities include, Snow-boarding, Skiing, river rafting, visiting water-falls, visiting monasteries, camel safari, bonfire and DJ parties and shopping.



The above diagram shows the participation of locals in tourism activities. Out of the total households interviewed, about 66 percent households have at least one family member employed in tourism, whereas only 34 percent are not directly engaged in tourism activities, although, a lot of them admit being dependent on tourism indirectly. This shows that the local population, especially the people residing near a tourist destination are in one way or the other benefitting from the tourism industry. But what matters is the kind of tourism activity they are involved in, which in turn shows the level of earning, job sustainability, seasonality of employment etc. The diagram below shows the percentage of people engaged in specific tourism activities.



The pie-chart above shows that out of the people employed in tourism industry, 35 percent of them are in accommodation related business. There are two aspects to this, the demand side and supply side. Demand for big hotels is lesser and for cheap accommodations is more, because other expenses are

already too much, like special clothing for places cold like Ladakh, hiring a vehicle for the whole trip, hiring a trekking guide and other everyday expenditure. The supply side says that the big hotels can't function in places like Ladakh, because tourist inflow is seasonal, the climate is extreme, in which only locals know how to survive, the maintenance cost of the hotel will be too high, and the hotels might experience heavy losses being in competition with the local guest-houses, motels and restaurants. That is the reason there are a lot of motels, guest-houses which the households are running very efficiently.

One more thing is that when tourists go to Ladakh they are not going to stay at one or a few places, instead they are going to travel a lot and visit many places on the go. Transportation is very crucial as tourist destinations are situated further from each other; therefore, tourists have to travel to far distances. They need vehicle to hire, and because the locals can drive much better in these mountains, so they need to hire a driver also. Consequently we see that 20 percent of the locals employed in tourism industry earn their income through transportation related businesses. The roads are well maintained during the summer season, but the passes are closed during winter, which also marks for the seasonality of employment. Vehicles which are hired on rent include sports utility vehicles (SUVs), all terrain vehicles (ATVs), Motorbikes, Bi-cycles mainly. As the pie-chart tells us, 20 percent of the locals dependent on tourism industry earn their living by providing various services to national and international tourists, there are tour guides, trekking guides, yoga instructors, river rafting instructors, help desks, cook, cleaners etc. The remaining 20 percent, accounts for laborers employed in every kind of business in tourism industry. They earn lesser but they usually undertake two or more jobs to compensate. Therefore, it is obvious that job opportunity scenario in Ladakh's tourism industry is pretty varied and diversified.

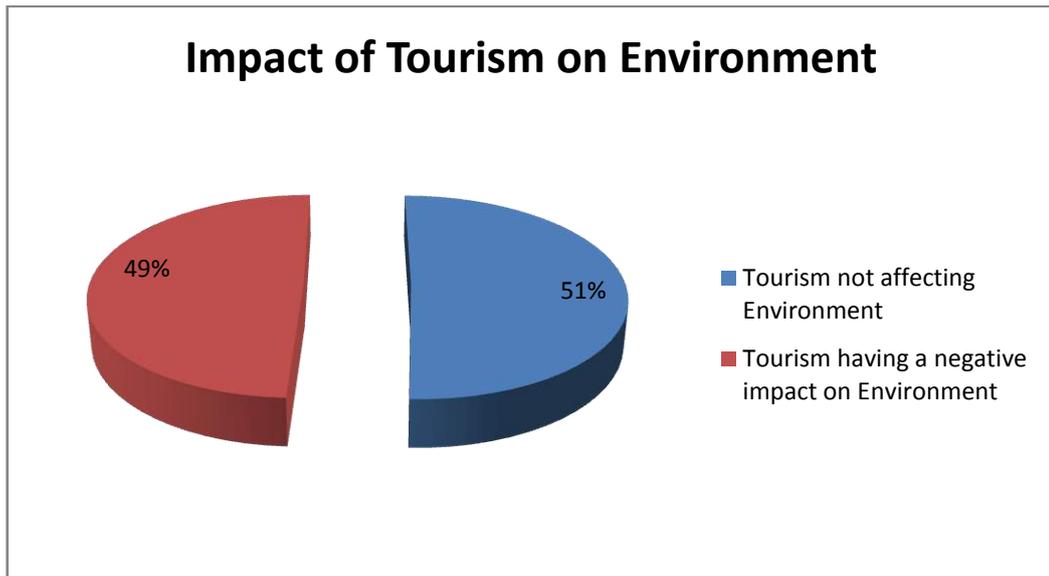
Impact Assessment of Tourism

As we know, tourism is a new thing for a lot of remote areas of Ladakh, due to the increased connectivity by various transport means, increased publicity, and a greater than before, interest of tourists in adventurous trips etc. has led to the present scenario. Although, it is good news, but still it is a wide known fact that Ladakh region is vulnerable to both environmental discrepancy as well as cultural infiltration. Therefore, the impact of tourism in the region is studied by taking into account two aspects:

- Impact on Environment
- Impact on Culture

Impact of tourism on Environment

Tourism activities, in its due course of time do affect environment of the destination. The damage, first of all, will be measured after some time, and second of all, it might not be reversible at all. Therefore, what matters is that, the locals should realize what is bad for their natural environment, what is simply unacceptable, what activities they should not all the tourists to carry out, even after the lure of big money. Because, let's face the facts, it's the people that are the biggest protectors of their home, not the government or the NGOs.

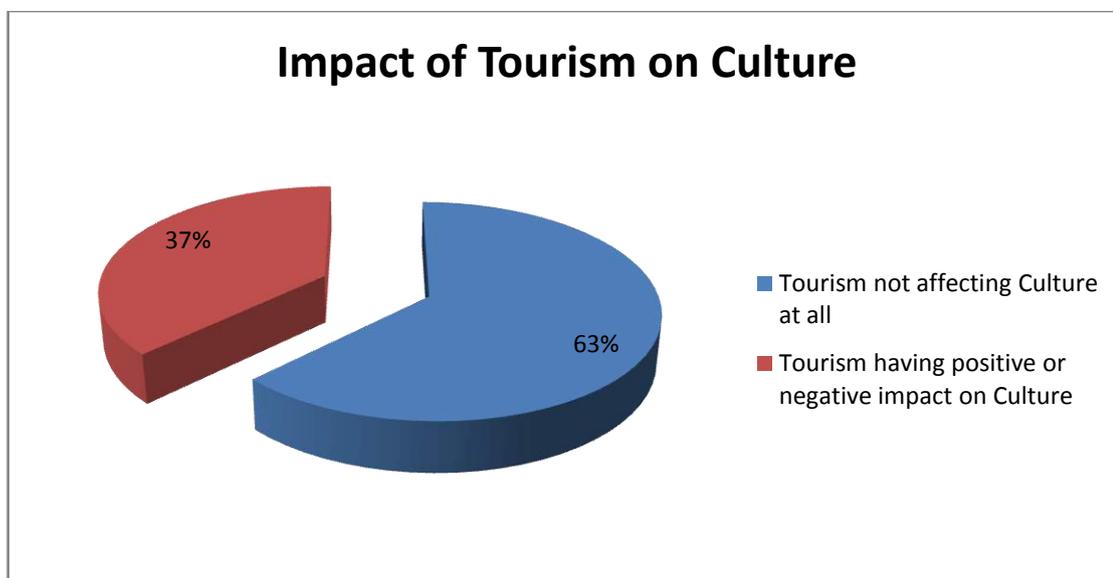


The locals were asked about, whether the tourism activities taking place, negatively affect their environment. The responses were a mix, almost 51 percent respondents don't think that tourism affects environment, these are mainly the locals engaged in and earning from tourism. Since they are dependent, they think that any measures taken to conserve the environment will put more curbs on the diversity of activities going on here, which will in turn affect their income. While on the other hand, almost 49 percent respondents think that the tourists affect their natural environment in more than one manner. According to them, tourists coming here have no idea about the vulnerability of the region. It is said that hilly and mountainous areas are susceptible to loud noise; therefore, the danger of displacement, rock fall, avalanches is also increased. Surface and ground water sources are not spared either, surface water sources like rivers and lakes are polluted by throwing garbage, rocks, waste, and excreta in them. Some people wash their cars and bikes in the river water, some people urinate and others throw food etc. in them, Ladakh is a cold desert, rainfall is close to zero, in such case the locals abstain from bathing daily, they even use dry toilets, but the tourists are provided with showers in bathrooms and toilets with flush, putting strain on the groundwater resources of

the region. These practices are so not in tune with the idea of eco-tourism. Forget about conservation, tourists are further damaging the nature in more than one manner, which is not even recognized let alone banned by the locals that accompany the tourists. It is the duty of the guides, drivers, and restaurant & guest-house owners to sensitize tourists and prevent them from doing any such stuff.

Impact of Tourism on Culture

Ladakh is part of the Tibetan Buddhist culture. Home to the famous Hemis gumpa, and many more monasteries this place is obviously threatened by the outside cultures coming from different parts of India and the world. Although, the culture and the traditions here are very ancient, they are deeply rooted in the society but still the younger generation is very much exposed to the infiltrations. Alcohol and drugs consumption, late night DJ parties, bike racing and car racing, cheating and using unfair means, abusive language are just the minute part of the dirt coming from the outsiders, there is so much more that can put the easy-going local youth, in-conflict with the local culture, which might result in them migrating, or trying to be someone else, blindly trying to fit in among the foreigners, becoming ashamed of their culture, their family. All of it in turn might result in the loss of a rich, peace loving religion-culture, at least in India.



Although, people responding in favor of the question (whether tourism has some impact on culture?), had mixed perception about the positive or the negative impact of tourism on culture. Out of these total 63 percent of them believing that tourism activities have at least some impact on culture, more than half believe that there is a negative impact and rest think that it has a positive

impact on their culture and religion. According to some respondents, it is a good thing that despite being situated in the remotest part of India they still get to see and observe other cultures from up-close. In the process of interaction, they always end up learning a few things which is beneficial to them in keeping up with the fast pacing world. Not only that, the increasing tourism activities are not totally damaging, the government and other organizations have started to provide certain kinds of amenities and connectivity, transportation facilities, shops, markets etc. have registered their presence which is only beneficial to the community.

Conclusion

The conclusion can be drawn on the basis of this whole analysis that sustainable tourism activities have not yet bloomed to their fullest. Local community is still deprived of the benefits of tourism activity in their region. Although local communities have established guest houses in their houses but depending on satisfactory need of tourists, they have switched towards unsustainable practices, like using flush in toilets which are supposed to be Arid toilets depending on the lack of water. Region is still like a dream world for many tourists with less money. Region still remains inaccessible for most of the part of the year. To practice ecotourism in the region, need is to continue with local practices and to avoid acculturation. The activities of tourism are not at all in tune with the concept of eco-tourism. There is need of, tourists' as well as local community's sensitization about Eco-tourism activities.

References

1. Davide Geneletti, Dorje Dawa, Environmental impact assessment of mountain tourism in developing regions: A study in Ladakh, Indian Himalaya, Environmental Impact Assessment Review, Volume 29, Issue 4, July 2009, Pages 229–242.
2. Jina, Prem Singh (1994) Tourism in Ladakh Himalaya, Indus Publishing Company, New Delhi
3. Kaul, Sridhar, Kaul, H.N., Ladakh Through the Ages: Towards a new Identity.
4. MICHAUD J. A historical account of modern social change in Ladakh (Indian Kashmir) with special attention paid to tourism, International journal of comparative sociology, 1996, vol. 37, no3-4, pp. 286-300 (1 p.1/4).
5. Michaud, Jean (1991) A social anthropology of tourism in Ladakh, India, Annals of Tourism Research, Volume 18, Issue 4, 1991, Pages 605–621.
United Nations Environment Programme, Environment for development, available at www.unep.org/resourceefficiency/Business/SectoralActivities/Tourism/FactsandFiguresaboutTourism/ImpactsofTourism/EnvironmentalImpacts.

URBAN ENVIRONMENTAL CORRELATION IN JAIPUR CITY DURING LAST DECADE: AN ECOLOGICAL OVERVIEW

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Abstract: *There is always feel a relationship between human and environment from the beginning of his race on the earth and it's a burning topic in present era and it creates a questionnaire of so many allusions and always needs to study and restudy. This research topic as 'Urban Infrastructure Development and Environmental Changes in Jaipur Region: An Ecological Overview' stands for a good result or outcome when human and environment affect by fast growing urbanisation. The more we do, the more we gain; always fit to a worldly person and he always deface the development of environment and nature from his acts towards development. In today's time, urbanisation means development and it is being a part of our society and excessiveness of urbanisation affects the life and environment. This study about Jaipur is also based on the same fact and it's a need of today and clearly states that experiments, surveys and research should be done on present status of men and environment relationship on the present speed of urbanisation.*

Key words: *Urban, Environmental development, Ecology, Pollution*

Introduction

Jaipur, the 'symphony in pink', is the land of superlatives where breath-taking beauty and rich art and culture blend superbly. Until the eighteenth century, Amber served as the capital of the Kachwaha clan of the Rajputs. However, due to its inaccessible tract on the Aravali hills, it was unable to meet the demands of a growing population. Sawai Jai Singh in 1727 decided to move his capital to the plains, 11 km south of Amber. Jaipur, situated in northwest part of India, was founded in 1727 A.D. and was named after its founder Sawai Jai Singh. Jaipur City was planned and executed in coordination with Sawai Jai Singh II, in such a manner that a substantial part of the city developed within seven years of its foundation. It nestles amidst the Aravali ranges and surrounded by rugged hills on three sides, each crowned by a formidable fort, while the city is studded with grand palaces, majestic mansions, and gracefully landscaped gardens and parks. It is perhaps the first planned city of India and was laid with great precision based on principle of 'Shilpa Shastra', the ancient Hindu treatise on

architecture. The city was built in the form of a rectangle divided into blocks or Chowkries, with roads and avenues running parallel to the sides.

In 1863 city of Jaipur was dressed in Pink to welcome Prince Albert, consort of Queen Victoria. The colour became an integral part of the city and it came to be known as 'The Pink City'. In 19th and 20th centuries, the city's population spread beyond its walls. After ascendance to the throne in 1922 by Man Singh II, civic buildings like the secretariat, schools, hospitals, and other public buildings were built. The municipality was reorganized in 1926 and a new municipal act was prepared in 1929. After independence in 1947, Jaipur merged with the states of Jodhpur, Jaisalmer, and Bikaner to become the greater Rajasthan in 1949. Under the State Re-Organization Act in 1956, Jaipur became the capital of the state of Rajasthan. Post-independence, planned development of the city was taken up after the city became the capital of Rajasthan. Though the city has grown into a modern metropolis and a throbbing commercial centre, it is a visitor's delight and caters to the needs of each form of tourism, ranging from historical, culture, adventure, sports, entertainment, shopping, business, conventions, and conferences. The City is part of the Golden Tourism Triangle of Agra, Jaipur, and Delhi and on the average attracting 3000 tourist per day. Jaipur is also a renowned handicraft centre and is also known for producing exquisite gold jewellery enamelled or inlaid with precious or semi-precious stones, blue pottery, carvings on wood, stone and ivory, block print and tie and dye textiles, leather articles, handmade paper, and miniature painting.

Methodology

Generally we use a methodology to get the best results of the study and for the proper planning of the resources which are scattered unqualified. Here we use the Historical method and Participatory Urban Implementations (PUI) method in this study. By the use of these methodologies we look out the history of infrastructure development of that study area and by the use of PUI, we generally communicate with the localities and administration.

Urbanisation in Jaipur city

Jaipur district is one of the 33 districts in the State of Rajasthan in western India. The city of Jaipur, which is Rajasthan's capital and largest city, is also the district headquarters. The district is situated in the North Eastern part of Rajasthan State. It is located between the North latitudes of 26°-23' N to 27°-51' N and East longitudes 74°-55' E to 76°-50' E. It is bounded by Sikar district in North- West, Alwar district in the North East, Dausa in East, Tonk in South, Ajmer in South West and Nagaur in West. The district has an area of 11151 Sq.Km. and occupies 3.3% area of the state. It ranks 9th in comparison to the

other districts of the Rajasthan in terms of the area. The district imbibes 2131 villages, of which 2077 are inhabited and 57 are uninhabited.

Jaipur being the capital of Rajasthan is the focus of socio economic, cultural, and political activities of the state. The city's transport needs are mainly met by a well-developed transport network system, based on ring and radial pattern, large fleet of buses like the Rajasthan State Road Transport Corporation (RSRTC). The majority share of travel needs of Jaipur commuters is met by road based transport systems. Jaipur is a medium sized city with a population of about 3.07 million (2011) spread over an area of 474 square km. Jaipur region is situated in north eastern part of Rajasthan. Jaipur region comprising of area under Jaipur Development Authority includes Jaipur city, Amber, Sanganer and towns and settlements of Bassi, Shivdaspura & Chandlai, Bagru, Chomu, Achrol, Jamwa Ramgarh and Contiguous areas. The present Jaipur region, for the preparation of the Master Development Plan 2025, covers the villages included in the Schedule I of JDA Act 1982, as per notifications listed below:

- Urban area notification issued under Raj. U.I. Act-1959 vide notification F1 (6) TP/72 dated 9.10.1972 covering 132 revenue villages, including Jaipur city into notified urban area limit.
- The Jaipur Development Authority was established with Jaipur city, Sanganer, Amber, Bagru, Chomu, Bassi and 335 villages of Jaipur, Sanganer, Amber, Jamwa Ramgarh, Bassi and Chaksu Tehsils vide notification dt. 12.10.1982.
- 153 villages were included in the Jaipur Region vide notification F7 (22) UDH/3/87 dated 25.10.1997 and 17 villages were included being nonexistent vide notification F7 (22) UDH/3/87 dated 12.9.1996
- 247 villages were included in the Jaipur region vide notification F7 (22) UDH/3/87 dated 1.10.2007.

In present scenario, as population grow up day by day and seeing this we need the same fluency in development. For a good development we have to progress in different areas as in education, health, infrastructure, environment, market facilities and so many things. Jaipur, the capital of Rajasthan, known from many titles, covers so vast rural areas with its urban development and infrastructure and with this fact we see the government bodies as JDA, Municipal Corporation, NGOs, plays an important role to maintain its environment, ecology and heritage also. There are many building and shopping malls situated in Jaipur, names as Gaurav Tower (GT), Crystal Palm, entertainment paradise (EP), Raisar Plaza, India's first world trade park (WTP), Mahindra SEZ, and much more infrastructure has developed in last ten years as

Sanganer international airport, proposed Disawar bus stop, Jaipur metro, many bridges and underpasses, national highways and state highways. With this infrastructure, we always decline the greenery, agricultural lands and the natural environment of a city. It also happens in Jaipur. How can we sustain environment and resources with fast growing infrastructure and land utilization? This is the question which generally stands in front of us. For the answer we have to see both the things parallel. As our one hand indulge in developing infrastructure as buildings, malls, cinema halls, four or six lane roads and the second one is in maintaining and creating new environmental regions. As in Kulish Smriti forest, Central Park, Jawahar Circle and so much small parks has been developed in every colonies & sectors and the roads with both sides green belts as JLN marg and with this nature and natural sites or green region are also situated nearby region of the city as Jhalana forest. Galta forest and Nahargarh hill forest and so other outsider green areas.

The government and the people who are free and retired from their jobs and environmentalists give their time and management skills and funds to maintain, to sustain, to restore, to recycle, to reproduce, to rearrange the thinking and plans which are needed for controlling man's encroachment in environment and natural regions. There are many policies and plans are made for maintaining heritage look of Jaipur and its natural environment not at the cost of decline in development and rearranged infrastructure. Both the things can come on the same track if a mankind thinks to do so and apply all the right plans and proper resources.

Infrastructure Development

Administratively, Jaipur district is a part of Jaipur division. The district is divided into 13 tehsils namely, Amber, Chomu, Jamwa Ramgarh, Shahpura, Viratnagar, Kotputli, Dudu, Phagi, Phulera, Bassi, Chaksu, Sanganer and Jaipur. It also comprises an equal number of development blocks. As the district has a State capital, hence Jaipur has the Legislative Assembly, Secretariat, State level offices of maximum Government departments along with divisional and district level offices.

With elevation in status for Jaipur as a Counter-Magnet Area (CMA), the state government has already started working on plans to be submitted before the National Capital Region Planning Board. A slew of proposals which include sewerage treatment, drainages and industrial development will be taken up on a priority basis. The NCRPB gives loans to develop basic infrastructure in counter-magnet towns. For sewerage and water supply facilities, the board provides 15% grant of total investment and remaining funds are provided as loans payable in 15 years. The rate of interest charged for such loans are from

7-8%. Officials claim that the intention of NCRPB to bring Jaipur under CMA is to provide more funding to the city. Counter-magnet towns are identified as those which can be developed as alternative centres of growth and attract migrants to them, rather than Delhi. Promoting growth of counter-magnet towns is the principal component of the strategy, so as to reduce both migration and population explosion in the Delhi metropolitan area. Currently there are nine CMAs including Jaipur. Hisar and Ambala in Haryana, Gwalior in MP, Patiala in Punjab, Bareilly and Kanpur in UP, Dehradun in Uttarakhand, Kota in Rajasthan are among others falling under such category. The main advantage of declaring counter-magnet cities are that they grow as potential economic centers. Their development gets the major thrust. Also, Jaipur will now get preference in projects for road transport and highways, railways and communication and information technology. These ministries will make concentrated efforts in improving the transport and communication linkages in these counter magnet areas in a planned manner within a specified time frame. However, the experts claim that Jaipur will have to work hard in reaping the benefits attached with the status of CMA. It is a welcoming step. Elevated status of Jaipur will help in development of urban infrastructure. Benefits are available and we should be ready for it," said VS Vyas, deputy chairman, state planning board.

Demographic Condition and Environmental Status Analysis

This analysis is needed to reach on a proper result or outcome about the relationship of human and environment. It may be called an ecological overview on the study area. Demographic conditions and environmental status both are studied together here. Jaipur district has shown an increase in the population over the past decades. In the last decade there was a growth of +35.06%, which has fallen to +26.19%, this decade.

Table1 : Decadal Population Growth of Jaipur District and city region

Year	Population	Population increase	Growth rate %	Rural (%)	Urban (%)
1961	1522591	-	-	67.90*	32.10*
1971	1993463	+470872	+30.93	64.19*	35.81*
1981	2786816	+793353	+39.80	57.66*	42.34*
1991	3887895	+1101079	+39.51	54.36*	45.64*
2001	5251071	+1363176	+35.06	50.64	49.36
2011	6626178	+1375107	+26.19	49.59	50.86

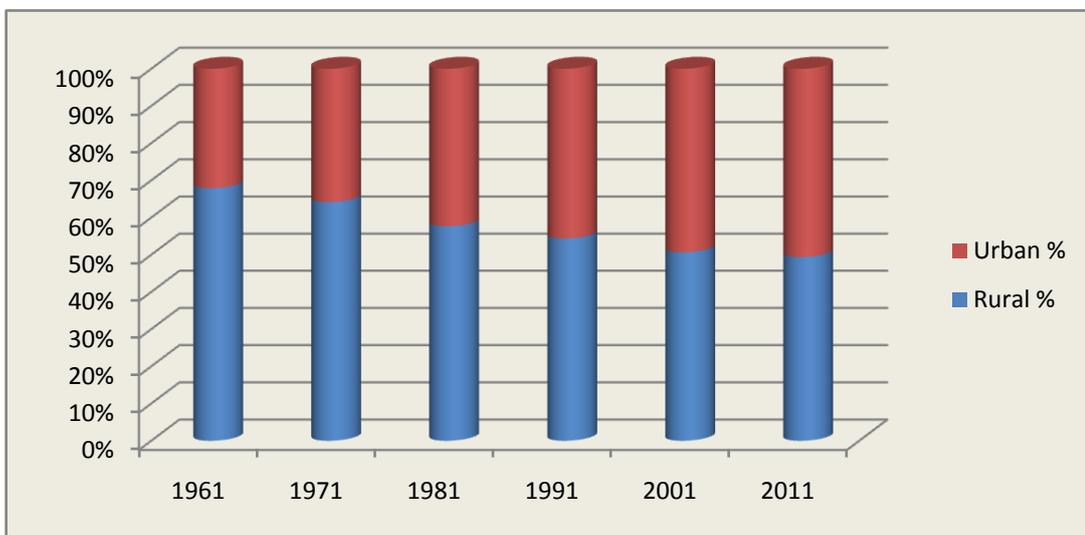
Source: Derived from Census of India

* excluding District Dausa. In 1992, Jaipur was then re-constituted with the creation of Dausa district.

The above table shows the decadal growth trend of the district. In 1961, the population of the district was 15.2 lakh which is now 66.26 lakh. The decadal growth rate of population ranges 30.9% to 39.8%, with an average

annual growth rate of 3.6%. However the population increase of last decade is not so much different from its nearly decade but the decadal growth rate shows much difference, it may be the good thing but not to be happy.

In 1961, the level of Urbanisation was 32% which has increased to 49% in 2001 and little increased to 50% in 2011. The national average of urbanisation is 32%. The increased level of urbanisation in the district is on account of the Jaipur city which is a primate city and also the major employment provider for the State of Rajasthan, besides, the Jaipur region covers almost 1/3 part of the district. Graphical representation of decadal urban population growth of Jaipur district is presented here-



Centrality index is computed to determine the centrality score values, which are worked out by taking into account various functions performed and services. Five decades census data are used for this present research work.

Biological Diversity

There are a number of wetlands and sanctuaries in Jaipur and Dausa district which are rich in biodiversity. There are however very small in size ranging to a maximum of 6 sq.km area. They do play a vital role in retaining the biodiversity, flora and fauna of the region. This includes all lands classed as forest under any legal enactment dealing with forests or administered as forests, whether state-owned or private, and whether wooded or maintained as potential forest land. The area of crops rose in the forest and grazing lands or areas open for grazing within the forests remain included under the forest area. District of Jaipur has 355 villages which have some forest cover. Out of these villages, 69 villages have forest cover greater than 50% of the total village area. There are 23 villages with forest area more than 75% of the village areas.

Conclusion

The critical and unavailable facilities are analyzed for the region spatially to certain the needs and proximity of things for enhancing the life and way to live life. These are considered important for the revolutionary changes in the relationship with ecology and life of the villagers and urban habitats and as essential requirements to improve the quality of life in these areas. An analysis of these requirements has been done to arrive at the depressed areas. There is always need to do work in sustainability of life and environment. Because of decadal growth in population the pressure on resources of city is increasing day by day so we must take some consurtive administrative decisions for sustaiable development of this city region.

References

1. Chakrabarti, Ranjan (ed), Does Environmental History Matter: Shikar, Subsistence, Sustenance and the Sciences, Kolkata: Readers Service, 2006
2. Chakrabarti, Ranjan (ed.), Situating Environmental History (New Delhi: Manohar, 2007
3. Cronon, William (ed), Uncommon Ground: Toward Reinventing Nature, New York: W.W. Norton & Company, 1995
4. David, A. & Guha, R. (eds). Nature, Culture, Imperialism: Essays on the Environmental History of South Asia. Oxford University Press, Delhi, 1995
5. Rajan, Ravi S., Modernizing Nature: Forestry and Imperial Eco-Development, 1800-1950 Oxford: Oxford University Press, 2006
6. Singh, Savindra, Environmental Geography, Prayag Pustak Bhavan, Allahabad, India, 2008
7. www.rajforest.nic.in

MODELING THE WATER COST : CASE STUDY OF GREAT MAN MADE RIVER AUTHORITY

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Abstract: *Libya, like its neighbours, depends on groundwater for the majority of its water supplies. However, most comes in the form of fossilised water from aquifers deep in the desert, through the Great Man-Made River Authority (GMRA). The world's largest Pre-stressed Concrete Cylinder Pipe (PCCP) project is owned and operated by the Great Man Made River Authority. Since its conception in 1984 the project has grown to include almost 4000 km of large-diameter pre-stressed concrete pipe. Eventually over 6.0 million m³ of water will be conveyed every day from aquifers in the desert to the coast in 4m diameter PCCP. This paper provides an overview of the project to date and it will conduct the cost analysis study by treating capital costs as sunk value, without interest rates.*

Key words: *Water Shortage Problem, GMRP, PCCP, Groundwater, Sunk Value*

Introduction

Description of GMRA

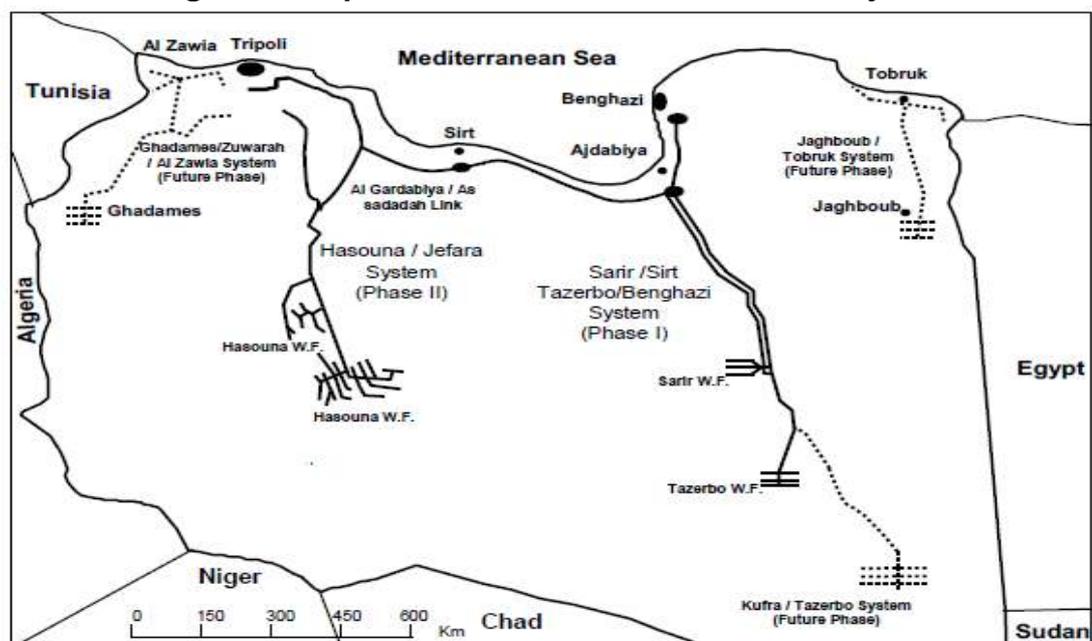
The North African state of Libya is in one of the driest regions of the world with an annual rainfall ranging from just ten millimeters to 500 mm. Just five percent of the entire area of Libya exceeds 100 mm annually. Evaporation rates are also high, ranging from 1,700 mm in the north to 6,000 mm in the south. To overcome the serious shortages of water and avert an impending crisis, a scheme was devised to convey high quality ground water from aquifers deep in the Saharan Desert to the coast where over 90% of the population live. These vast water basins were discovered during the exploration for oil. Water is extracted in well fields and conveyed to the coast through four-meter diameter pre-stressed concrete cylinder pipes. Because of the size of the pipes and the amount of water they convey over thousands of kilometers, the scheme became known as The Great Man Made River Project. Phase I or the Sarir-Sirt/Tazerbo-Benghazi (SS/TB) conveyance of the project consists of two lines and involves conveying two million cubic meters of water per day, from well fields in Sarir and Tazerbo to end reservoirs at Sirt and Benghazi (Fig. 1). The total length of PCC

pipes used is 1900 kilometers, the majority being four meters in diameter. The system is designed to ultimately carry a flow of 3.5 million cubic meters per day in the future, with the additional water being drawn from a well field at Kufra. This phase is complete and under operation. Phase II of the Great Man Made River Project involves conveying two million cubic meters of water from well fields at East Jabal Hasouna and North East Jabal Hasouna to Tarhouna and Tripoli. Two hundred eighty-seven production wells at the East Jabal Hasouna well field will produce 1.4 million cubic meters of water per day and 153 production wells at North East Jabal Hasouna will produce a total of 0.6 million cubic meters per day. The Gardabiya-Sedada system will link Phases I and II, enabling bi-directional flow This phase is complete and under operation. Future phases include:

- The Kufra-Tazerbo System, which will add 1.5 million cubic meters per day to the Phase I conveyance from 285 wells in Kufra. This phase is currently being under construction.
- Jaghboub-Tobruk System, which will supply Tobruk and the eastern coast of Libya with 50 million cubic meters per year of water for domestic use from 47 wells in Jaghboub. Exploratory wells are currently being drilled in Jaghboub to determine the optimum location of the well-field. This phase is currently being under study.
- Gedames-Alzawia System, which will have a total production of 90m cubic meters per year from 144 wells in Gedames. This phase is currently being under construction.

The project will ultimately convey over 6 million cubic meters of water per day through mainly 4-meter diameter pipes [1].

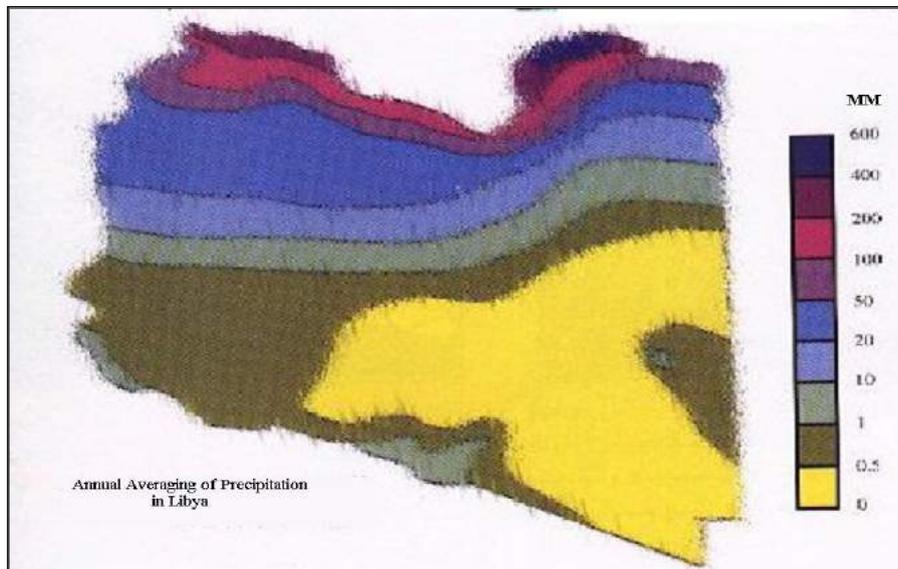
Figure 1. Map of the Great Man Made River Project



Libyan Water Resources

Water is a valuable commodity and its scarcity is becoming an ever-increasing problem worldwide. In North African countries in particular, water supply is limited, the quality is deteriorating and there is an ever-widening gap between availability and increasing demands. All these factors make it imperative serious action is taken now, both to avoid an impending shortage and also to avoid disputes and international conflicts over trans-boundary water resources. The Libyan authorities were aware from a very early stage of the impending water crisis in Libya and in the North African region generally and decided to implement its own national solution. The Great Man-made River scheme—the first two phases of which were completed in 1991 and 1996 involves conveying high quality water from groundwater in the southern basins to coastal regions where the country's main domestic, agricultural and industrial demands need to be met. Libya is one of the driest regions of the world with an annual rainfall ranging from just 10-500 mm. Only 5% of the entire area of Libya exceeds 100mm annually as shown in Fig. 2. Evaporation rates are also high, ranging from 1,700 mm in the north to 6,000mm in the south.

Figure 2. Annual average precipitation in Libya – only 5% of the country receives more than 100 mm/year



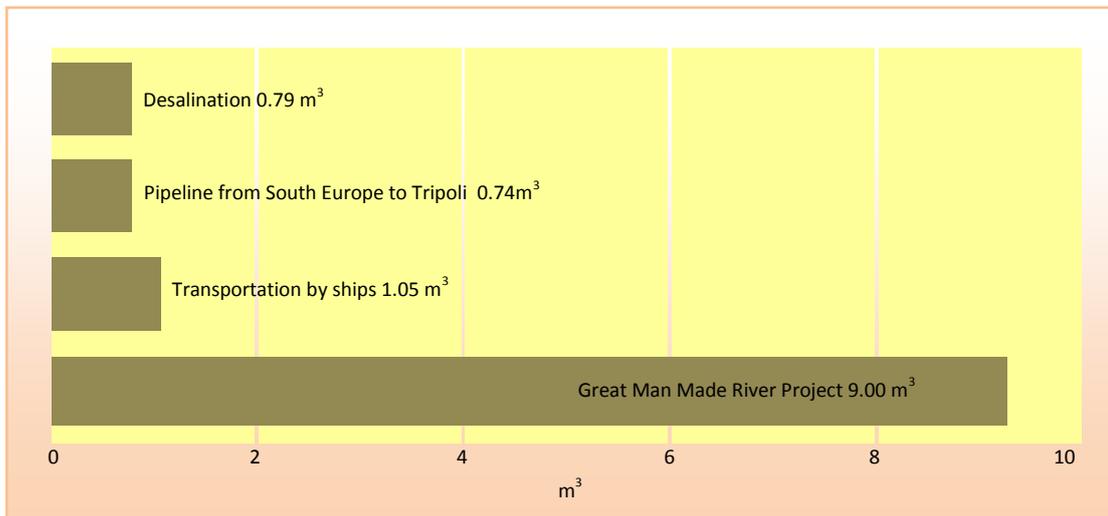
Feasibility Studies

Ground water is the primary source of freshwater, accounting for 96% of total Libyan demand. Studies have shown that aquifer replenishment to the coastal aquifers is 500 million m³/year, which is small compared with the ever-increasing rate of consumption, which is currently 4.7 billion cubic meters per year. As a result of excessive abstraction, seawater intrusion has taken place in the coastal aquifer with a marked increase in salinity reaching over 7,000 parts

per million in the Tripoli region. To overcome this deficiency in supply, there has been a concerted effort to develop additional sources of water including, among others, surface water which contributes 2.3% to the total demand, desalination 1.4%, and water treatment 0.7%.

Subsequent investigations have proved the reserves available and defined the limits of a number of potentially vast aquifers at Kufra, Sirt, Murzuk and Hamadah. Aquifers with water levels laying at depths of less than 100 metres below ground surface were recharged by torrential tropical rain, particularly in the period 38,000 to 14,000 years ago. Each of these basins contains reserves amounting to 3000 km³ of economically extractable fossil water. The aquifers targeted in these basins are mainly the phreatic type with high 'storativity'. Storativity is defined as the amount of water released or added to aquifer storage through a vertical column of aquifer having a unit cross-sectional area, due to a unit amount of decline or increase in average hydraulic head. Feasibility studies showed that the cost of abstracting groundwater from the Libyan southern basins and conveying it to the northern region compared favourably with other options, see Fig. 3, resulting in the conception of the Great Man-Made River Project in 1984. A recent in-house study by the Data, Studies and Researches Centre of the Great Man Made River Authority estimates that the unit cost of water will be US\$0.28/m³ when all phases finally become operational [2 & 3].

Figure 3. Analysis of the quantity of water



Statement of Problem

Groundwater, which constitutes about 0.6% of the world water reserve, is defined as water concealed in underground reservoirs originated mostly from rain as a renewable source. If man in one day with his modern technology could benefit from falling rain waters on earth, which is potable and suitable for all

uses with minimum treatment, the world water shortage problem could be resolved radically. Although water sciences, in general, and hydrology, in particular, are so developed, groundwater resources are still considered as an unseen resource as compared to surface water resources, especially in two ways:

- a) Quality: the change that could occur in quality is normally expected and hardly predicted.
- b) Quantity: due to the complication of the nature and engineering of underground reservoirs, the scientific estimation of these waters does not accurately assure its disappearance and deepening.

The phenomenon of seawater intrusion is a manifestation of the deterioration of water quality of many groundwaters and a proof of the continuance contact of ground reservoirs underneath. The management of different water resources and treatment of water for specific usage would mean the proper evaluation and utilization of these resources taking into account the following:

- 1) Resource expected life: what is its life span, how could it be managed properly, and its basic participation in resolving the water shortage problem.
- 2) Resource suitability: for the different uses and the required treatment for certain use in case its quality is degraded.
- 3) Resource cost analysis: in order to be utilized fully in comparison with others.

Hence, groundwater is a natural un-renewable resource, like other water resources, it should be utilized and managed wisely, its consumption rationalized, and it should be preserved and conserved by sound scientific means. In this regard, Libya is endowed with two great water resources:

- a) Groundwater resource located in underground reservoirs under the desert in the southern regions,
- b) Seawater resource located in the coast, which is considered to be the longest (~1900 km) on the Mediterranean, in the northern regions.

In order for these two resources to be utilized fully in an integrated manner that takes into account the previous considerations, in addition to:

- 4) Water local exploitation: which advocates the utilization of water resources locally in a manner that provides the development of the local surrounding and considers the costs of transport and distribution of these water as follows:
 - Development of coastal regions domestically, agriculturally, and industrially (desalination is worthier).
 - Development of desert regions in a similar manner (GMRA is worthier).

In the framework of conserving these two resources, a comprehensive national plan should be implemented. Here is a citation of some of the features:

- Environmental dimension: It means that the proper cautious utilization of any resource should not neglect environmental issues, such as:
 - For desalination: Air and water pollution and conservation of marine life should be considered.
 - For GMRA: Avoid severe depletion of groundwaters which might cause the cracking and sliding of earth surfaces. It is worth mentioning that the consumption of groundwaters should not exceed the safe yield parameter which is defined by Kongling and Bank [4 & 5] as the yearly water consumption rate that takes into account the following:
 - Protection of water rights in the specified region without violation (consideration 4 water local exploitation),
 - The consumption should not exceed the yearly feed rate of the reservoirs,
 - The consumption should not lower the water level more than the allowed economical rate of pumping,
 - The consumption should not lower the water level to the extent of permitting seawater or polluted water intrusions.
- Developmental dimension: which means that the wise utilization of any resource should take into account human development plans as referred to in consideration 4.
- Economical dimension: It advocates that the ideal utilization of any resource should consider economical cost such as:
 - For desalination: Efforts and research should continue to lower the costs of desalination until it becomes suitable for domestic, agricultural, and industrial applications.
 - For GMRA: Its economical competitive cost should not exceed the cost of other resources due to deterioration of its quality and rising need for treatment, the quick lowering of water level, or the need to deepen the wells, hence, increase of the pumping cost.
- Quality dimension: In other words, it means that the secure and safe utilization of any resource should abide by the requirements mandated by health standards, human rights, and suitability for domestic, agricultural, and industrial applications.

In this paper, the cost analysis required to transport GMRA water from south to north is presented, where the capital costs are considered as sunk value.

Theoretical Development

The most important cost analysis studies which expressed in Table 1 conducted prior to this study [6 & 7], to calculate the cost of 1 m³ of water produced by GMRA. The common objection to the previous studies is their lack of using mathematical models, which are very vital to such studies for checking any inconsistency and discrepancy, future predictions, simulation and forecasts, urgent recalculations, comparative testing with other resources, and decision making for the planners.

This paper suggests two models:

- The first model predicts the behavior of operation and maintenance cost with respect to water production.
- The second model predicts the behavior of consumed electrical power cost with respect to water production.

The study will prove the success of the two models in predicting empirical data obtained from the operation experience for the project.

Table 1 : Previous cost analysis studies for GMRA in Dinar/m³

Date	Stage	Production (m ³ /d)	Calculation authority	Re. No.	Costs (Dinars)	Details		
						GMRA	Istethmar	Marafeg
1/1/1993	First stage	Maximum production	Milod G. Elhasia	17	Construction	0.046	0.029	0.021
		O&M costs			0.036	0.019	0.033	
		Total			0.082	0.048	0.054	
15/5/1994	First stage	2,000,000	Salem Bazina	16	0.082			
		1,800,000			0.087			
		1,600,000			0.018			
		1,780,000			0.104			
18/11/1996	Sarir	1,000,000	Daniel P. Loucks and Philippe Pallas	15	0.05–0.13			
	Saris+Tazerbo	2,000,000			0.06–0.13			
	Kufra+Sarir	1,780,000			0.10–0.22			
1/1/2003	First stage	1,700,000	Mohamed A. ElDarrat, Adel Bakir and Basher O. Elsalah	14	0.379			
	First stage	2,000,000			0.335			
	Second stage	2,100,000			0.430			
	Second stage	2,500,000			0.336			

First Model Development [8 & 13]

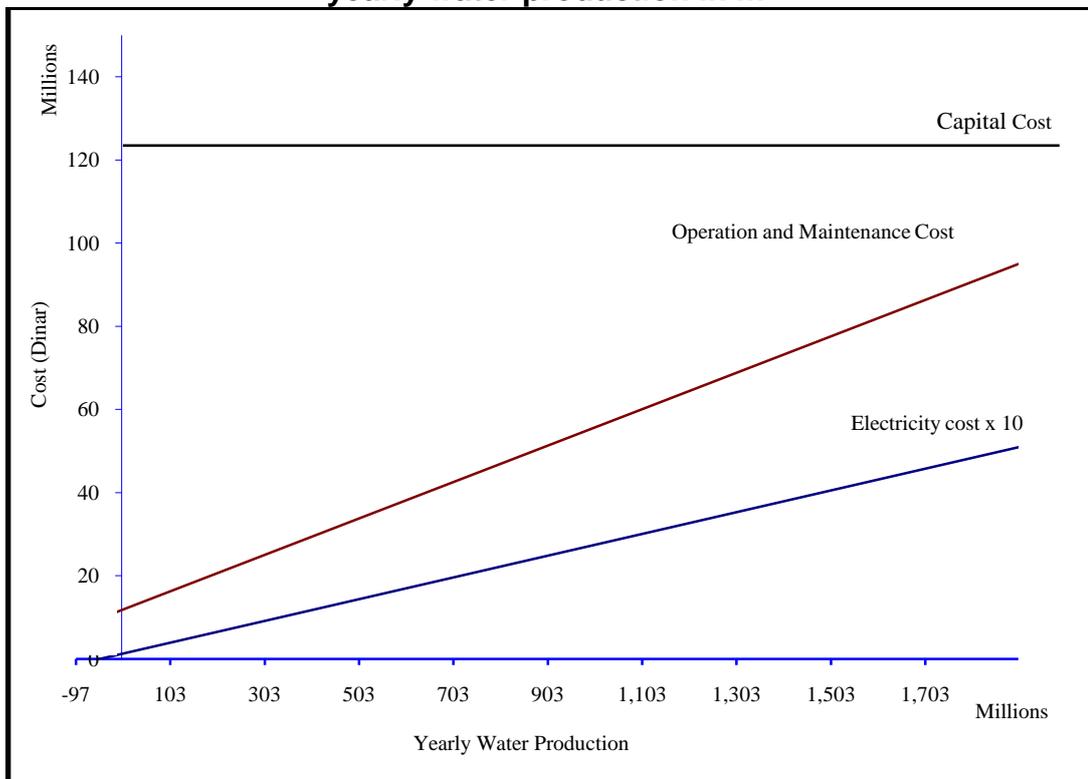
Analysis of operation-maintenance cost data with water production, Table 2, Fig. 4. Looking at the values of operation and maintenance cost (C) in dinar and water production (W) in m³, an attempt was made to model this behavior by using linear, logarithmic, and power mathematical models, which resulted in adopting the following model:

$$C = a + b (W) \quad (1)$$

Eq. (1) is a simple linear model, where the parameters are determined by fitting the data points to the model equation using least square analysis method. This resulted in the following empirical equation:

$$C = (5,754,240) + (0.059406751) W \quad (2)$$

Figure (4) : The relationship between the different costs (in Dinars): (a) capital cost, (b) operation and maintenance cost, (c) electricity cost vs. yearly water production in m³



The prediction was so good that the correlation coefficient reached approximately 96%. The model was applied to the period of gained experience between 1993–2005; in addition a few years were included up to 2011 to reach steady state of maximum production in order to:

- Predict the remaining period of more than 50 years, and Compensate for the fluctuation occurred in the first three years which showed negative values

Second model development [8 & 13]

Analysis of consumed electrical power (E) in MWh with respect to water production, Table 2, Fig. 4. Analysis of the data points for the period 1995–2004 resulted in a similar linear model as shown below:

$$E = (1750) + (0.00089) W \quad (3)$$

The correlation coefficient is approximately equal to 98% which proves the good prediction of the model and was capable of estimating the values for the period 1995–2005 and up to 2053.

Table (2) : Values of water production (W) in m^3 , operation and maintenance cost (C) in Dinars, cost of m^3 of water (C_w) in Dinar, consumed electrical power (E) in MWh, consumed power per m^3 (e), cost of electricity in Dinar (C_e) per m^3 according to GECOL, and their equivalent values (W' , C' , $C' w$, E') calculated by suggested models. Calculated model parameters: first model: $a = 5,754,240.317$, $b = 0.059406751$, $R = 0.9590$, $W = 491,656,364$, $C = 34,961,948$, $C_w = 0.07$; second model: $d = 1750$, $f = 0.00089$, $R = 0.0791$, $W = 217,623,732$, $E = 195,512$, $e = 0.8984$

Year	Water production, W (m^3)		O&M cost (Dinar)		Cost of m^3 of water (Dinar)		Consumed electrical energy (MWh)			Consumed power/ m^3 (KWh/ m^3)	Cost of electricity (Dinar)
	Real (W)	Model (C)	Real (W)	Model (C)	Real (W)	Model (C)	Real (W)	Model (C)	Error%	e	C_e
-	-	-96,861,723	-	0	-	-	-	-	-	-	-
1993	25,156,778	-47,945,159	2,905,974	7,248,723	0.12	-0.15	0	24,148	-	0.9599	772,736
1994	70,559,826	-55,335,319	2,466,949	9,945,970	0.03	-0.18	0	64,573	-	0.9152	2,066,443
1995	81,211,731	-3,322,241	5,556,877	10,578,765	0.07	-3.18	66,952	74,057	9.6	0.9119	2,369,823
-	-	0	-	5,754,240	-	-	-	-	-	-	-
1996	111,895,989	27,050,677	7,361,233	12,401,618	0.07	0.46	93,651	101,377	7.6	0.9060	3,244,089
1997	193,174,027	13,713,155	6,568,894	17,230,082	0.03	1.26	170,073	173,743	2.1	0.8994	5,559,703
1998	197,171,813	93,670,184	11,318,882	17,467,577	0.06	0.19	175,897	177,302	0.8	0.8920	5,628,072
1999	206,027,410	202,937,652	17,810,107	17,993,659	0.09	0.09	189,466	185,187	2.3	0.8988	5,925,678
2000	216,785,617	282,652,263	22,516,762	18,632,770	0.10	0.07	199,650	194,766	2.5	0.8984	6,230,939
2001	223,233,339	318,184,132	24,656,526	19,015,808	0.11	0.06	208,794	200,506	4.0	0.8982	6,416,262
2002	280,727,780	348,457,613	26,454,975	22,431,366	0.09	0.06	281,194	251,697	14.1	0.8966	8,054,417
2003	315,405,683	323,160,881	24,952,179	24,491,467	0.08	0.08	287,194	282,572	1.6	0.8959	9,042,302
2004	350,603,934	525,375,782	36,965,109	26,582,481	0.11	0.05	282,247	313,911	10.1	0.8953	10,044,662
2005	403,560,044	576,432,847	39,998,243	29,728,432	0.10	0.05	-	361,060	-	0.8947	11,554,086
2006	663,935,992	626,071,801	42,947,132	45,196,521	0.06	0.07	-	592,887	-	0.8930	18,972,635
2007	749,954,207	708,624,929	47,851,346	50,306,584	0.06	0.07	-	662,473	-	0.8934	21,200,306
2008	920,002,602	1,291,755,075	82,493,213	60,408,606	0.09	0.05	-	820,876	-	0.8923	26,269,386
2009	1,209,650,401	1,337,182,342	85,191,900	77,615,641	0.07	0.06	-	1,078,764	-	0.8918	34,520,519
2010	1,535,071,740	1,363,809,833	86,773,752	96,947,866	0.06	0.07	-	1,368,504	-	0.8915	43,792,527
2011	1,587,342,010	1,409,481,471	89,486,956	100,053,073	0.06	0.07	-	1,415,042	-	0.8915	45,283,693
2020	1,587,342,010	1,651,881,198	103,887,136	100,053,073	0.07	0.06	-	1,415,042	-	0.8915	45,283,693
2030	1,587,342,010	1,969,467,152	122,753,886	100,053,073	0.08	0.05	-	1,415,042	-	0.8915	45,283,693
2040	1,587,342,010	2,439,834,094	150,096,858	100,053,073	0.09	0.04	-	1,415,042	-	0.8915	45,283,693
2051	1,587,342,010	2,592,533,124	159,768,212	100,053,073	0.10	0.04	-	1,415,042	-	0.8915	45,283,693
2053	1,587,342,010	1,857,556,899	116,105,662	100,053,073	0.07	0.05	-	1,415,042	-	0.8915	45,283,693

Results and Discussion

Influence of Production Efficiency in Cost Analysis

Looking at the theoretical studies of the data analysis showed the following:

1. Operation and maintenance cost is not considered constant, but is dependent directly on water production as illustrated in Eq. (2).
2. Electrical power consumption is not considered constant, but is dependent directly on water production as illustrated in Eq. (3).
3. Only construction cost is considered constant because it is calculated with the assumption that the capital costs are considered as sunk value, without including interest rate.

Hence, assuming these costs to be constant is trivial and resulted in the miscalculations of water costs related to production efficiency. In order to correct this error, the calculations were reiterated on the following basis:

1. Conducting the cost analysis for full production with 100% efficiency on a yearly basis using Eqs. (2) and (3).
2. Calculating the effect of production efficiency by evaluating the value of this water of decreased efficiency as follows:
 - a. Calculating operation and maintenance cost for the water resulted from efficiency difference between 100% and the lower one, then adding this cost to the 100% efficiency.
 - b. Doing the same calculations for the electrical power consumed as in (a).
3. Calculating the total cost considering:
 - Constant construction cost.
 - Cost resulted from the decrease in efficiency.

Table 3 presents these calculations which can be compared with the results obtained from previous studies in Table 4 that assumed constant values and exhibited lower values due to the following:

1. It was only proportional to the decrease in efficiency, while the present analysis considered the effects of decrease in production and efficiency and their influence in the increase of costs of m^3 .
2. Assuming operating-maintenance cost to be constant meant the devaluation of this water which was not produced due to decrease in efficiency.
3. It did not neglect the influence electrical power cost of this water, although its effects value was negligible.

Table 3: Summary of the cost of m³ of GMMR water in Dinars for the two stages with different production efficiencies

Description	Production efficiency 100%	Production efficiency 70%	Production efficiency 50%	Production efficiency 30%
Designed capacity of water production for the two stages, m ³	7,875,000,000	55,125,000,000	39,375,000,000	23,625,000,000
Water quantity resulted from difference in efficiency between 100% and lower, m ³	0	23,625,000,000	39,375,000,000	55,125,000,000
Constant construction costs (Libyan Dinars)	7,462,959,539	7,462,959,539	7,462,959,539,000	7,462,959,539,000
Operation and maintenance cost	4684	1409	2345	3281
Electrical power cost	2173	652	1086	1521
Sum of operational costs	6857	2061	3431	4802
Total costs	7,462,966,397	2,061,305,561	3,431,305,561	4,801,504,389
Total costs per m ³	0.1818	0.3546	0.4585	0.7009
Operational cost per m ³	0.0871	0.1245	0.1542	0.2903

Table 4: Variations of the cost of m³ of water according to production efficiency as calculated by the River Committee

Description	Production efficiency 70%	Production efficiency 50%	Production efficiency 30%
Total cost of water per m ³	0.271	0.379	0.632
Operational cost per m ³	0.110	0.154	0.257

Conclusion

The result of this study conclude that water management and cost analysis of water resources in Libya should concentrate on the following issues:

- The importance of mathematical models in the correct evaluation of water resources in Libya from the point of view of comprehensive feasibility studies.
- The continuous evaluation of the different water resources necessitates the most ideal utilization of these resources in a constructive, neutral, correct, and scientific way.
- Emphasis on the integration policy for the utilization of these resources in order to resolve the growing water shortage problem.
- When using these resources, an account of successful human development plans must be implemented to afford health, comfort, and prosperity for humans.
- Then the controlling factors in the wise management for these resources are:
 - The different uses: domestic, agricultural, and industrial, requires specific regulations that control the quality of these resources, and the needed treatment to make it fit.
 - The use of any resource should not disturb the environment and its conservation.
 - These resources should compete for their good utilization in order to lower their cost for the different uses.

References

1. A.A. Elhassadi and A.M. Darbi, Problems facing electro-dialysis plants in Libya. Scientific Symposium on Drinking and Waste Water Treatment, 1990.
2. A.A. Elhassadi and M. Hosni, Ground water salinity increase in the Green Mountain Region – a threatening phenomena, Scientific Symposium on Drinking and Waste Water Treatment, 1990.
3. A.A. Elhassadi and N. Hassan, Evaluation of demineralization units in North Benghazi Power Plant, Scientific Symposium on Drinking and Waste Water Treatment, 1990.
4. A.A. Elhassadi, Report on the Selection of the Most appropriate Desalination Plant for the University of Garyounis. University of Garyounis, Benghazi, Libya, 1991.
5. Abdulsalam Eljahawy : Libyan National Plan to Resolve Water Shortage Problem in Great Man Made River Project, 2006
6. Adam Kuwari, Water Mining: the Great Man-Made River, Libya, proceeding of ICE, Civil Engineering 159, Pages 39-43, Paper 1482, 2006.
7. D.K. Todd, Ground Water Hydrology. 2nd ed., J. Wiley, 1980.
8. Daniel P. Loucks and Philippe Pallas, Report on estimation study of production alternatives costs in collaboration with UNESCO organization, 1996.
9. Desalination Markets 2005–2015. Global Water Intelligence, 2004.
10. G.A. Fleischer, Capitol Allocation Theory. Appleton, 1967.
11. Great Man-Made River Authority, Previous Cost Analysis Studies, Libya, 1993.
12. M. Selawai, Ground Water: Theory and Practice. Libya Dar for Publication, Distribution, and Advertisement, 1986.

13. Milod G. Elhasia, Study about Great Man Made River Authority with title : The pricing of the Great Man-Made River Authority's water for agriculture, industry and drinking, 1993.
14. Mohamed A. EIDarrat, Adel Bakir and Basher O. Elsalah, Report on the costs of the project water compared the costs of water desalination, 2003.
15. Omar Essamin and Mark Holly: The role of Acoustic Monitoring in the Management of the World Largest Prestressed Concrete Cylinder Pipe Project, 2005.
16. Report on Calculating the Cost and the Price for GMRA Project's Water. Decree 123, 2005.
17. Report on Calculating the Cost and the Price for GMRA Project's Water, 2005.
18. Salem Bazina, Study presents to Great Man Made River Authority with title : The pricing of the Great Man-Made River Authority's water for agriculture, industry and drinking, 1994.

**THE STATUS OF MEDICAL FACILITIES IN THE TRIBAL AREAS OF
CHHATTISGARH
(With special reference to Primitive Tribes)**

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***Abstract:** To assess the developmental status of any society, one has to peep in to the health, education, income and capacity of the production of that state. According to World health Organization, health is a combination of biological, psychological and socio-cultural status of a person. Good health is a primary need of any society and it has been declared as our fundamental human right by WHO. The term “health” is not only related to the medical security, but it also includes the unified overall development of a society which comprises of social, cultural, economic, educational and political development. It also deals with the health, economic, political and religious customs of a society. Any society can be developed only by developing the educational and medical facilities. In addition to these, economic conditions also played a vital role.*

***Key words:** Health, Education, Tribal Area, Human Right*

Introduction

The state of Chhattisgarh was newly formed on 1. Nov.2000. According to the census 2011 the total population of the state is 2,55,45,198 and the total tribal population is 78,22,902. Out of the total population of the state, 30.06% population consists of tribes. The number of these tribal groups is 31 (42 in undivided M.P.). Out of these tribal groups, 5 tribes have been declared as the primitive tribes by the government of India, as per the survey made by “Chhattisgarh Primitive Tribal Research and Training Centre, Raipur” in 2005-2006, the total population of these five tribal groups in state is 1,46,423 and total number of families of primitive tribes in the state is 34,203 and among them. These are - Hill Korwa, Kamar, Birhor, Baiga and Abujamria. The tribal groups in the state, who have been given the status of special backward class by the government of india, reside in the following regions –

Table 1: Distribution of Primitive tribes in Chhattisgarh

S.No.	Name of primitive tribes	Residing
1.	Abujhmaria	Bastar, Kanker and Dantewada,
2.	Baiga	Bilaspur, Kawrdha, Korba, Durg
3.	Birhor	Raigarh, Jashpur, Sarguja,
4.	Hill Korwa	Jashpur, Sarguja, Korba
5.	Kamar	Dhamtari, Gariaband, Mahasamund

Source : C.G. Tribal Research and Training Untitute, T.K. Vaishnav, 2008.

The above table makes it clear that all the five Primitive tribes of Chhattisgarh are scattered almost equally throughout the state. On one hand the Abujhmaria reside in the southern part of the state; district Bastar, Kanker, and Dantewada of the state, on the other hand the Baigas are found in the central region (District Bilaspur, Kawrdha, Korba, and Durg). Similarly the Kamar tribe lives in Dhamtari, Gariaband and Mahasamund District. The Birhor and Hill Korwas are found in the northern region District Raigarh, Jashpur, Sarguja,

According to *Baiga Vikas Abhikaran* Kawardha, the total population and sex ratio of Baiga tribe in the state is:

Table No. 2: Sex Ratio in Baiga Tribe

Male	Percentage	Female	Percentage	Total Percentage
34250	50.94%	32991	49.06%	67241 100%

Source: *Baiga Vikas Abhikaran, Distt. Kawardha (C.G.), 2004-05*

The table reflects that the Baiga tribe is the largest tribe found in Chhattisgarh. The number of Baigas in the state is 67241 and the percentage of male and female is 50.94% and 49.06% respectively.

Objective of the Study

The following objectives have been determined to examine the health condition of primitive tribes in Chhattisgarh and the situation of medical programmes being run by government-

1. What is the health condition of Primitive tribe in Chhattisgarh ?
2. Which type of health programmes are being run by the Government ?
3. How much the Government health centres have been successful in providing them medical services ?
4. What are the social conventions that hinder their health condition directly or indirectly?
5. What is the situation of its implementation.

Review of Literature

There has been a vast literature on the subject of Tribes. But most of the available literature on the subject are basically Anthropological, Sociological, Economical, Geological and Ethnological in character and describe various aspects of Tribal life, culture, religion etc. In other words, they have made extensive studies in the field of social-cultural patterns of life. Economists, too, have studied their economic problems and evaluated the programs and projects meant for the development of Scheduled Tribes.

In the context of Indian Tribes, T.C.Hudson in his book 'The Primitive Culture of India' (1922), has traced the complex historical evolution of various tribes of India. J.H.Hutton has further analysed their conditions in his book 'Primitive Tribes' (1941). Stephen Fuchs has written a comprehensive account of the aboriginal tribes of the Indian sub-continent in his book 'The Aboriginal Tribes of India' (1973). E.T. Dalton in his book 'Descriptive Ethnology of Bengal' (1872) has provided an account of the tribal societies of north-eastern state. B.S. Guha has discussed the racial affinities of the Indian Aborigine's different perspective in his book 'The Aborigine Races of India' (1951). P.N. Sengupta has studied the the consumption nutrition pattern of the aborigines in his book 'The Aborigine- Their Nutrition and Welfare' (1959). L.P.Vidyarthi in his book 'Rise of Anthropology in India' (1978), has produced valuable studies on the socio-economic organization of Indian tribes. G.S. Ghurye has depicted the historic development of the Indian Tribes and made a chronicle of the tribal development since Independence in his book 'The Scheduled Tribes' (1963).

N.K. Ambastha has studied the education system vis-à-vis the income and expenditure pattern of the tribes in his book 'A Critical Study of the Tribal Education' (1969). N.K. Bose has discussed the socio-cultural features of the Indian Tribes in his book 'Tribal Life in India' (1971). A.R. Basu in his work 'Tribal Development Programs and Administration of India' (1985), opines that development strategy and tribal communities has to be in tune with the development strategy of the nation. S.C. Dubey in his book 'Tribal Heritage of India' (1977) has examined the changing pattern of socio-cultural organization of the tribes.

B.D. Sharma investigates into the impact of socio-cultural practices on the economic developments of the tribe in his book 'Tribal Development – Concept and the Frame' (1978). K.S. Singh, 'Tribal Society in India', 1985 studies the Tribal society of India in an Anthropological perspective. A. Kumar, 'Tribal culture and Economy', 1986 has attempted to analyze and interpret the sociocultural and economic structure of the Mal Paharia in the light of regional geographical complex. S. B. Saha, 'Tribes of Tripura', 1986 presents a

graphic account of the distribution of various tribes in Tripura. He also studies their regional pattern of cultural and social perspective. T.S. Das, 'Life Style:Indian Tribes', 1987 studies the genre de vie of the Indian tribes in institutional perspective. R. Prasad, 'A Cultural Ecology and Tribal Dynamic', 1988 simply studies the cultural ecology vis-a-vis the reciprocity of various tribes and also analyses various indices of colour blindness among the tribal population of Gujarat. The rate of blindness varies from 0.70 among the bill to 8.96 among koli. B.C. Roy, 'Tribals of Orissa', 1989 has edited a book which consists of analysis of various tribes of Orissa, their society and culture. But none of the work could claim to be empirical in nature. P.A.Sinha, 'Religious life in Tribal India', 1989 discusses the various spatial aspects of Religious life at the DudhKharia, an important tribe of the Gumla district.

D.K. Behera and M.Parida, 'Problems and Treatment of the Aged Among the Plain –Bhuiyans of Orissa', 1990 in their paper make an humble attempt to examine the problems and treatment of the aged among the plain-Bhuiyans of Orissa. The paper is a study of Koira block of Sundargarh, a tribal predominated northern district of Orissa and Bhuiyans constitute the largest tribe of this block. A. K. Holder, 'Aging among the Bedia of Ramgarh hill Range', 1990 has provided general account of economic and health condition of the Bedia of Ramgarh hill range. S. Dasgupta, 'Role of Forest on the Socio-cultural life of the Birjia-Some observation', 1992 has highlighted in his paper how the forest plays role in Birjia's life and also their closeness or affinity or dependence on forest.

The above mentioned studies make it evident that definitely the studies have been done on the primitive tribes, but they all have focused on Bihar, Jharkhand, Orissa and West Bengal. There has been very less research on the Primitive tribes of Chhattisgarh. Some studies have been done, but they are from Social – Economic and Anthropological point of view, but not about health condition.

Present health condition of the Primitive tribes in Chhattisgarh

While collecting the data of the diseases, for the purpose of health study, it is found that in Primitive Tribes, they suffer mainly from malaria, typhoid, skin-disease, anemia, diarrria, filaria and leprosy etc. The main causes of these diseases, found were-

Table 3: Name of the Main Disease and Cause

S. No.	Name of Disease	Cause
1.	Skin-Disease	Unhygienic life style.
2.	Diarrhoea, Jaundice	Consumption of impure water
3.	Typhoid	Lack of cleanness
4.	Malaria	Outbreak of Mosquitoes
5.	Mal-Nutrition	Intake of low Calorie in food

Source: Chhattisgarh Schedule Tribe Research and Training Centre, Raipur, (2004-05).

The above table shows that the Baigas of Chhattiagarh are mainly suffering from five type of diseases. The causes of these diseases are also given. For example the cause of skin-disease is their Unhygienic life style and Diarrhoea, Jaundice is due to the consumption of the impure water etc. Previously, the Primitive tribes used to live in the hills and forests where the doctors and medical facilities could not reach. So they were compelled to get the treatment from local Baiga or Gunia with local herbal medicines. Even today, in some remote regions, which are still away from modern medical facilities, the traditional remedial methods like- Casting out evil spirits by the means of charms and worshipping of Gods and Goddess etc., are prevalent. The specialists in these fields are going door to door in various villages and treat the ailing persons. But they have to go ultimately go to the doctor for some serious diseases. The present status of treatment is given below -

Table 4: Preoriti of Treatment in Tribal Areas of Chhattisgarh

S.No.	Nature of treatment	Percent
1.	Domestic Treatment	09.9
2.	Baiga Gunia	49.3
3.	Harbel Medicines	14.05
4.	Qualified Doctors	26.61
Total		100.00

Source: Chhattisgarh Schedule Tribe Research and Training Centre, Raipur, 2008. Vol. 4

It is clear from the table that whenever Baigas fall sick, 49.39% of them prefer to go to Baiga- Gunia for treatment; thereafter 26.61% Baigs go to the qualified doctors for treatment where as 14.05% Baigas prefer Herbal Medicines and 09.95% Baigas believe in Domestic Treatment for them.

The Status of Government health Programmers in tribal Regions

The Government welfare schemes are being run in this region. Many Primary Health Centre (PHC) Programs are running in these areas and trained health workers (NMA) are being appointed. The status of health programmes in this region is given below-

Table 5 : Medical Facilities in Tribal Areas

Population	No. of Villages	No. P.H.C. Centers	No. of N.M.A s
112594	1176	26.2 %	41.14%

Source: Chhattisgarh Schedule Tribe Research and Training Centre, Raipur, 2008. Vol. 4

It is clear from the above table that although the Government is running many programs for providing health facilities to the tribals, still the efforts being done are not at all sufficient in comparison to the population .The primary

Health centers have been established only in 26.2% areas .Moreover NMAs are limited in only 41.14% villages. The number of doctors and health workers were also very few in number.

Suggestions

After evaluating these programs, it can be said that the Government is making policies for the speedy development of the tribal but still development of tribal in Chhattisgarh state remains a distant dream. The primitive tribes remain primitive. Health services are not within the reach of the tribes. Literacy among the tribes is at a low level. Female literacy among them is negligible. A mere stepping up of investment without bringing out any structural change in the institutional framework causes utter failure of the programmes in many cases. The causes of failures may be due to:

1. It is very essential to study the socio-cultural background and health culture, related to the health of the tribes.
2. The tribes should be given knowledge regarding health and nutrition by arranging Health Education Camps in those areas. Documentary films, based on health education and physical education should be shown in the schools as well as to the villagers.
3. There is a need for establishing more training centers for tribal nurses, midwives, compounders and health workers.
4. The efficient herbal vaidyas of tribal areas should be identified and this knowledge should be preserved and handed over to the youths by organizing Herbal Medicine Training Programmers.
5. The facility of pure drinking water should be provided in tribal regions.
6. There should be special allowances and promotion provisions along with well furnished homes, electricity, telephone and vehicle facilities for the doctors and nurses.
7. The mobile dispensaries should be introduced in these remote areas.
8. As the tribes are related to the herbal medicines for centuries, the Ayurvedic dispensaries should also be established.
9. Some special health programmers should be organized on some specific recurrent diseases in these tribal regions.

Conclusion

As a healthy mind lives in a healthy body, it is very important that the tribes should remain healthy for their overall development. A healthy mind along with a healthy body is the first condition of a working population. The area of Chhattisgarh where the Primitive Tribes are residing is affected with lots of diseases like; Guitre (Ghengha) and Malaria, especially in the rainy season. Moreover, due to ignorance and unavailability of clean water, they are also

affected by the skin diseases. Although the Government provides them free medical checkups and medicines from the health services, but due to a limited number of health services, they can't get full benefited by it. In addition to this, the number of health employees is also less in comparison to the population of the region.

Since the literate tribes prefer to go to the qualified doctors, it is also recommended that the literacy rate of them should be increased. There should be special health awareness camps in the rainy season, when cholera or malaria are spread in these areas. If it is essential, Anganbadi workers should be trained for spreading gamaxin in the affected Tribal villages, distribution of chlorine should be made available in the affected regions. Mobile Medical Vehicles should be introduced so that they can provide medical facility to the tribes living in the remotest areas. They should be encouraged to use hand-pumps, instead of ponds for drinking water, because most of the time, polluted water is the main cause of the epidemics.

References

1. Shrivastava Mahesh "The Effect of Government Programmes on the Economic Status of Baiga Tribes in Chhattisgarh." Unpublished Project Report for U.G.C. New Delhi, 2011.
2. Vaishnav, T.K. "*Chhattisgarh ki Adim- Janjatiyan* Tribal Research and Training Centre, Raipur, Chhattisgarh, 2007.
3. Vaishnav, T.K. "The Scheduled tribes of Chhattisgarh, Tribal Research and Training Centre, Raipur, Chhattisgarh, 2008.
4. *Vanya Jati, Bharatiya Aadim Jati Sevak Sangh*, New Delhi, Jan. 2010, Vol.58.
5. Vikas Yojnayan, Scheduled Cast and Scheduled tribe department C.G.Govt. Raipur. 2004-05.

BIODIVERSITY CONSERVATION AND SUSTAINABLE USE**Sunil Kumar Verma**

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Abstract: *Biodiversity is the establishment of life on earth and one of the mainstays of feasible advancement. The wealth and mixed bag of life on earth makes conceivable the environment benefits on which we depend: clean water, nourishment, sanctuary, medication and attire. Situations rich in biodiversity are strong when stricken by characteristic debacle. The greater part of this is of specific significance for the poorest natives of our reality. The individuals who live on just a couple of dollars a day need biodiversity to meet their fundamental needs. Without the preservation and maintainable utilization of biodiversity, we won't attain to the Millennium Development Goals.*

Key words: *Agricultural Biodiversity, Ex Situ Conservation, In Situ Conservation, Plant Genetic Resources, Sustainable Development, Practical Farming.*

Introduction

Biodiversity is being lost at an extraordinary rate. This, is genuinely disintegrating the limit of our planet to manage life on earth. It is therefore that world pioneers going to the World Summit on Sustainable Development in Johannesburg in 2002 consented to attain to, by 2010, a critical diminishment in the rate of loss of biodiversity. This dedication was repeated at the 2005 World Summit. The 2010 biodiversity target is currently completely incorporated into the system of the Millennium Development Goals and, as an indication of further backing, the universal group chose to proclaim 2010 the International Year for Biological Diversity. As the world likewise concentrates more consideration on environmental change, the connections between environmental change and biodiversity are additionally being enunciated. The Millennium Ecosystem Assessment - a best in class evaluation of the world's biological systems and the administrations they give - has distinguished environmental change as one of the greatest reasons for our planet's loss of biodiversity, alongside changing area utilization designs. What's more, the as of late discharged report of the Intergovernmental Panel on Climate Change made it completely clear that environmental change is genuine and will keep on

influencing our lives and biological communities for a long time to come. Those effects will incorporate the eradication of constantly expanding quantities of species, further debilitating various effectively delicate biological systems.

It is convenient that the topic of the current year's recognition of the International Day for Biological Diversity is "Biodiversity and Climate Change". Surely, the protection and supportable utilization of biodiversity is a fundamental component of any procedure to adjust to environmental change. Mangrove woods and other beachfront wetlands speak to a rampart against compelling climate occasions and climbing ocean levels. As farming scenes get to be hotter and drier, the differing qualities of animals and cereal harvests can furnish ranchers with alternatives to adapt to new conditions. Woodlands, peatlands and different biological systems add to sequestering carbon dioxide from the climate, in this manner serving to moderate increments in nursery gas emanations. Through the Convention on Biological Diversity and the United Nations Framework Convention on Climate Change, the universal group is focused on saving biodiversity and battling environmental change. The worldwide reaction to these difficulties needs to move considerably more quickly and with more determination at all levels - worldwide, national and neighborhood. For the purpose of present and future eras, we must attain to the objectives of these milestone instruments.

To utilize biodiversity as a part of a reasonable way intends to utilize common assets at a rate that the Earth can recharge them. It's an approach to guarantee that we address the issues of both present and future eras. As human populace expands, so does the weight on biological systems, since we draw steadily assets from them. Our biological foot shaped impression on the planet is unsustainable and will get to be intolerable unless we change our utilization designs and our conduct as a rule. Before, people have adjusted to changing conditions by expanding benefit, yet now we have come to the furthest reaches of the Earth's ability. Today our just choice is to oversee profit and assets in a manageable way, decreasing waste wherever conceivable, utilizing the standards of versatile administration, and considering conventional learning which adds to the support of biological system administrations.

Much of the time, conventional information has added to securing natural life and biological communities and to guaranteeing a "characteristic parity". Customary learning contains "information, developments and practices of indigenous and nearby groups far and wide, created as a matter of fact increased over hundreds of years and adjusted to the neighborhood society and environment, which is transmitted orally from era to era", as per the Convention on Biological Diversity (CBD). Customary learning is aggregately possessed

and takes the type of stories, tunes, fables, maxims, social qualities, convictions, customs, group laws, nearby dialects and horticultural works on, including the improvement of plant species and creature breeds. Article 8(j) of the CBD calls for nations to regard, protect and look after learning, developments and practices of indigenous and nearby groups exemplifying customary ways of life important to the preservation and feasible utilization of biodiversity. Biodiversity preservation specialists should in this way guarantee that the groups depending straightforwardly on common assets are included in protection activities and assurance their dynamic support amid the entire protection process. Some manifestation of group engagement is fundamental for the achievement of any biodiversity preservation venture. There are additionally numerous great cases of group monitored territories as far and wide as possible. These destinations have been overseen by groups for eras for the reasonable utilization of regular assets, for example, therapeutic plants and water springs, or actually for religious purposes. These locales might possibly have government assurance or composed administration regulations. Then again, the group individuals have grown decently perceived and regarded principles that are frequently stronger than any law and have been honed for eras. The final result is the preservation and reasonable utilization of assets. A few administrations now lawfully perceive customary practices and regard indigenous and neighborhood groups as the standard stewards of the biodiversity.

An Evolving International Consensus

The significance of reinforcing environmental cognizance and flexibility as fundamental conditions for both biodiversity preservation and supportable advancement has pulled in developing consideration lately in an extensive variety of protection and improvement flora. The World Summit on Sustainable Development, which was held in Johannesburg in September 2002, received the objective of securing by 2010 a noteworthy lessening in the current rate of biodiversity misfortune. In setting out how this can be attained to inside the connection of practical improvement, the Johannesburg Plan of Implementation required the advancement of 'national and territorial biological systems and halls'.

The most vital biodiversity preservation instrument, the Convention on Biological Diversity, likewise perceives the estimation of biological soundness as a method for attaining to the Convention's three targets – the protection of organic assorted qualities, the supportable utilization of its parts and the reasonable and evenhanded offering of the profits emerging out of the use of hereditary assets. Despite the fact that the Convention itself does not determine the accurate means by which these targets are to be accomplished, its

executing instrument is attempting to advance the reinforcing of biological reasonability. For instance, in 2002 the Conference of the Parties to the Convention prescribed that, to ration woodland organic differences, 'biological passages' ought to be produced on a national and local premise.

Concerning more extensive usage approaches, in 2000 the Conference of the Parties distinguished the Ecosystem Approach as the essential structure for the execution of the Convention and suggested the utilization of its standards. The Ecosystem Approach can be viewed as a methodology for the administration of area, water and living assets that advances preservation and feasible use in a fair way. At the heart of the methodology is the mindfulness that, without the successful administration of environments, there can be no financial improvement that creates feasible human and social welfare; similarly.

A key issue that these improvements raise is the ramifications of the Convention, the Ecosystem Approach and environmental systems for the focal mainstay of biodiversity protection – the secured territory. This is a matter that concerns not just how preservation and improvement methodologies ought to best be connected in regional terms. It has far more extensive ramifications, for example, for law, institutional structures, the portion of stores, arranging systems, neediness assumption, strategy incorporation and the part of indigenous people groups. In any case, there are great purposes behind belligerence that the two methodologies ought to be seen less as contenders than as partners that, in the more drawn out term, will advantage from a considerable level of collaboration.

Two focuses merit accentuating here. Initially, it is pass that ensured range administration itself has experienced a transformation over the previous decades. Today there is an expansive and developing mindfulness that the assurance of individual organic components –, for example, locales and undermined species – is by and large not succeeding in capturing the decrease in biodiversity. The conventional perspective that views secured regions as islands of nature fenced off from a debilitating world is now viewed as very restricted by a considerable extent of the ensured territories group. Second, keeping in mind the end goal to reinforce their part in monitoring biodiversity, stores are progressively being assigned and oversaw as frameworks of secured territories. That is to say, the push of ensured region approach in numerous nations or locales is moving towards the objective of guaranteeing the protection of a delegate cluster of trademark environments and species populaces. The consequence of these two advancements is that, inside the ensured regions group, a wide mindfulness has emerged of the need to grasp

the environmental, social, monetary and social connection inside which secured territories work as a method for enhancing their viability.

Biodiversity holds various qualities which incorporate direct (subsistence and tradable) and backhanded (watershed insurance, supplement reusing, atmosphere regulation and numerous other environment administrations). These assets regularly act as a monetary "cradle" supplying option organic assets for the rustic and urban group. In any case, in recent time next to no of the world's biodiversity stays unaffected by human movement. Loss of biodiversity directly affects the solidness of the environment. This shows the interest of pressing mediation to readdress the many negative effects of biodiversity control, and move far from concentrating on transient additions, to anticipate those who are subsistence subordinate, or get pay from exchanging biodiversity. Consequently it is vital to survey and analyses a methodologies for the protection and manageable utilization of biodiversity for the profits of the group and the nature itself. The point of this paper is to survey diverse articles identified with the preservation of biodiversity and selects the best alternatives and methodologies that can help to keep up the capability of natural assets while keeping the needs and yearning of the group. In this respect, taking into account the site condition distinctive biodiversity conservation methodologies were distinguished which include: in-situ protection, ex-situ preservation, around situ protection and reciprocal protection. Preservation in view of the biodiversity segments was additionally alternate methodologies used to dissect and distinguish the fitting protection approach at a bigger scale. This segment based biodiversity preservation methodology incorporates: the hereditary based protection, species-based conservation, ecosystem-based preservation and scene level protection approach. From this union it has been learnt that, the environment methodology has been commented as the best approach for the preservation of biodiversity. Because, ecosystem methodology is worked in view of (i) the use of investigative systems, (ii) individuals are an integral piece of numerous biological communities, and (iii) utilizing versatile administration to manage the unpredictable and element nature of environments. Thusly, due to its comprehensive nature, the environment methodology can possibly main stream conservation into general human issues and utilized as the best alternative for the protection and economical utilization of biodiversity

The gratefulness for rural biodiversity has developed and developed, bringing about an expanding mindfulness that its valuation and utilization could add to long haul protection and utilization. This sourcebook empowers activity went for overseeing horticultural biodiversity assets inside existing scenes and biological communities, in backing of the vocations of ranchers, fishers and animals managers. The production is an aggregation of field-based encounters

by researchers, advancement masters, scholastics, strategy producers and benefactors as far and wide as possible; it comprises of three volumes: 1) comprehension horticultural biodiversity, 2) fortifying neighborhood administration of farming biodiversity, and 3) guaranteeing an empowering domain for agrarian biodiversity. It is intended for utilization by rustic improvement experts and neighborhood executives, and also mentors and educationalists.

Biodiversity is the level of variety of life. It is a measure of the mixed bag of living beings introduced in diverse biological systems. This can allude to hereditary variety, environment variety, or species variety (number of species) inside a range, biome, or planet. Physical biodiversity has a tendency to be most noteworthy close to the equator, which is by all accounts the aftereffect of the warm atmosphere and high essential productivity. Biodiversity is not disseminated uniformly on Earth. It is the wealthiest in the tropics. Marine biodiversity has a tendency to be most noteworthy along coasts in the Western Pacific, where ocean surface temperature is most noteworthy and in the mid-latitude band in all seas. There are latitudinal slopes in species diversity. Biodiversity for the most part has a tendency to group in hotspots, and has been expanding through time yet will be prone to abate later on.

The most punctual proofs for life on Earth are graphite discovered to be biogenic in 3.7 billion-year-old met sedimentary rocks found in Western Greenland and mat fossils found in 3.48 billion-year-old sandstone found in Western Australia. Since life started on Earth, five noteworthy mass eliminations and a few minor occasions have prompted extensive and sudden drops in biodiversity. The Phanerozoic age (the last 540 million years) denoted a quick development in biodiversity by means of the Cambrian blast a period amid which the greater part of multi-cellular phyla initially showed up. The following 400 million years included rehashed, enormous biodiversity misfortunes delegated mass termination occasions. In the Carboniferous, rainforest breakdown prompted an awesome loss of plant and creature life. The Permian–Triassic eradication occasion, 251 million years prior, was the most noticeably bad; vertebrate recuperation took 30 million years. The latest, the Cretaceous–Paleocene termination occasion, happened 65 million years back and has frequently pulled in more consideration than others in light of the fact that it brought about the annihilation of the dinosaurs.

The "Protection" standard has changed in the most recent few decades from the "uninvolved" approach that rejects individuals from the biodiversity security regions (PA) to a comprehensive approach that includes both as well as advances practical biodiversity for utilization somewhere else, since

biodiversity clients incorporate the neighborhood rustic groups, as well as far away urban natives. Therefore, biodiversity-accommodating exercises must be coordinated into both rustic and urban ways of life, to keep away from the mystery in which the country poor are constrained to yield their survival needs of fuel, feed, fertilizer, sustenance, and so on. On the other hand, the therapeutic plants exchange to meet the developing urban natural restorative covetousness undermines species annihilation. Encouraging such a coordinated methodology obliges limit building of the country groups for protection and manageable utilization of biodiversity, while that of the urban purchasers for impartial profit imparting. Such comprehensive instruction can advance exercises that meet the triple main concern of biological maintainability, monetary suitability and social value. Endeavors for such an incorporated, pragmatic instructive methodology are depicted in this note, to upgrade practicality of the employments of the provincial poor, and make urban utilization sustainable.

Fair Trade for Sustainable and Equitable Use

Advancing provincial development for rustic restorative needs can decrease harvest weight on wild assets insignificantly. In any case, it can't stay away from the danger of species termination owing to much higher urban business request because of the quickly developing home grown restorative industry- including skin and body care items coming about because of eagerness. Every town utilizes around 15-20 therapeutic plants, and people healers think around 100-200 species each. The aggregate number of species utilized therapeutically all over India is around 8,000. Around 800 are exchanged, suggesting high urban interest, of which 600 of these are completely gathered from the wild while the rest are either developed or foreign to some degree (Ved et al, 2003). Of these, almost 300 i.e. half of the aggregate wild accumulations are of high protection concern, due to high populace diminishment because of harvest weight and territory misfortune, and may confront risk of termination eventually. The eradication danger to these species can't be diminished by advancing development of few species for provincial medicinal services. Business development of species in high exchange interest may help in lessening the harvest weight of their wild populace, however may not help diminish the drudgery of the provincial gatherers. Most therapeutic plants gatherers are landless workers, who depend on products gathered from open grounds. They may not land positions if the rich proprietors attempt development of species prior assembled from nature. Developed species additionally regularly do not have the restorative adequacy gotten from the wild source, created by regular stretch, for example, dry spell, irritation or microbial assault, and so on. Therefore, there is constantly a higher request and cost accessible for the wild sourced therapeutic items than the developed ones. Along these lines,

development alone can't tackle the issues of species termination or job imbalance. Advancing economical collecting of the wild deliver and evenhanded offering of its business advantage is irreplaceable.

At the UN Conference on Sustainable Development in Rio in June 2012, world pioneers focused on the protection and feasible utilization of sea life organic assorted qualities in zones past national purview (the high oceans). Our examination of crevices in high oceans administration demonstrates that an ideal model change to a more methodical methodology will be expected to shield high oceans biodiversity from mounting dangers. Experience from physical and waterfront regions demonstrates that a deliberate way to protection arranging and administration can help to keep up environment wellbeing and benefit while empowering maintainable utilization. Our investigation further shows that the momentum lawful administration on the high oceans is deficient to understand these goals: administration establishments have neither a satisfactory command for incorporated arranging nor the capacity to viably organize crosswise over numerous administrations. We distinguish key components for future high oceans administration and place that a two dimensional methodology is most guaranteeing: the advancement of an enhanced worldwide lawful administration that joins deliberate arranging and in addition the development of existing and new local understandings and commands. This joined methodology is destined to attain to the obliged biological community based, incorporated and science-based administration that world pioneers at Rio recognized ought to support sea administration.

Exploration structures a piece of a continuum that ranges from unadulterated and vital research through connected and formative stages to boundless use of the examination results. The MOFEC-Tropenbos program in Kalimantan covers an extensive piece of this continuum; it has grown as a multidisciplinary way to issues in woods arrangement and administration. This issue introduction is a prominent peculiarity of the system. Again and again research is directed in a vacuum, in a scientist's own particular thin field, and does not address significant approach issues. Numerous individual researchers, research foundations and improvement orgs overlook the requirement for science to add to the approach process and to address the issues or wishes of all partners in the timberland. Specifically, there has been checked hesitance by financial and biophysical researchers to address issues on a multidisciplinary and between disciplinary premises. Organic differing qualities and its protection are crucial to the accomplishment of manageable utilization of tropical downpour woodlands yet natural differences fluctuates between biological systems, species, populaces, qualities and alleles; inspecting for biodiversity must make note of variety due transient and geographic impacts. Test sizes

may be diminished by the recognizable proof of different markers including species area connections, biological and financial pointer species, taxic gatherings and practical gatherings. A scope of techniques for evaluation and observing of biodiversity incorporate customary woodland stock and vegetation investigation upheld by remote sensing procedures and late sub-atomic systems.

Since the United Nations Conference on Environment and Development in 1992 the significance of biodiversity and its protection has been generally perceived (Heywood, 1995). The Convention on Biological Diversity perceives that natural assets ought to be made unreservedly accessible for feasible utilization subject to reasonable and impartial imparting of profits from the utilization of hereditary assets; this is frustrated with the need to perceive the protected innovation privileges of the individuals who initially moderated an asset or its data and of the individuals who work towards its hereditary change and application. To embrace economical preservation of natural assorted qualities and the astute utilization of hereditary assets, we require strategies for the evaluation of organic differences and for its protection. We look to ration organic differences for moral, stylish, environmental and monetary reasons however every one of them need the fundamental data, perceiving that natural assorted qualities itself alludes to biological systems, species, populaces, genotypes and qualities.

Conclusion

Biodiversity preservation and maintainable improvement are two between related limbs concentrating on social advancement, financial development and ecological assurance on one side, and biological system protection on the other. Preservation incorporates the endeavors completed in ensured regions, for example, national parks and group saves, and in different territories with rich and critical biodiversity where protection is not the principle center. It is in these recent gainful scenes where manageability is required most. Practical farming, manageable fisheries and maintainable administration of characteristic assets are the principle approaches for safeguarding these scenes for long haul social, monetary and environmental profits.

References

1. Alcamo, J. & Elena, M. (2003): *Ecosystems and Human Well-being: A Framework for Assessment*. Washington, DC, World Resource Institute.
2. Brawn, J.D., Robinson, S.K. & Thompson, F.R.III (2001): The Role of Disturbance in the Ecology and Conservation of Birds. *Annual Review of Ecology and Systematic*, 32: 251– 276.

3. Bried, J.T., Herman, B.D. & Ervin, G.N. (2007): Umbrella Potential of Plants and Dragonflies for Wetland Conservation: A Quantitative Case Study Using the Umbrella Index. *Journal of Applied Ecology*, 44: 833–842.
4. Botanical Survey of India (1983): *Flora and Vegetation of India an outline*. Botanical Survey of India, Howrah.
5. Forest Survey of India (1997): *State of Forest Report*, Ministry of Environment of Forests, Dehradun.
6. Fahring, L. (2003): Effects of Habitat Fragmentation on Biodiversity. *Annual Review of Ecology, Evolution and Systematic*, 34: 487–515.
7. Ganguli, P.M. (1950): *Rice in Assam*, Department of Agriculture. Assam State Govt., India.
8. Hawkes, J.G., Maxted, N. & Ford-Lloyd, B.V. (2001): *The Ex-situ Conservation of Plant Genetic Resources*, Kluwer Academic Publishers, London.
9. Hosetti, B.B. (2002): *Wetlands Conservation & Management*, Pointer Publishers, Jaipur.
10. Hosetti, B.B. (2003): *Wildlife Management in India*. Pointer Publishers, Jaipur.
11. Jodha, N.S. (1998): *Sustainable Development in Frasila Environment*. CEC Ahmedabad.
12. Khan, T.I. (1998): *Biodiversity Conservation & Sustainable Development*. Pointer Publishers, Jaipur.
13. Khan, T.I. (2001): *Global Biodiversity and Environmental Conservation*. Pointer Publishers, Jaipur.
14. Khan, T.I. (1999): *Global Biodiversity Conservation Measures*. Pointer Publishers, Jaipur.
15. Kothari, Ashish (1997): *Understanding Biodiversity Life, Sustainability and Equity*. Orient Longman.
16. Kotwal, P.C. & Banerjee, Sujoy (2002): *Biodiversity Conservation in Managed Forests and Protected Areas*. Agrobios, Jodhpur.
17. Kumar, U. & Asija, M. (2003): *Biodiversity: Principles and Conservation*. Agrobios, Jodhpur.
18. Mathur, H.S. (2003): *Essentials of Biogeography*. Pointer Publishers, Jaipur.
19. Meena, V.P. (2000): *Desert Ecology*. Pointer Publishers, Jaipur.
20. Pandey, H.P., Verma, B.K., Govindrao, A.K. & Narain, S. (1998): Ethno Biology & Conservation of Biodiversity. *EN, New Delhi*, 21-27 March, 22 (51): 1-3.
21. Raju, R.A. (2002): *The Spirit of Beautiful Trees*. Agrobios, Jodhpur.
22. Ranga, M.M. (2002): *Wildlife Management and Conservation*. Agrobios, Jodhpur.
23. Sharma, N. (2002): *The Flora of Rajasthan*. Pointer Publishers, Jaipur.
24. Singh, B.D. (2002): *Plant Breeding Principles and Methods* 6th ed., Kalyani Publishers, Ludhiana, India. 832-846.
25. Trivedi, P.C. (2002): *Biodiversity Conservation*. Pointer Publishers, Jaipur.
26. Trivedi, R.N. (1996): *Dimensions of Safe Environment*. Anmol Publication, New Delhi.
27. Trivedi, R.N. (1998): *Environment and Biotechnology*. Anmol Publication, New Delhi.
28. Ved D.K., Shankar, Darshan, Mudappa Anjana, & Singhm Archana (2003): *Export Potential of Indian Medicinal Plants*. FRLHT, Bangalore.

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