Octa Journal of Environmental Research
International Peer-Reviewed Journal
Oct. Jour. Env. Res. Vol. 6(4): 142-152
Available online http://www.sciencebeingjournal.com

Oct.–Dec., 2018
ISSN 2321 3655

Research Article

Octa Journal of Environmental Research
(Oct. Jour. Env. Res.) ISSN: 2321-3655
Journal Homepage: http://www.sciencebeingjournal.com

SOCIAL-ECONOMIC VALUES OF ATAL SAGAR HYDROELECTRIC DAM (MADIKHEDA DAM) IN SHIVPURI, MADHYA PRADESH, INDIA

Yogesh, Singh [a], Lodhi, R. K. [b], Gurjwar, R. K. [a] and Rao, R. J. [a]
a. SOS in Environmental Science, Jiwaji University, Gwalior, MP India
b. Conservation biology Lab, SOS in Zoology, Jiwaji University, Gwalior, MP India
Corresponding Author's Email: **singh.yogesh059@gmail.com**
Received: 19th Nov. 2018 **Revised**: 17th Dec. 2018 **Accepted**: 30th Dec. 2018

Abstract: Atal Sagar Hydroelectric Dam (Madikheda Dam) is major project in Shivpuri district of Madhya Pradesh. It comes under the Sindh project phase- II. Atal Sagar Hydroelectric Dam (Madikheda Dam) is constructed over the Sindh River. It is multi purposes uses dam. The dam world over has been playing dual role of harnessing the river waters for accelerating socio-economic growth and mitigating the miseries of large population of the world suffering from the vagaries of floods and droughts. Since the advent of civilization, man has been constructing dams and reservoirs for storing surplus water available during wet periods and for utilization of the same during lean periods. Energy plays a key role for socio-economic development of a country. Hydro power provides a cheap, clean and renewable source of energy.

Keywords: Hydroelectric Dam; Socio-economic values; Water.

Postal Address: Conservation Biology Lab, SOS in Zoology, Jiwaji University, Gwalior-474011 MP India Phone - +91 9074140459

INTRODUCTION

Water is important for sustenance of all forms living organism on the earth. It is not evenly distributed all over the world and even its availability at the same locations is not uniform over the year. Dams, wetlands and aquatic water bodies are the biological machineries of the earth. They are the root for life and the livelihoods of local communities. Understanding, protecting, and restoring ecosystems at river basin level is essential to foster equitable human development and the welfare of all species. Dams transform landscapes and create risk irreversible impacts. The International Commission of Large Dams (ICOLD, 1998) defines large dams as dams with a height of 15 m or more from foundation to crest. Dams between 10 to 15 m also fall into this category if: crest length is over 500 m or spillway discharge over 2000 m^3s^{-1} or reservoir capacity is more than one million cubic meters. Dams have one of the most important roles in utilizing water resources. They were constructed long years before gaining present information about hydrology and hydromechanics. They are not ordinary engineering building.

Water resources planning is an important basis for their exploration, development, conservancy, and protection, which falls into river basin planning and regional planning. The former is further divided into river basin comprehensive planning and river basin specialized planning, while the latter is further divided into regional comprehensive planning and regional specialized planning (Jiao et. al., 2004 and Liu, 2006). Specialized planning means planning for the hydrographical test, flood control, hydropower

development, logging control, irrigation, navigation, recreation and tourism, fishery, water and soil conservancy, water resources protection, environment protection, etc., of the river basin or region concerned. India, during 1901 to 1950 about 250 dams were added. That is, at the time of the beginning of plan period (1950-51), after India obtained Independence in 1947, there were a total of about 300 dams. During the next twenty years, there has been a spurt in the dam construction activity in which 695 dams were added bringing the total number of dams to nearly 1000 up to the year 1970. The dam building activity intensified during the next two decades and at the end of 1990 the total number of Indian dams stood at 3244 without accounting for 236 numbers of dams for which the year of construction is not available. Due to dwindling economy only 115 dams could be added after 1990 and today about 695 dams are at various stages of construction. As per the National Register of Large dams, India has as on today 4291 large dams including the 695 dams under construction (World Commission on Dams, 1999)

At present, more than 45000 large dams and an estimated 800000 small dams regulate the world's river; some have been built to supply water including irrigation, control floods, provide for navigation, fishing and recreation, and importantly to generate electricity. The dam has played a powerful role in economic development; however, there has been growing controversy about the failure of these projects to address environment and social concerns. Amongst the 30 large dams have planned over the Narmada River, India, the Sardar Sarovar Dam is the largest with a proposed height of 136.5 meter, the proponents claim that the multipurpose Sardar Sarovar project would be serve irrigation more than 1.8 million hectares of mainly for drought-stricken areas, also provide electricity and flood control. The project would displace more than 320000 people and owing to related displacements by the canal system and other allied projects, at least 1 million people are expected to be affected if the project is completed. Controversies surrounding dam projects, including environmental and social destruction and high price tags, have grown, especially in the last twenty years in the development's countries. Following a writ petition by an NGO calling for a comprehensive review of the project to take into consideration all the concerns raised, the Supreme Court of India halted construction of the dam in 1995 at a height of 80.3 m. However, in an interim order in February 1999, the Supreme Court gave the go-ahead for the dam's height to be raised to a height of 88 m. In October 2000, in a 2 to 1 majority judgment, the Supreme Court allowed immediate construction on the dam up to a height of 90 m. Further, the judgment authorized construction up to the originally planned height of 138 m in 5-meter increments subjects to receiving approval from the relief and rehabilitation sub group of the Narmada Control Authority. Critics of the projects say that even to this day, years after the construction began; no survey has been completed for villages affected by dam's backwaters. Who will lose land or livelihood due to the project's irrigation canal, compensatory afforestation; wildlife sanctuary, construction colony, and other dam related infrastructure are not currently entitled to rehabilitation (The Friends of Narmada, 2009).

In India, recent research shows that development-caused displacements over the last five decades affected over 50-55 million people (Fernandes, 2005); by sector, India's dam construction alone accounts for the single largest displacements. In August 1917, around 1500 peoples were killed when the Tigra reservoir was breached at the level of 744.65 feet and the inflow was probably 13500 cusecs (Given Information by Dam Department). In 2005, at least 62 Hindu pilgrims were killed when the water from the Indira Sagar dam of the state-run Narmada Hydroelectric Development Corporation (NHDC) was released without warning during a religious ceremony (Bhootdi Aamavasya or Moonless Night) attended by an estimated 300,000 Hindus who gathered to bathe downstream from the dam on the banks of Narmada river near Dewas. The Indira Sagar has a full reservoir level of 262.13

meter and is part of more than 3,000 dams being built across Narmada River and its tributaries as part of the Narmada Valley Hydro project. One another case is that, in June 2014 about 26 Students were washed away when the Larji Hydropower Project (on Byas River, Mandi Himachal Pradesh) authorities suddenly released water from the dam (Wikipedia, 2014).

Study Area

Shivpuri is an urban area and a municipality in Shivpuri district of Madhya Pradesh. It is in the Gwalior region of northwest Madhya Pradesh and is the administrative control center of Shivpuri District. It is situated at an altitude of 1,515 feet (462 m) above sea level. Shivpuri shares border with Jhansi in Uttar Pradesh towards the east and Rajasthan towards the west. It has nine tehsils, namely, Badarwas, Karera, Kolaras, Narwar, Pichhore, Pohri, Bairad, Shivpuri and Khaniyadhan. This city is also famous for Madhav National Park in Madhya Pradesh, which support best habitat for wild and aquatic animals. As of provisional figures of 2011 India census, Shivpuri had a population of 1,725,818. Males constitute 919,369 of the population and females 806,413. Shivpuri has an average male literacy rate of 76.2% and female literacy rate of 49.5%. Children population of Shivpuri (0-6 years) is 285,770. Shivpuri is located at coordinates 25°43.N 77°65.E. It has an average elevation of 468 meters (1535 feet). Shivpuri has a cool and dry environment. The warm period starts from about the mid of April and go on up to mid of May. The temperature in June traces 44^0C. By the end of June or by first week of July, the monsoon breaks and the weather becomes cool, through humid. The Shivpuri receives its rain from the Arabian Sea. The rains are over generally by end of September. The Shivpuri receives on an average 875 mm/year rain.

Table 1. Climate of Shivpuri District Year 2014

Month	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Min. (^{0}C)	01^0C	05^0C	08^0C	11^0C	22^0C	22^0C	22^0C	21^0C	21^0C	16^0C	09^0C	0^0C
Max. (^{0}C)	29^0C	31^0C	40^0C	42^0C	46^0C	44^0C	33^0C	33^0C	36^0C	35^0C	33^0C	30^0C

Atal Sagar is hydroelectric dam, its water source is Sindh river which come from Malwa Plateau in Vidisha district, and flows north-northeast through and districts of Guna, Ashoknagar, Shivpuri, Datia, Gwalior and Bhind, and this river includes as main river of India. Atal Sagar dam, generate 60-megawatt electricity and provide the water for irrigation. That mean it is firstly used for electricity production and then for irrigation. Due to this dam so many districts have benefited these are Shivpuri, Bhind, Gwalior and Datia. In the present study socio-economic impact were evaluated of Atal Sagar Dam (Madikheda Dam) is as follows:

Atal Sagar Hydroelectric Dam (Madikheda Dam)

Atal Sagar is a Multi-purpose Dam which provides many things like water for irrigation, electricity for human use, and provides job to peoples. Atal Sagar dam is also known as Madikheda dam. This dam has huge capacity of stored water for irrigation. The Atal Sagar Dam Project (ASDP) is a multipurpose project of Government of Madhya Pradesh. The multipurpose Dam projects have miscellaneous impact on economic development and environment. Remarkable development has been attended by the areas where this project was commenced successfully, particularly in the field of agriculture and energy. The Atal Sagar Dam Project (ASDP) is being constructed in the Sindh river near Madikheda village, about 35 km away from Shivpuri town (district headquarter) of MP state in India. The extension of ASDP lies at latitude 25^o33'20''N and longitude 77^o51'10''E. The Sindh River is one of the sub-systems of Ganges, which confluences with Yamuna River near Etawa (Uttar Pradesh). At the same time, ecological implication, such as depletion of forests and extinction of wild animals, is enormous. Similarly, the problems of water logging and consequently various waterborne diseases manifested a way for health hazards in the

affected areas. Rehabilitation of the ousters also remains a big barrier for the agencies involving with this practice. The economy is mainly based upon the cultivation of subsistence cereal crops, which economic viability is considerably low; even the population of the region does not meet the two times food requirement. Agriculture is rain-fed. The crops are grown mostly during the three months of monsoon season. The production and productivity of the crops is adversely very low. Drinking water crises in the summer season is considerably high as the people have to walk kilometers for water. The supply of energy, in a form of electricity, is just negligible even sometimes twenty-four hours energy cut can be noticed. Construction of this dam and canals from it will definitely boost up the agricultural production and solve the energy crises as the main objective of this dam project is generation of electricity and ample supply of water for irrigation and drinking purposes.

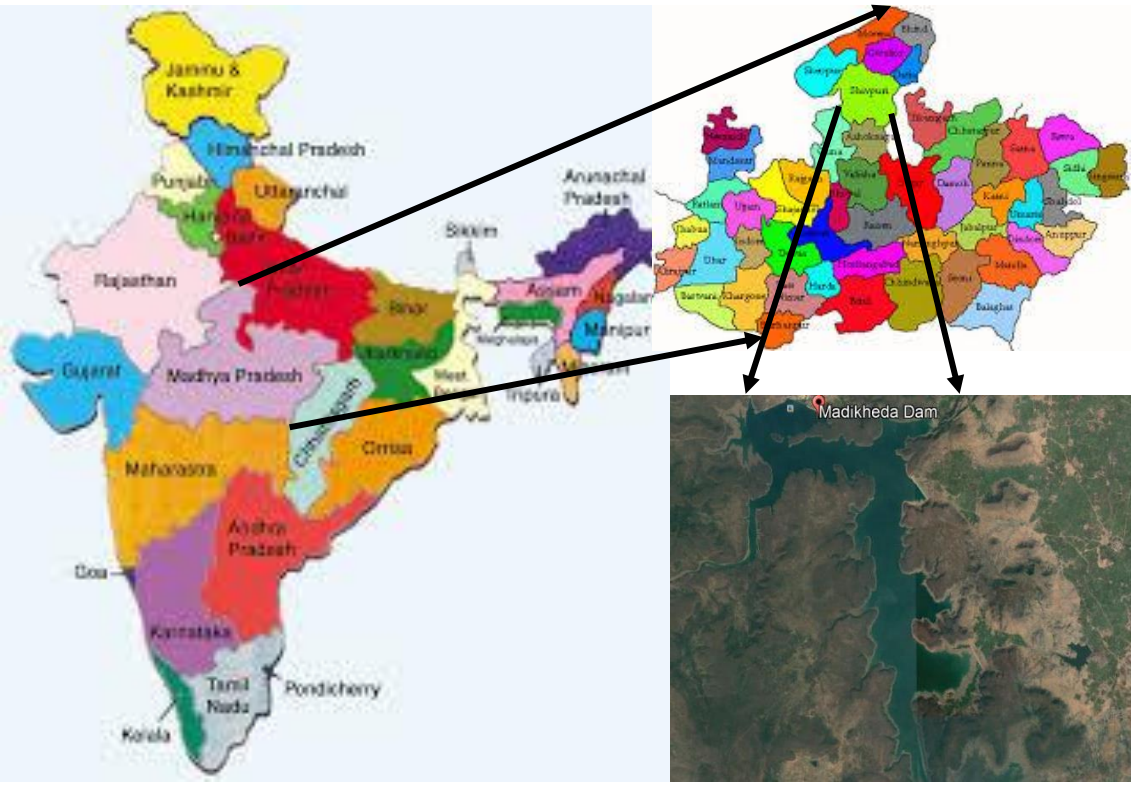

Figure 1. Showing the location of Atal Sagar Dam

Salient Features of Atal Sagar Dam

Name of the dam	Atal Sagar Dam	Purpose of Dam	Hydroelectric, Irrigation
Nearest City	Shivpuri	Length of Dam	1072 m
District	Shivpuri	Dam Height	61.9 m
State	Madhya Pradesh	Type of Spillway	Ogee
Basin Name	Ganga	Generate Electric	60 mw
Tributary River	Yamuna River	Length of Spillway	218.5
River	Sindh	Design flood	14026.4 cumec
Dam type	Gravity / Masonry	Spillway capacity	14026.4 cumec
Dam Status	Completed	Total Canal	4
Start Date	1978	Seismic zone	Seismic zone II
Completion year	2008	Benefited District	4
		Dam Gate	10

Figure 2. Spillway of Atal Sagar Dam

Figure 3. Current Water level at Atal Sagar Dam

EXPERIMENTAL

The study was conducted in Shivpuri district between the months of January 2014 to December 2014. The study sites were selected for field visits and primary data collection. Information was collected through field surveys, interviews with officials concerned with Dam and local villagers who are dependent on the resources of dams. Various research advisors' local communities and staff of Dams and other key organization were consulted during the study period. The study is mainly based upon the collection of primary data, which were gathered through household level survey near to dam affected area. For household survey, questionnaire and scheduled were framed and affected people and government employee were interviewed. Survey of the areas of dense vegetal cover and habitat of wild life, which are under submerged were done simultaneously.

The data used for one such study come from different sources:

- GPS Locations of villages and socio-economic infrastructures;
- Socio-Economic data obtained by field interviews of affected local peoples;
- Taken Photographs of interviewed peoples.
- Data from Irrigation department

In the present research work, different instruments were used for data collection. These instruments were provided by Department.

GIS Mapping: Maps of dam was prepared with the help of GIS application Arc GIS 9.1 version. Also, the same application was used to calculate the area of Dam. To make main view map of Dam, GIS Software, Arc GIS was used. Arc GIS consists of Arc Catalog, Arc Editor and Arc view. In Arc Catalog, the shape files of all the dam were prepared. This shape files were then transferred to Arc view – Arc map and the mapping of the dam were done as well as areas were calculated.

Photography: Canon D 600 camera which was used for taking photographs during field survey of dam. These photographs used in my research study. Socio-economic impact analysis can be completed with a variety of tools. In this case, the socio-economic impact analysis is retroactive, and the research aimed to quantify impact that has already occurred across a broad population. A questionnaire is the most efficient option and examines the potential socioeconomic outcomes.

RESULTS AND DISCUSSION

Atal Sagar dam is major project of Madhya Pradesh. It comes under the Sindh project phase-II. It is constructed over the Sindh River. Construction work of Atal Sagar dam was started in 1978 and completed in 2008. At the time of construction of Atal Sagar Dam, 13 villages were come under affected area by the dam so these all 13 villages were relocated on other places (Table 4). Theses villages were Raipura majra (Madikheda), Shounsha, Binoga, Bamanoua, Khajuri, Dehari, Uadwaha, Kanthi, Mitloni, Dangipura, Aamola, Karmai and Rasoi. At this

time about 10 villages are located nearby Madikheda dam. Their names are Dhamkan, Nahargarh, Eravan, Uakayala, Aamol Path, Kalyan Pur, Madikheda, Pava Pachfediya, Chapura and Tuki (Table – 3). In these villages about 9250 (Aprox.) peoples are reside and they have about 7520 acres farmland for cropping. Peanut, Rice, Pea, Wheat, Gram and Mustard mainly crops of in this region grows. Dhanzayme, Uttam and Persuit pesticides use in area nearby Atal Sagar hydroelectric dam. Fertilizers uses in cropping for earn more income and these chemicals are Natural fertilizer, Urea, DAP (Di Ammonium Phosphate) and Super. In season of Statues immersion dam authority does not permitted to allow statue immersion in Atal Sagar Dam but dam department permitted allow to statue immersion in other places like Rajgarh far from Atal Sagar Dam. At the time of Construction work of Atal Sagar Dam provided the job opportunity to local peoples. At the time of the dam construction there are weighty losses of forest, because, the reservoir submergence would entail loss of 3100.00 ha of forestland of which 1658.45 ha is a part of the Madhav National Park (MNP). Unlike Kanha National Park, MNP is the oldest national park of Madhya Pradesh. The park was set up in 1958 with a total of 165.32 sq. km. In 1982, the total area of MNP was extended up to 346.6 sq. km. It is situated close to Shivpuri town. The area of MNP was part of the former Royal Shooting preserve of the Maharaja of Gwalior.

Uses of Madikheda Hydroelectric Dam

Hydroelectricity: Atal Sagar Dam is multipurpose project in Shivpuri region and it is only single hydroelectricity dam in Shivpuri region. 1.4 billion Electricity unit production from the 60 MW hydro power capacity power house generated per year, which help for peak power availability for the region. The revenue at the present rate is Rs. 4.2 billion. The installed capacity of the dam is 2.40 MW and annual generation is 60 MW. The dam helps to electricity supply in Shivpuri and its surrounding districts. The total cost of the dam is proposed to 123.05 MW. It is a vital role play in making electricity and also improving the economy of Madhya Pradesh.

Fish Culture: This Dam can be cultured include Catla (*catla catla*), Rohu *(Labeo Rohita),* Mrigal *(Cirrhinus Cirrhosis).* The total fish production from the dam could be of the order of 142 T/year, generating revenue of Rs. 8.52 million. About 150 fishermen families can also maintain their income from Dam fisheries/resources.

Figure 4. Fishing in Atal Sagar Dam

Irrigation: The Dam firstly used for electricity production but it serves the water as irrigation for Gwalior, Datia, Shivpuri and Bhind district. Irrigation is big problem in Shivpuri area so for irrigation, government has proposed 4 canals (Table 2). These fulfil the irrigation requirement of Gwalior-Chambal region.

i. **Doab canal system:** The canal is drained from the Harsi Poshak Canal having 37.95 km length which supply irrigation facilities to 65 villages of Shivpuri district along with 20, 680 ha land.

ii. **Right bank canal system (Up to Mahuar River):** This canal is started from Mohini pick-

up wear having length about 32.76 km. It supplies irrigation water for 68 villages and 22, 968 ha land.

iii. **Uakayala canal system:** The source of this canal is Ukayala Sandal Reservoir, which is having the distance about 42.30 km and provide water for 34 villages and 16, 693 ha area for irrigation purposes.

iv. **Right bank canal system (after Mahuar River):** Samoha pick up bear is completed, and ready to provide water for irrigation purposes to 58 villages and 27, 112-hectare land of Shivpuri and Datia districts.

Figure 5. Irrigated Farmland near Atal Sagar Dam, Shivpuri

Flood Control: Flood in the rivers have been many a time playing havoc with the life and property of the people. Dams and reservoirs can be effectively used to control floods by regulating river water flows downstream the dam.

Bird habitat: Atal Sagar Dam is that place; attract the migratory birds for suitable habitat. Migratory birds come during at the time of winter season so Atal Sagar Dam is best habitat for birds and also so famous for migratory birds.

Table 2. Details of Canal System of Atal Sagar Dam

S. No	Canal Name	Canal Distance (km)	No of benefited Villages	Benefited Land (Hectare)
1.	Doab canal system	37.95	65	20, 680
2.	Right bank canal system (Before Mahuar River)	32.76	68	22, 968
3.	Uakayala canal system	42.30	34	16, 693
4.	Right Bank Canal System (After Mahuar River)	35.48	58	27, 112
Total		**148.49**	**225**	**87453**

Table 3. Villages around Atal Sagar Dam in Shivpuri

S. No.	Village Name	Population (Aprox.)	Dam	Land for Crops (Acres) (Aprox.)
1.	Dhamkan	300	Atal Sagar	200
2.	Nahargarh	250	Atal Sagar	170
3.	Eravan	400	Atal Sagar	150
4.	Uakayala	800	Atal Sagar	500
5.	Aamol Path	6000	Atal Sagar	5500
6.	Kalyanpur	300	Atal Sagar	350
7.	Madikheda	300	Atal Sagar	150
8.	Pava Pachfediya	250	Atal Sagar	200

9.	Chapura	500	Atal Sagar	300
10.	Tuki	150	Atal Sagar	-
Total		**9250**		**7520**

Table 4. Information regarding benefited districts by Atal Sagar Dam

S.No.	Benefited Villages	Irrigated Area (In ha.)	District
1.	193	62726	Gwalior
2.	157	65936	Shivpuri
3.	72	24591	Bhind
4.	31	8487	Datia
Total	**453**	**162100**	**04**

Table 5. Relocated people by Atal Sagar Hydroelectric Dam

S. No.	Affected Villages	Farmland (ha.)	Affected Families	Affected Year	Relocated Place	Tehshil
1.	Raipur Majra (Madikheda)	63.68	58	2003	Aadrash Gram Madikheda	Shivpuri
2.	Sonsha	32.5	13	2003	Kali Pahadi	Narwar
3.	Binoga	19.16	72	2003	Kali Pahadi	Narwar
4.	Bamanoua	26.18	1	2003	Kali Pahadi	Narwar
5.	Khajuri	72.02	72	2003	Rajgarh	Karera
6.	Dehri	90.34	5	2003	Rajgarh	Karera
7.	Uadwaha	47.51	-	2003	Basahat (Rajgarh)	Karera
8.	Kanthi	316.02	88	2004	Sunaaj	Kolaras
9.	Mitloni	140.32	83	2004	Sunaaj	Kolaras
10.	Aamola	370.01	438	2004	Shir Shood Tila and Ramnagar	Karera
11.	Dangipura	205.56	103	2004	Jagdoora	Narwar
12.	Karmai	155.52	117	2004	Shivraj	Pichhore
13.	Rasoi	27.04	72	2004	Hinotiya	Pichhore
Total		**1565.86**	**1122**			**5**

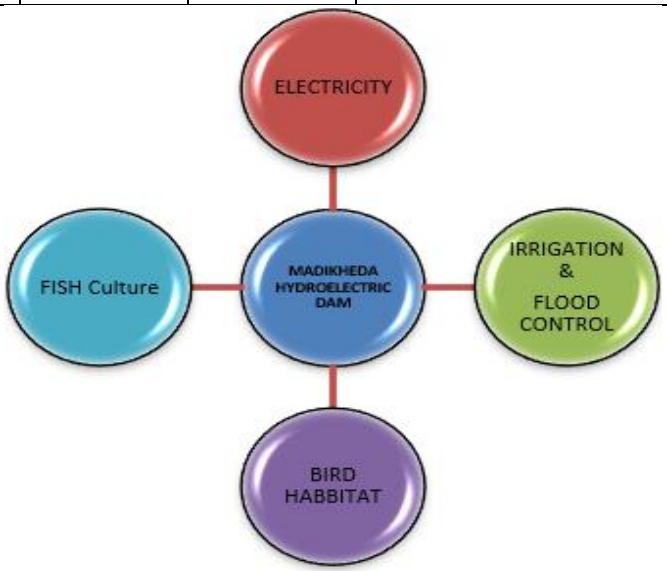

Figure 6. Positive Importance of Atal Sagar Hydroelectric Dam (Madikheda Dam)

The multi-purpose dam projects in worldwide have extremely improved the entire development processes of the region and most of the countries having developed stage of their economy only after successfully completion of these dam projects. According to the World Commission on Dams (WCD 2011), today there are over 50,000 large dams. It is estimated that 472 million people are affected downstream of a major dam because of the environmental changes caused by dam construction. Sedimentation due to build-up of river carried material behind the dam (especially in glacial rivers) can quickly reduce the dam lifetime, and significantly affect the amount of power produced. Sedimentation in the Sanmexia Dam in China reduced energy generation from 1,200$_{MW}$ to only 250$_{MW}$ after only 3 years. Annual average hydro plants in the USA produce only 46% of expected generation according to industry (McCully, 2001). In Shivpuri region, the dam has been observed sedimentation owing to constructed of Dam like Atal Sagar Hydroelectric Dam (Madikheda Dam). Transportation difficulties were also seen in the areas around most of the dam whenever there was a heavy release from the spillway which leads to the flooding of the low-lying roads around the surrounding villages. As the release of water from the spillway is an occasional event bridge construction across the streams is also difficult. The major dams in India have been responsible for 12 percent of the forest land losses during the period 1951 to 1985 (Shah 1990). Singh (1990) reported that big river valley projects have consumed 0.5 m ha of forest land between 1951 and 1976, roughly one-tenth of the area, which has benefited from irrigation. The direct impacts of construction activity for any dam and reservoir projects are generally limited in the vicinity of the construction station only during the construction phase. The construction site includes the dams and reservoirs site, canal network, power station along with borrow areas and places where grouting needs to be carried out. The main impact of construction activity on flora is mainly indirect. In the Atal Sagar Dam, a large population migrated in this area and their activity could cause significant loss of flora from the adjoining areas of the construction sites. At the time of construction work of Atal Sagar Dam (Madikheda Dam) project about 1122 families were relocated (Table 5).

The precise nature of destruction and its quantification is not possible as it depends on numerous undefined reasons. About 7, 000 workers including technical staff are congregated in the area during construction phase of Atal Sagar Hydroelectric Dam (Madikheda Dam). Dhawan (1986) reported that with the advent of canal irrigation, crop yields rose substantially. Irrigation is the support in increasing productivity as leads to boost in gross cropped area, gross irrigated area and flood grain production. It stabilizes production during drought years. Under the submerged area of the dam, the farmland is very less. Hence, the impact on the agricultural land due to construction of dams in submerged area is just negligible. While the command area of dam has the vast agricultural land, which is uncultivated due to lack of irrigation since the rainwater is not enough to cultivate the crops, therefore, most of time in the year, the land is remained fallow. Construction of canal, as they are already in operation, will supply ample water for irrigation purposes. In the second phase of the Atal Sagar Hydroelectric Dam (Madikheda Dam), 5 canals helped to four districts in terms of irrigation facilities for 162, 100 ha area (Table 4). Dam storage affords opportunity for improved recreation facilities, *e.g.* Vrindavan Gardens in Karnataka and Mallampuzha garden in Kerala. They have developed in increasing country's tourism trade. Dam projects improve the elements of local environment and success through infrastructural services. Highways and extension of railway lines connect the area with other centers of trade. The area where this dam is being constructed is already a tourist interest place. There are so many places of tourist interest in Shivpuri region. Madhav National Park in Shivpuri, and the Dam is being created will absolutely expand the tourism activities in the region. A tourist route can be developed for providing conveniences to the tourists. Water logging is also a threat which disturbed to local people who live

nearby the dam. This can be observed in the areas lying downstream to the dam. Singh and Rao, (2016) study revealed that Tigra reservoir attracts to migratory birds. Migratory birds come during winter season. Same as like Atal Sagar Hydroelectric Dam (Madikheda Dam) is also support to bird habitat for migratory birds that comes in winter season.

The Peoples of Shivpuri region did not actively participate in the development planning of the dam. This has largely contributed to failure by authorities to ensure the local communities gain maximum benefit from the dam. Public involvement in the dam construction also reduces the impact of uncertainties and stress caused by uprooting and resettlement. Thus, bottom up planning is necessary for the achievement of sustainable development. Fishers should also be provided with increased access to capital resources in order for them to purchase modern fishing gear. This will help them to reduce the incidence of drowning and being attacked by wild animals in the water among fishes. Further, aquaculture should be developed as a way of diversifying economic activities in the area. Aquaculture will also increase access to fish protein for the community. The policies should be framed by correct inspection of local sites so that the proportionate balance between biotic and its components of the environment can be maintained and the potential power of rivers can be utilized correctly. Before sanctioning any other power project, the World Commission on Dams recommendations must be taken into consideration, which has stressed four fundamental values regarding the dam building viz., equity, efficiency, participatory decision-making, sustainability and accountability. The non-governmental organizations (NGO) should come forward with full time participation to protect the environment and by taking appropriate strategies and to make the local people aware about their rights and environment.

CONCLUSION

The study has shown that Atal Sagar Hydroelectric Dam (Madikheda Dam) have both positive and negative socio-economic impact in Shivpuri region of Madhya Pradesh state in India. However, there is need to enhance the beneficial impacts and minimize the adverse impacts of the dam. The beneficial economic impact of the dam is the development of the irrigation scheme and the supply of water to the area near to reservoirs and other villages. Irrigation has the potential to boost local agricultural income through ensuring constant supply of water for crops throughout the year. The development of irrigation scheme is also an important mitigation measure against climate change. The benefit of Dam can be improved by using its water resources for the development of the hydroelectric power plant project. The hydroelectric power plant project would supplement the national power grid and contribute to the production of clean energy. The project could be beneficial from carbon trading as this will be one of the alternatives to achieving net carbon sink status. This will be a plus for combating global climate change and achieving sustainable development. Local communities should also participate in water resources development planning. This empowers local people so that they regard the development projects as their own.

Acknowledgements: Authors wat to thank to Conservation Biology Lab, School of studies in Zoology, Jiwaji University Gwalior.

REFERENCES

Dam Problems, (2011). World Commission on Dams, Presidential Inauguration Research Poster Competition.

Dhawan, B.D. (1986). Output impact according to main irrigation sources: empirical evidence from four selected states. Paper to present Seminar on Water Management-The key to development of agriculture. Indian National Science Academy, New Delhi

Fearnside, P.M. (1995). Hydroelectric dams in the Brazilian Amazon as sources of Greenhouse Gases. *Environmental Conservation*, 22(1):7. (doi:10.1017/s0376892900034020)

ICOLD, (1998). Computerized Version. International committee on large dams, Paris. World register of Dams.

Jiao, Y. Zhang, G. L., Li, D. X. (2004): China water conservancy advancing towards modernization-Tenth Five-year Plan. China Water Power Press, Beijing (in Chinese).

Liu, N. (2006): Study on project objective decision making. China Water Power Press, Beijing (in Chinese)

Mccully, P. (2001). Silenced Rivers: the ecology and politics of large dams. London: zed books.

Chen, S.H. (2015): Planning and Design of Hydraulic Projects, Hydraulic Structures, Springer-Verlag Berlin Heidelberg, (DOI 10.1007/978-3-662-47331-3_2)

Shah, R. B. (1990). Role of major dams in Indian economy. *In* B. D. Dhawan (ed.), big dams: claims, counter claims. Commonwealth Publishers, New Delhi, 105-125.

Singh, R. P. (1990). Water management: A crucial factor for a sustainable agriculture, *Yojana*, 16(31):6-18.

Singh, Y. and Rao, R. J. (2016). Usages of Reservoirs in Gwalior-Chambal Region in Madhya Pradesh, *International Journal of Global Science Research*, 3(6):406-420.

World Commission on Dams (1999). Options Assessment – Large Dams in India, IV, 5. Wikipedia (2014). Available online at www.wekipedia.org/wiki/2014_Beas_River_Tragedy

Source of Financial Support: Nil
Conflict of Interest: None, Declared.