



## Variable impacts on Environment during Construction and Operation of Dam Projects

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### ABSTRACT

Dams are playing a significant role in utilizing the resources of water and have a larger impact on the river ecosystem. It has an enormous deal of positive and negative effects on the environment in addition to their benefits like managing stream regimes, as a result preventing floods, obtaining domestic and irrigation water from the stored water and producing energy. The acute and chronic effects due to the construction of the dam are various and categorized according to the area, the services provided by the dams to the community and also its unsocial impacts, advantageous and detrimental impacts on nearby communities and to the aquatic environment. These consequences of the construction of any dam project may be commanded in a rigorous and complicated approach resembling climatic, hydraulic, biological, communal, intellectual, archaeological etc. The role of Dams and their benefits are much more and impact directly in our social and environmental life, but it is also a key point that we have to focus about the negative effects of these developmental activities and major and minor dam construction projects by the way of water resource engineering and sustainable development. Dams have the majority of significant functions in utilizing water resources. All through the history of the world, dams have been used successfully in collecting, storing and managing water needed to uphold civilization. Dams have a great deal of affirmative and pessimistic effects on the environment. The advantages are also varying from modest to many folds to the community like controlling stream regime as a result of preventing floods, obtaining domestic and irrigation water from stored water and generating energy from hydropower. Whereas dam endows with significant benefit to our civilization, their impact on the surrounding includes resettlement and relocation, socioeconomic impact, environmental concerns, sedimentation issue, safety aspects etc. Over and above their incredibly important communal and ecological benefits, it is significant to moderate the negative effects of the dam on the environment regarding sustainable development.

**Key words:** Dam; Environment; Water Resources; Hydro Power; Flood; Aquatic Ecosystem

### 1) INTRODUCTION

Water is the essential resource to maintain all existing communities on the earth and its scarcity will have various direct and indirect impacts on each and every life forms of ecosystem [1]. But it is very unfortunate that this life saving natural resource is not uniformly distributed in all over the planet by season or else by location [2]. And the boom comes in the present era on worldwide due to dam projects and its developmental activities will complex it manifolds because the dam projects have many positive and negative impacts on human life and its related environment [3]. The positive impacts of the dam projects include that they mitigate the demand of drinking water at appropriate time and durability; it regulates environmental flow regimes, and have a major role in the growth and development of human civilization and overall

development of the world's metropolitan cities, its industrialization as well as in agriculture practices [4]. The need and demand of water is ever increasing at the present time due to rapid urbanization and industrial accomplishments. The increase in the world's population will also trigger the demand and unsustainable use of these resources along with developmental activities will put more pressure on this natural resource [5]. The reservoirs structured by these dams are storing a quantity of almost 3,600 km<sup>3</sup> of palatable water. The world's highest dam is located on Yalong Jiang River in the China measured 305 meters, while the tallest dam in India is on the Bhagirathi River, near Tehri, in Uttarakhand named as Tehri Dam measured 205 meters. Hirakund dam is the

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longest dam in India, about 26 km in length constructed across the Mahanandi River, almost 15 km from Sambalpur in the state of Orissa.[6].

Dams have been constructed in order to check floods, to provide drinking and domestic water, to generate energy and for irrigation purposes since the old times [7]. It is well established that the construction of large and small dams and small irrigation channels of rivers in countries worldwide have a common potential aim to benefit and mitigating the objectives which are drinking water supply, provide water for various agriculture activities, generating hydropower energy along with controlling flood and quality and quantity of water [8]. The supplementary advantages include that they can also be utilized for recreational and navigating purposes. Besides all the surpluses, dams hold possibilities of substantial damage to the environment along with changing physical and chemical properties of water body and economical and social impacts, noise pollution and negative impact on aquatic flora and fauna along with the human beings, Over and above their advantages such as meeting essential requirements of the society and increasing living standards [9]. Almost 700 dams were built each ten years up to 1950s. This number grew speedily subsequent to 1950s. At the same time as the dams were built and completed it was observed that there was somewhat missing and disadvantageous prospects. Even though the effects of water on human life and the improvement of civilizations are distinguished all over the world, it is claimed that the economical profits expected from the projects designed to develop water resources could not be gained and also required precautions to diminish the environmental, economical and social losses were not taken. Even some studies aiming to block these water contributing projects of the developing countries are carried out by some international organizations [10, 11].

## **2) POSITIVE IMPACTS OF DAM ON THE ENVIRONMENT**

### **Fulfilling the demand of water for Domestic and Industrial Use**

One of the essential requirements for socio economic growth in the world is the availability of sufficient quantity of water with the suitable capacity. The worldwide per capita the water demand is expected to about 750 liters per day in the year 2000, when the world population will be just over 6 billion. Appropriately planned, designed, constructed and maintained dams contribute significantly in the direction of fulfilling our water supply requirement. The principal source of fresh water supply is from precipitation [12]. Of the total precipitation, only 1/3 remains for runoff in our rivers, the rest is lost to infiltration and evaporation. Only 36% of this runoff is obtainable for utilize. To accommodate variation in the hydrologic cycle, dams and reservoirs are needed to store water and then provide consistent yearly supply [13].

### **Effects of dams on hydraulic system**

The most important hydraulic effect is the discharge of the collection basin to a stationary reservoir instead of a stream bed [14]. Therefore, an instant change will start

downstream; downstream of a stream dries partially or totally whenever the reservoir begins to accumulate water [15]. During this temporary or periodically repeating time interval, the hydrological balance can collapse; irretrievable death, vanishing and structural jumps are pragmatic in the water dependent ecosystem. Even though after this development the stream forms a new and vigorous ecosystem in this part of it, neither this new aqua balance nor the terrestrial ecosystem and even the ocean surroundings with the purpose of that if the stream at some point joins the sea have not the probable opportunity to retain their previous health [16,17].

### **Effects of dams on the atmospheric system**

Variations in moisture quantity, temperature and air body movements of air caused by the big stationary water body differentiate microclimate related to province topography. In adding simultaneously, regional scaled climatic changes can be observed. These adjustments may seem not very detrimental for human health, but they are noteworthy for many plants and animals. Their secondary effects influence human beings [18].

### **Effects of the dams on territorial biological systems**

Biological life of the river changes quickly both in the reservoir and in downstream [19]. The parts of the bio system that are having an effect on from the dam are the watered parts on the shore. During the filling works of the dam, while the lands continue beneath water the land part of the province decreases. On the other hand, the water-land boundary extends. Thus, plant, animal or human being settlement areas alternated [20]. Forests, agricultural areas may come under water. As the water altitude and levels discriminates now and then, some species starts living under these changed dynamics of water from time to time and adapt, in the tide zone. This area may turn to marshy land or riverbed depending on the soil structure. Water reservoirs have always been direct relation to its sediments of soil and nutrient, which were settled after floods in the downstream of the dam, change in a long period of time [21]. Moreover, the changes are also very crystal clear and significantly recorded in nearby flora and fauna, on agricultural lands and on the traditions of people in that particular region. These effects can easily become wider form some miles to kilometers after the vigorous developmental activities and dam construction.

### **Congregating the Agriculture requirements for Food**

One of the biggest utilizes of water on worldwide scale is agriculture irrigation. By the end of the 20<sup>th</sup> century it will be calculated for approximately 1147 liters per day per capita [22]. Since near the beginning of 1990s, below than 1/5 of the land suitable for agriculture in the world has been irrigated, and it has contributed about 1/3 of world food production. It is also presumed that about 80% of supplementary food productivity will come by the year 2025 through irrigated land. Most of the areas in need of irrigation are in arid zones, which represent a chief portion of emergent countries. With the increase in the rate of population worldwide, it is very necessary to conserve and sustainable use of water resources in

agriculture sector by improvements in irrigation technology and the construction of more reservoirs and dams to mitigating the demand of the world for food and nutrition fulfilled by existing agriculture activities [23, 24].

#### **Barrier of Floods**

Dams and reservoirs can be effectively used to standardize river level and flooding downstream of the dam by for the time being storing the flood volume and releasing it later [25]. The most effectively method of flood control is accomplished by a quantity of multipurpose dams strategically located in river basin. The dams are operated by an unambiguous water control plan for rooting floods through the basin without damage [26].

#### **Promotion of Recreational activities**

The tourism and recreational activities generate revenue to the country, so the pleasant appearance of reservoirs and dams for tourism has significant benefits, in addition to the other principle advantages of the dam. This is very significant in the areas where the natural surface of water is not ongoing. Recreational activities correlated with lakes, like boating, swimming, fishing, bird watching and scenery, are taken into consideration during the development stage, all together with the objectives accomplished to balance a project. The recreational activities of dams and reservoirs can increase the chances of tourism and more income generation [27].

#### **Development of Hydropower**

The energy and power is a basic need of life for performing day to day activities and also play a major role in industrial growth and development. Therefore, it is valuable to use the form of energy that is clean, proficient, reliable and generated by renewable means [6]. Hydro power meets all these requirements. in countries, where a vast amount of development still lies ahead, good condition often exists for renewable energy sources [28]. Technically most advanced and economical source of energy is hydro power. But it is estimated that till the time a smaller percentage of hydropower energy i.e. 20 % has been generated and utilized. Hydropower projects generate energy with a high rate of efficiency and without burdening future generation with pollution or waste [29].

### **3) NEGATIVE IMPACTS OF DAM ON THE ENVIRONMENT**

#### **Repositioning and Relocation**

From the beginning of the construction of large dam till the end of the construction and afterwards the migration or relocation and resettlement is a common negative impact faced by the millions of the people across the world which resulted in the loss of over million people's dwelling places and their own residence. Other than that the loss of huge precious archaeological and cultural heritages along with significant ecological alterations are some of the negative impact associated with the dam construction [30]. It is also calculated till the date, almost from 40 to 80 million people around the world have been permanently relocated from their native places as a result of dam construction.

#### **Earth's Crust and seismic activities**

During the construction and development of dams it is also notices that seismic activities are also takes place during or after fulfilling the construction, but it has not been scientifically proven yet experienced by nearby areas [31]. So, it's hard to examine that how such type of activities have put pressure on earths seismic zones and that what will be the negative impact of such activities on earth crust and life forms.

#### **Destruction to Aquatic Life**

The aquatic animals have a tendency to flow with the current present in the water body or in river ecosystem. The dam construction will create a hurdle in the free movement of aquatic fauna specially fishes [32]. The survival of dam means mortality for fish species and also reduction in their diversity which spends assured part of their life in the water bodies or in the flood gateways, turbine and pumps of elevated dams. A dam construction will break off these creature's movement and make a prime reason to travel them to the havoc and end results into deaths in masses. However, the bypass flow was designed to overcome this problem and reduce the causalities of fishes [33].

#### **Disappearance of Historical Places**

After impending under the reservoir, the archaeological and historical places along with geological and topographical places had lost their natural beauties forever [34].

#### **Weakening and deterioration of River**

Water releases from reservoir collectively with that obtainable a turbine regularly contains extremely little suspended sediments, and this in order can lead to scouring of riverbeds and loss of riverbanks. During the flow regulation in consequence of dam construction and other developmental activities, rivers get segmented and lost its natural existence and connectivity [35].

#### **Introduction of New Species**

According to ICOLD the temperature of water, salt and oxygen distribution may change vertically as consequence of reservoir formation. This may cause the generation of new living species and the replacement of original environment [36, 37].

#### **Effect on Human existence**

The occurrence of many diseases such as typhus, typhoid, fever, malaria and cholera due to wood and trash during the overall activities performed in the dam will impact on human life and existence [38].

### **4) CONCLUSION**

Dams are considered as a strong modulator of river flow, alongside capturing both high and low tide of flooded area, power generation, drinking and agricultural water demands along with tourism and navigation [39]. With a lot of negative effects on ecosystem and human kind we would never deny the role of dams and reservoirs to fulfil the everlasting demand of water at appropriate amount and time to conduct the activities of daily life, as it is impossible to sustain the life without the supply of water, food and energy resources [40].

The challenge is that to utilize the dam and reservoirs with the improved technological interventions and sustainable management systems in near future and reduce their negative impacts [41]. The negative effects of the dam will be reduced or resolved by the proper planning and decision making that involves the public interference and inputs in the early stage of planning and construction and operational activities of any dam project [42]. The power generation from the dams will be able to enhance the industrial activities, meanwhile, it reduces the risk of flood for the population living in the downstream [43]. In comparison to harms and benefits of dam construction over a long period of time it will be concluded that the force of the negative impact will be reduced because of the various advantages indulges in the near future [44].

But these large structured dams supposed to be reminding us that we have to focus not to alter any component of the ecosystem as all the food chains and trophic levels are interconnected with each other [45]. By altering any one of the component in the system will destroy or extinct the whole ecosystem and create imbalance between the components present in the system. By considering these important facts the Environment Impact Assessment is compulsory from the preliminary to final stage of any dam construction [46]. The reaction of the disturbance or imbalance will result in big devastations, so it's better to consider each and every sensitive response of this ecosystem and our mother earth. Sustainable development is the key to overcoming with all the negative sides of constructing large and small dams [47].

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