

## **ENVIRONMENTAL IMPACTS OF CHOTIARI RESERVOIR CONSTRUCTION ON COMMUNITIES AND NARA DESERT ECOSYSTEM, SANGHAR, PAKISTAN**

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**Abstract:** The goals of sustainable development can be achieved through serious implementation of environmental impact assessment process and better decision making but this potential is hardly used in most of the under developed country i.e. Pakistan. Pakistan is an agro-based country supported by the availability of fertile land and Indus Basin Irrigation System. The rapid unsustainable growth and extensive expansion in the agri-sector has resulted in debacle of natural ecosystem, its environmental services and the livelihood of poor folks are at great risk. This article discourses the root causes of weak performance of EIA in this sector by discussing the case of Chotiari Reservoir, where unwise decision-making led to the destruction of habitats, biological diversity, ecological services, agricultural lands, and livelihood resources. The results show that the degradation of livelihoods of local community i.e fishermen, mat makers and farmers has increased the biodiversity devastation process in the region. The purpose of this article to discuss the deficiencies and limitations in the country's EIA framework and to suggest way out to achieve environmental sustainability in the region.

**Keywords:** EIA, Indus Basin Irrigation System, Sustainability, Chotiari Wetland, Reservoir, Biodiversity, Livelihood and environmental destruction.

### **1. Introduction**

The government of Pakistan promulgated Pakistan Environmental Protection Ordinance (PEPO) in 1983, which was enacted to provide a basis for the control of pollution and preservation of the living environment. However government of Pakistan formulated Environmental Protection Act of Pakistan (PEPA, 1997) to safeguard natural and built environmental heritage of the homeland and Environmental Impact Assessment of major or minor development projects either public or private is obligatory under section 12 of it (Ministry of Environment, Government of Pakistan, 1997). The standard operating

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procedures of implementing EIA process was developed, approved and made it public in 1998. Later in 2000, EIA stipulations were amended and updated for initial environmental examination (IEE) or environmental impact assessment (EIA) (Government of Pakistan, 2000).

EIA outline was developed purely on scientific basis with deficiencies such as without conceiving major changes in existing environmental and ecological conditions by diverting natural water into artificial lake and increase in water volume and without realizing its impacts on biodiversity and livelihood of fishermen, simultaneously, the EIA, could not deliver to accomplish the goals of environmental sustainability and unable to safeguard natural environment. This article debates a case study of reservoir construction in environmentally sensitive area of the Nara Desert, District Sanghar, Sindh Province, Pakistan resulted not only shrunken ecological habitat but also put limitation for poor local folks to utilize natural resources (Nauman, 2003). The purpose of this article is to analysis of overlooking of EIA process and its consequences on the biodiversity of Chotiari reservoir ecosystem.

## **2. Background of Reservoir Construction**

Pakistan lies in semi-arid climatic zone on global map and hold agriculture sector as economic backbone that gives major share in the gross domestic product (GDP), dependent on surface water resources of the country. During the Colonial Era irrigations, system was expended extensively in 20<sup>th</sup> century to boost up agriculture product and to expand cropping farmlands (Alam et al., 2007). Initially concept of flood irrigation was introduced not only for growing crop requirement but also for groundwater recharge but the concept was miserably failed and resulted in water logging and salinity issue particularly in Sindh Province (Alam et al., 2007). To resolve these issues, Government of Pakistan in coordination with World Bank started to work in 1960s on drainage project to get rid of unwanted water from basin. After couple of decades in early 1980s Government of Pakistan realized that scientific strategies were necessary for environmental sustainability in the river basin (GoP-LBOD, 1998). Under the plan, the Left Bank Outfall Drainage (LBOD) project was implemented on the left bank of the Sukkur Barrage Command in Sindh, Pakistan. It was designed to prevent agricultural land from going out production because of salinity and waterlogging (EIA-LBOD). At the tail-end of the Indus river basin to provide drainage to 1.27 million acres in three districts (Nawabshah, Sanghar and Mirpur Khas) of Sindh Province (World Bank, 1984). Drainage

was not the only aim of the project and other gears were the Chotiari Reservoir and remodeling of the existing Nara Canal (GoP-LBOD, 1993).

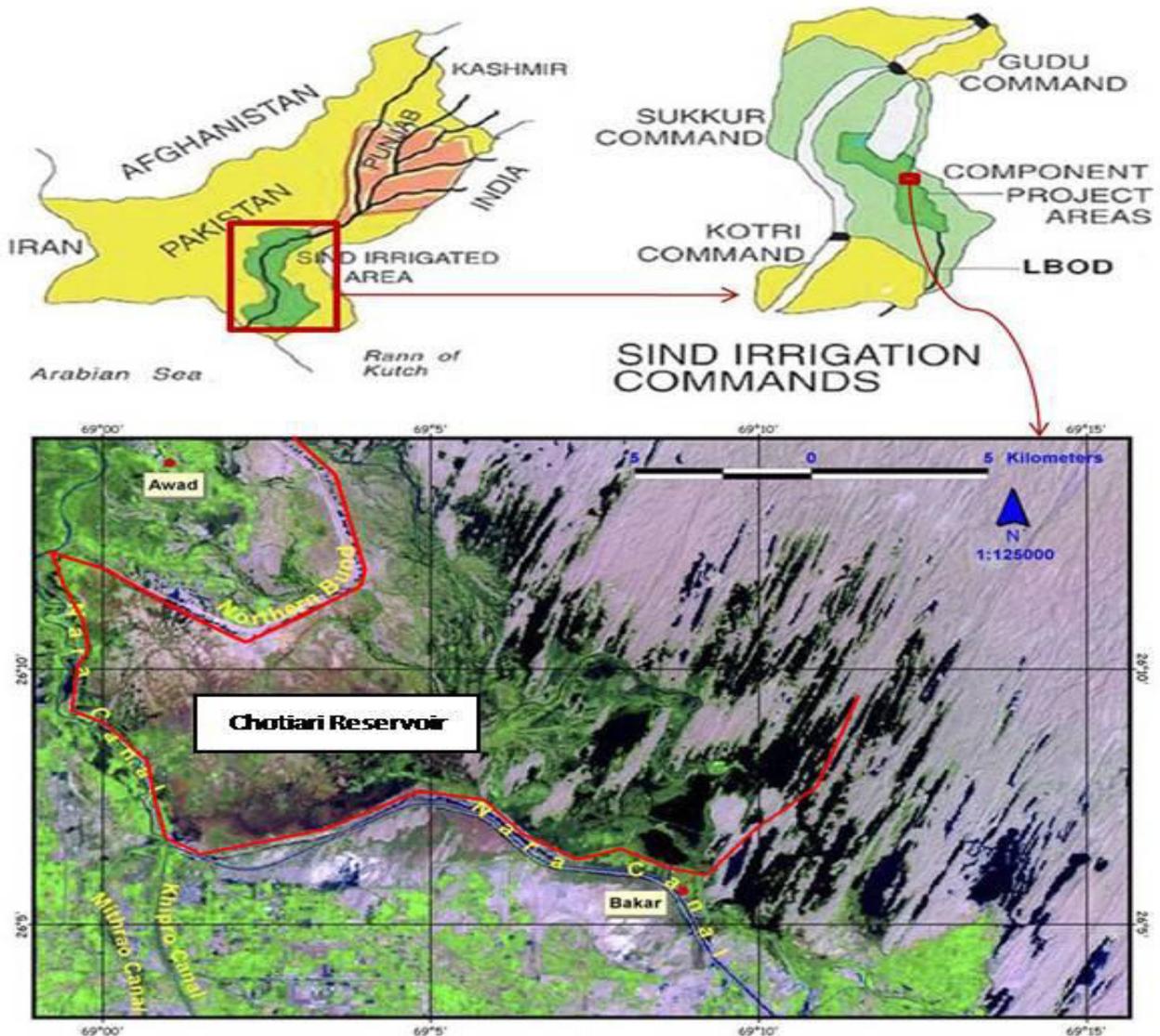
### **3. The Chotiari Reservoir**

Chotiari is located 15-20 km northeast of Sanghar District situated on the eastern side of the Achro-Thar (The White Sandy Desert) Desert, spreading over around 1,800 hectares and covering 30 kilometer area in Sanghar's desert zone.

The dam was designed with building stone-pitched embankment from one side, leaving the other three sides, which are open from sand dunes. It is an off-canal storage reservoir on Lower Nara Canal. This reservoir is built in natural depression and this area was bunch of lakes before its construction. The reservoir area was complex of around 60 small and big lakes, some of them are known as natural habitats of several species of Fishes, micro-vertebrates, birds, reptiles, and small mammals. The lakes were also supported by *Typha angustata*. The desert borders the reservoir naturally on the eastern side while the other side embankments were constructed mainly along the left bank of Nara Canal (Project EIA, 1998).

The open water area of present lakes was 4,000 hectares with some seasonal variations while the enlarged reservoir would raise the open water surface to 18,210 hectares at 87.5 Foot Elevation Contour (FEC) the maximum storage level. Nara Canal, off-takes from Indus River at Sukhur Barrage, fills the reservoir through its Ranto tributary that makes an inlet to the reservoir.

To extend 2.5 times the water surface area of existing lakes and retain 0.71 Million acre-feet (MAF) of water at its maximum storage level, the enlarged Chotiari reservoir was designed. It has capacity to irrigate 60,700 hectares of cropland (Project EIA, 1998). During peak flow season in the late monsoon of Indus River, this reservoir is filled. In the dry months of winter from January to April, the water is released to irrigate in one of the two growing seasons of Pakistan. Ecological importance of the Chotiari reservoir is described in the following section of the paper.



**Map 1:** Chotiari Reservoir Location Map

**Source:** Figures adapted from FAO, 2002; Development of Research Programme in Irrigation and drainage in Pakistan- and remote sensing image from WWF-Pakistan, 2007; Preliminary Baseline Environmental Assessment Report under Indus Eco-region Conservation Program.

### 3.1 Ecological Importance of Chotiari Reservoir Project Site

The Chotiari Reservoir area was a unique habitat of wetland and open water, riverine forest, deserted scrubs and sand dunes.

Chotiari wetland supports a rich biodiversity with wonderful wetland complex. The Chotiari wetland also supports farmlands, pastures, grazing lands. Despite a very hot and arid climate the Chotiari wetland area is biologically most diverse and rare in the region. A variety of faunal diversity exists here that includes 14 species of large mammals, 19 species of small

mammals, 109 species of birds, 58 species of reptiles and amphibians and about 53 species of freshwater fish (WWF-Pakistan, 2008).

The area also maintains refuge to various important and endangered species listed in the IUCN Redlist. Endangered species of Hog Deer (*Axis porcinus*) and Fishing Cat (*Prionailurus viverrinus*) and two vulnerable species of Chinkara (*Gazella bennettii*) and Smooth-Coated Otter (*Lutrogale perspicillata*) are among mammals. Where as in avifauna two species are of great concern i.e. Marbled Teal (*Marmaronetta angustirostris*), a worldwide vulnerable migratory bird, visits and breeds in the area and Pallas's Fish-Eagle (*Haliaeetus leucoryphus*), also an internationally vulnerable bird, exist in the area. The Marsh Crocodile (*Crocodylus palustris*) is most important and globally endangered species also resides in this area. A survey was conducted by Zoological Survey of Pakistan in 1997, which disclosed that 50 marsh crocodile inhabit the Chotiari lakes, and the endangered species of marble teals also reported in the wetland area (LBOD-EMP 1998). A total of 50-200 number of species populations has been recorded so far by various national and international environmental organizations including WWF-Pakistan (WWF-Pakistan, 2008). Chotiari might be the biggest habitat of Marsh Crocodile in Pakistan (Hafeez, 2006). Following part of the article will account about EIA report overview of the Chotiari reservoir and its current status.

### **3.2 EIA Report of the Chotiari Reservoir Project: Overview**

The EIA of Chotiari Reservoir Site was conducted to assess the possible impacts on natural environment of the area establishing sound baseline but it resulted with deficiencies to highlight impacts. The negative aspects include risks to Hog Deer (*Axis porcinus*) and important species of the area due to loss of their habitat but unable to draft any tangible mitigation plan. It did not conduct research on peripheral habitats nor determines their carrying capacity for relocation of displaced fauna, yet the availability of adjacent habitats were given as justification for habitat loss (Nauman, 2003). The EIA report states that Marsh Crocodile and Waterfowls would get benefit due enlargement of reservoir due to seasonal flooding. Nevertheless, this statement is questioned as nesting and eggs of marsh crocodile would be at greater risk when seasonal flooding would touch the habitat area (Santiapillai et al., 2001). At the same time submerged reed beds and swamps would not provide suitable resting place for waterfowls, especially Marbled Teal is not adapted to widening of the lakes (EC & Birdlife, 2008).

The Chotiari wetland area was also historical importance. There were ten historical lakes i.e. Bakar, Ganwari, Tajar, Phulel, Sao Naro, Seri, Makhi Ageo, Nimwari and Pokhial converted into artificial manmade lakes. Some of the lakes were connected some were separated by dunes and reed bed.

The EIA was also incapable to determine the change in reef beds and swamps, which were supported to nursery for the fish fingerlings. Fishery is the biggest livelihood for the fishermen, the EIA also lacking the change in fish and its direct impact on fisherman's livelihood. Overall EIA report was unable to trace multi-layered impacts on ecological diversity of the Chotiari Reservoir area. Due to submerging of riverine forest, many resident birds lost their tree nesting and migratory birds also lost their roosting place when they visit this area during winter. Inundation of rangelands in the reservoir has put great pressure on carrying capacity of the remaining pasture lands which are the main habitat of endangered species Hog Deer. If we examine the crux of the EIA report then it would be revealed that, it was unable to assess any substitute sit or option. Chotiari project site is prone to high evaporation rate and seepage due to harsh climate of the desert and it did not justify being reservoir site.

Above all, the EIA was unable to disclose the impacts either positive or negative on livestock, grazing, non-commission of reservoir, impacts of loss of vegetation, important changes in biodiversity and impacts of livelihood on fishermen, farmers and herdsmen.

### **3.3 Current Situation of Chotiari**

It was dilemma of the EIA, which was developed based on positive impacts rather than negative impacts and it was assumed in the EIA report that Chotiari Reservoir would be operational as per design. A few socio-economic benefits were also highlighted, since it was proposed that Chotiari Reservoir would provide much increased off-stream storage from Indus during the flood season. It was anticipated that there would be 25 percent increase in cropping intensity, benefiting some 120,000 households, most of whom derive a substantial proportion of family income from sharecropping. The inflow to Chotiari Reservoir is varying from year to year; however, maximum design inflow is 6500 cusecs. (LBOD Consultants-Pre Design Report; Chotiari Reservoir, 1998).

However, with storage capacity of around 0.71 million acres feet (MAF), it was built to provide livelihood to farmers' of three districts namely i.e. Sanghar, Mirpur Khas and Umerkot and local fisherfolk as well. Unfortunately, the Chotiari reservoir has failed to get

adequate water. The construction of the reservoir was completed in 2002, it was filled only once during 2006 floods. Since then it never received enough water.

The construction of Chotiari reservoir has resulted in long-term socio-ecological tragedy for local farmers, fishermen and herders. Simultaneously ecological niche of rare and endangered species has been suffered from considerable losses and became fragmented.

The most important and globally endangered species of the complex wetland site is the Marsh Crocodile (*Crocodylus palustris*), Marble teals (*Marmaronetta angustirostri*) and Smooth coated otter (*Lutra perspicillata*). The manmade activities such as construction of reservoir embankment and merger of important lakes, resulting the system in isolated wetland pieces, loss of fish, loss of vegetation and this scenario triggered the environmental disasters.

WWF-Pakistan with local community-based groups has been focusing on recovery of endangered species, sustainable rangeland management, promotion of sustainable fishing practices, management and control of seepage, provision of alternate energy and reforestation for the growth and improvement of livelihood.

There were herder families, enjoying separate states for their livestock. But gradually, they are facing unfavorable conditions by complex alterations in the local ecosystem. These include. Because loss of vegetation, waterlogging and erosion has not only shrunk grazing fields and islands, but it is also threatening to the life and livelihoods of communities and disturbing wildlife. The next section will describe about overlooking impacts of EIA on Nara Desert Wetland Complex.

### **3.4 Impacts to Nara Desert Wetland Complex**

The Chotiari wetlands have had an importance in region, since; it is an ecologically rich area and unique wetland complex. It is characterized by mosaic of diverse habitats of riverine forest, freshwater lakes, agricultural lands, rangelands, sand dunes scrub, reed beds and swamps.

The project has not only generated major negative ecological influence, but also created socio-economic consequences on local communities and farmers of three districts i.e. Sanghar, Mirpur Khas and Umer kot.

Rise in water level of reservoir has inundated and damaged riverine forest resources and similar affects have been observed on rangelands that resulted in vanishing of rangeland floral species and fodder for livestock. Seepage from western and southern areas has inundated fertile agricultural lands that resulted in waterlogged, salinized and barren due to

increased water level in the reservoir. Unsustainable and overfishing are the main cause of gradual depletion of reservoir fish stock.

The livelihood sources i.e. agricultural land, fishing from lakes and pasturelands have been miserably affected due to reservoir construction. The construction was also caused displacement of 993 families and their livestock (Magsi et. al, 2012). The project further exacerbated negative impacts on the habitats, fish catch, agricultural lands, fodder for livestock, forest and associated biota that have been a major livelihood source for the area of indigenous people (Raza, 2009). Moreover, deforestation of Makhi forest, destruction of ecological beauty of wetlands, as well as increasing stress on flora and fauna of the area (Raza, 2009). Therefore, the substantial increase in the water level has drowned grass species, trees and the complex ecosystem around the lakes (Siddiqui, 2009).

As a result, affected people and thousand of herds created negative impact on surrounding existing wetlands, forest and other ecologically important places are converted into agricultural land and new settlements are created in the sensitive areas changing the land use dynamics of the area.

Before the construction of Reservoir, the lakes were highly enriched with commercial fishes of crap family such as *Lebeo rohita*, *Catla Catla* and it was major source of livelihood of fishermen. However, the current ecological changes in water regime has also brought the change in fish and now increasing the population of cat fishes instead of carp fishes. This change in the fish species has lost the income of fishermen. Already existing poverty among poor folks have been exacerbated due to limitations in their income sources and now local communities are switching their profession on marginalized natural resources, which has further aggravated adverse effects on the habitats and associated biota.

The project draft of Chotiari reservoir had claimed that once at full capacity it would irrigate 60, 700 ha of agricultural lands in winter cropping season but the scarcity of water at upstream of Indus River has never let it to achieve maximum water level in the reservoir. Approximately 30,000 ha of arable land in and around reservoir will be destroyed due to increased water level; this is assessed by various experts. Considering other factors of rangelands destruction, fish depletion, deforestation and biodiversity loss, one can envisage that the economic losses for this development are much higher than its benefits. The next section will conclude critical findings of this study.

This study has only reviewed biodiversity related aspects of the EIA, however other dimensions of the EIA in relation to Chotiari reservoir remains to be studied in the future research.

#### **4. Conclusions**

In Pakistan, after the 18<sup>th</sup> amendment Provincial Environmental Departments/ Agencies under Ministry of Environment are responsible to address environmental concerns and approval of both public and private projects. The same agencies are responsible for updating of environmental legislation and preparation of necessary guidelines.

In Sindh Province, The Sindh Environmental Protection Agency (Sindh EPA) is responsible to deal the issues. Unfortunately, the Sindh EPA is still unable to establish environmental guidelines related to EIA and Environmental Management.

Chotiari Reservoir is the one of example of many projects executed in Pakistan especially in Sindh province in which EIA has failed to address the issues of biodiversity, sustainability of natural resources and socio-economic rights of local communities. Moreover, overlooking of EIA has caused to destruction of healthy ecosystem of human wellbeing.

The project EIA can be characterized by absence of alternative analysis, poor evaluation of socio-economic impacts, faulty scoping of biodiversity impacts and non-compliance of mitigation measures.

EIA does not appear to be an effective tool to safeguard the environment and the socio-economic fabric of the communities in Pakistan (Aslam, 2006). In developing countries many loopholes and weaknesses have been identified in EIA framework and practice (Ahmad et al., 2002) that leads to bad decision making and Pakistan is not an exception in this regard. The country's legislative and guideline packages are much comprehensive but the obstacles to produce desired quality EIAs.

#### **5. Recommendations**

As the legal stipulations for EIA in Pakistan are well defined (Nadeem et al., 2008) and through the strict follow up practices can be detailed to get success in environmental management. The following recommendations can be implemented through strong political will and institutional sincerity to improve the quality of EIA to achieve good environmental governance.

- There is a dire need to enhance the capacity of EIA directorate of EPA-Sindh through providing enough financial and human resources.

- The participatory approach should be adopted of various stakeholders for EIA Review Committee.
- EIA officials of EPA should be strengthened with effective authority and resources.
- The preparation of EIA and implementation of Environmental Management Plan should be executed with effective inspection.
- PRA tools should be applied in EIA preparation and review process for better analysis and enhance the positive image of EIA.
- Registration and certification of consultants, their rating and ranking will promote a culture of competition and that will lead to good quality reports. If it can be coupled by training them to how to better address biodiversity in EIA by international experts in workshops and seminars will certainly help in achieving the desired goal of sustainability.
- Consultant and proponents should be encouraged to involve in public throughout the process of EIA preparation. Engineering consultants should be asked to involve a biodiversity specialist while conducting an EIA.
- Follow-up-procedure should strictly be adopted.
- Awareness about the values and importance of biodiversity should be raised among all stakeholders of EIA.
- Local public should be given access to courts for controlling and evaluating EIA and environmental mitigation matters.

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