

CONSTRUCTION OF DAMS ON KABUL RIVER AND ITS SOCIO-ECONOMIC IMPLICATIONS FOR KHYBER PAKHTUNKHWA, PAKISTAN

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Abstract

Pakistan and Afghanistan have planned various developmental projects on Kabul River System (KRS) with the intention to overcome water and energy deficiencies irrespective of ecological problems faced by Kabul River and socio economic complexities of each other. The objectives of this paper are to know the present uses of Kabul River and future potential of the river for construction of dams. Studies conducted during 1990-2010 revealed that the Kabul River has already been used for hydro power generation and irrigation by both the riparian countries, Pakistan and Afghanistan. Undoubtedly, it has a major role in uplifting the socio-economic condition of the farmer communities. But this heavy extraction of water has also posed some negative impacts on the river's ecology and surrounding community such as fishermen and people attached with tourism. Therefore, further construction of dams need technical hands with the idea not to bring further distortion in the environment. As per analysis of five years flow data recorded at Nowshera station, the flow rate during July-August rose above 1000 M³/Sec. Water received during this period of time can be termed as extra and can be allocated for storage. If Afghanistan constructs more dams on Kabul River or on its tributaries, it will have negative impacts on Khyber Pukhtunkhwa province. Three fertile districts, Peshawar, Nowshera and Charsada will be suffered in terms of productivity and crop yields. The diversion of Chitral River is good for Pakistan but not for Afghanistan. By doing so, Pakistan will be able to irrigate its eastern part, mostly fall in erstwhile Federal Administered Tribal Area (FATA), Dir and Charssada

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districts. But two fertile districts i.e. Peshawar and Nowshera will remain barren. In this way, diversion of Chirtal River cannot be counted as a good decision. It is therefore recommended to use the water after proper calculation by keeping in view both the agricultural as well as the ecological aspects. For this, both the countries are required to take the initiatives for identification of collective responsibilities/efforts and conserve the river by using it in a sustainable manner.

Key words: Kabul River System, Ecology, Hydro power, Irrigation, Prior Appropriation,

Introduction

Rivers are not only a source of economic development, but also have ecological importance. The ecological characteristics are dependent on the surrounding environment and vary from place to place and season to season. Changes in the surrounding environment and season mainly affect the river water quantity and quality.¹ Change in river's volume not only important ecologically but also economically.² Both the concepts, economic development and ecological changes are running parallel and are inter related and dependent.³ Therefore a careful hand of management is always required. Over use of water for economic development can bring ecological damages in the form of decrease in water volume and increase in pollution. That has not only negative effects on aquatic and terrestrial flora and fauna but can also add to socio-economic decline in the vicinity.

Rivers are important water resources with an estimated contribution of 0.0001% to the total global water budget and are considered as the most sensitive part of the hydrological cycle in terms of ecological sensitivity.⁴ Most of the rivers are flowing across the globe irrespective of political boundaries and is always a source of conflict.⁵ The same is the case with Pakistan, where majority of rivers have been shared with the neighboring

¹ Nafees. M., *Environmental Study of Kabul River and its Tributaries in North West Frontier Province* (Now Khyber Pukhtunkhwa), Pakistan. M.Phil Thesis, (Department of Environmental Sciences, University of Peshawar, 2004).

² Bunn, S. E., & Arthington, A. H. Basic principles and ecological consequences of altered flow regimes for aquatic biodiversity. *Environmental management*, 30(4), (2002): 492-507.

³ Mol, A. P., Ecological modernization and the global economy. *Global Environmental Politics*, 2(2), (2002): 92-115.

⁴ Peavy, H. S., Dowe, D. R and Tchobanoglous, G., *Environmental Engineering*, (Mc-Graw Hill Publisher, New York, 2015): 12

⁵ Giard, J., "Water Flows across Political Boundaries, Brings Conflict with it" *Dakotafire Magazine*, (2014). URL:<http://dakotafire.net/land/water-flows-across-political-boundaries-brings-conflict/6003/>

countries, India, and Afghanistan. Most of the countries have resolved such conflicts by signing mutually agreed bilateral agreements in the form of treaty. In such treaties there is always reflections of two basic doctrines i.e. prior appropriation⁶ and/or riparian law.⁷ The basic idea of prior appropriation is, not to harm development at one place at the cost of development at another place. The famous example is of great Nile River, flowing through ten countries. First treaty on Nile River was signed in 1929 between Sudan and Egypt. Over the years the treaty was modified 21 times with the idea to benefit all the ten riparian countries.⁸

Worldwide there are certain examples related to mismanagement of such international rivers. For instance, consider the case of Amu Darya (Amu River) and Syr Darya (Syr River) are common water resources of Central Asian countries. Both the rivers were feeding into Aral Sea. That had established a unique ecology in the region with special economic activities. These include tourism and fisheries related business. There were twenty four fish species of commercial importance. Study conducted during 1988 revealed that 20 species were disappeared completely. This is a clear evidence of negative change in term of ecology and economy.⁹ The upstream countries have trapped both the rivers for agriculture and hydro power generation that had created problems in Aral Sea and the down streams countries. Almost 90% of the Aral Sea has been dried. Physical and chemical characteristics of the remaining 10% Sea have been changed to an extent that it is no more habitable to support fish and other flora and fauna.¹⁰ In this way a unique habitat was lasted with the loss of significant floral and

⁶ The doctrine of prior appropriation, also known as the "Colorado Doctrine" of water law. The essence of the doctrine of prior appropriation is that, while no one may own the water in a stream, all persons, corporations, and municipalities have the right to use the water for beneficial purposes. The allocation of water rests upon the fundamental maxim "first in time, first in right"

⁷ As per riparian law, all owners of water frontage have rights to the water. Generally this doctrine works best in areas of abundant water where scarcity is not a serious issue. Owners must return the water to the water body, at least in theory. Running a water mill is clearly permissible. Watering crops is permissible even though much of the water soaks into the ground or evaporates. Filling a pond is debatable, especially if the filling interrupts the flow significantly. Extracting large amounts of water to transport elsewhere is not permissible

⁸ El-Fadel, M., El-Sayegh, Y., El-Fadl, K., & Khorbotly, D., The Nile River Basin: A case study in surface water conflict resolution. *Journal of Natural Resources and Life Sciences Education*, (2003): 32, 107

⁹ Micklin, P. P. Desiccation of the Aral Sea: a water management disaster in the Soviet Union. *Science*, 241(4870), (1988): 1170-1176.

¹⁰ Micklin, P., The Aral Sea disaster. *Annual Review of Earth and Planetary Sciences*, 35, (2007): 47-72.

faunal species. Not only this, the dried portion of the Aral Sea is a continuous source of particulate matter (dust) and sand dune migration in the vicinity.¹¹ The upstream countries, like Tajikistan and Kirghizstan are enjoying bulk of water and low cost electricity, but the riparian community of Turkmenistan and Uzbekistan were badly suffered. These include fishing community, and people dependent on tourism. Reservoirs constructed on Amu and Syr Darya have also been affected the agriculture land of Tajikistan and Kirghizstan in terms of water logging and salinity. Moreover its negative impacts can also be seen in the downstream countries like Uzbekistan and Turkmenistan. For the last so many years the riparian countries are in conflict with no visible solution.¹² Similarly Pakistan had signed a treaty on Indus water system with India in 1960. According to the treaty, management of three rivers i.e. Beas, Ravi and Sutlaj Rivers were handed over to India and three Rivers, Indus, Chanab and Jehlam were set free for Pakistan.¹³ This had got negative impacts on Ravi River. The river, which was famous for fish life, tourism and re-creation, now presenting a view of a drain. Not only this, during flash flood, India releases bulk of water in those river channels and inundate Lahore city and the surrounding regions. That has got negative impacts on Pakistan economy.¹⁴

¹¹ Whish-Wilson, P. The Aral Sea Environmental Health Crisis. *Journal of Rural and Remote Environmental Health*, 1(2), (2002): 29-34.

¹² Asian Development Bank. *Central Asia Atlas of Natural Resources*. (Central Asian Countries Initiative for Land Management Asian Development Bank Manila, Philippines, 2010).

¹³ Wolf, A. T., & Newton, J. T., *Case study of trans-boundary dispute resolution: The Indus water treaty*. Oregon State University College of Science. Program in water conflict management and transformation, (Institute for water and watersheds, 2008). < [http://www. Trans-boundary waters. orst. edu/research/case studies/Indus_New. htm](http://www.Trans-boundarywaters.orst.edu/research/casestudies/Indus_New.htm)>[Last accessed on 3ed October 2013].

¹⁴ Farzand A., 'Blood money' for flood victims. *India today*, 2010. URL: <http://indiatoday.intoday.in/story/blood-money-for-flood-victims/1/110454.html>

Kabul River System (KRS) falls in two countries (Fig. 1), Pakistan and Afghanistan and has got a big role in socio economic uplift. In Pakistan KRS decorate northern half of Khyber Pukhtunkhwa province. In Pakistan, The major contributing rivers include Chirtal, Swat, Panjkora, Jinday and Bara rivers.¹⁵ In Afghanistan the major contributing tributaries are Kunar (coming from Chitral), Paghman, Panjsher, Alingar, Loghar and Kabul River itself. Kunar or Chitrail River is the major tributary, contributing more than 70% of

Fig. 1: Map of Kabul River and its Tributaries in Pakistan



water.¹⁶ The main Kabul River coming from Sanglakh range was the large and central stream of KRS. This main stream is almost trapped for irrigation purposes only (Fig. 2). This is why Chitral River is the major perennial tributary that joins Kabul River at Jalalabad.

¹⁵ Nafees, M., Ghulam K and Khan S. Investigation of Chemical and ecological evaluation of Adezai River. *Peshawar University teacher association Journal (PUTAJ)*, 9(1), (2002): 77-82

¹⁶ Pakistan Defens. *India to help Afghanistan build 12 dams on Kabul River.* (2016). URL <http://defence.pk/threads/india-to-help-afghanistan-build-12-dams-on-kabul-river.108204>

Fig 2: View of Kabul River at Kabul City during winter

Pakistan has planned to divert about 40% of Chitral River (known as Kunar in Afghanistan) to Pajkora River during summer with the aim to irrigate District Dir and to decrease the hazard of flood caused by Kabul River in Charsada and Nowshera districts.¹⁷ If Pakistan divert Chitral River, the main contributing tributary, will have negative impacts on Afghanistan. If Afghanistan traps Kabul River or its tributary will have drastic adverse effect on Khyber Pukhtunkhwa province in general and particularly the three major districts including Peshawar, Charsada, and Nowshera can adversely be suffered up to greater extent.

Impact on Irrigation

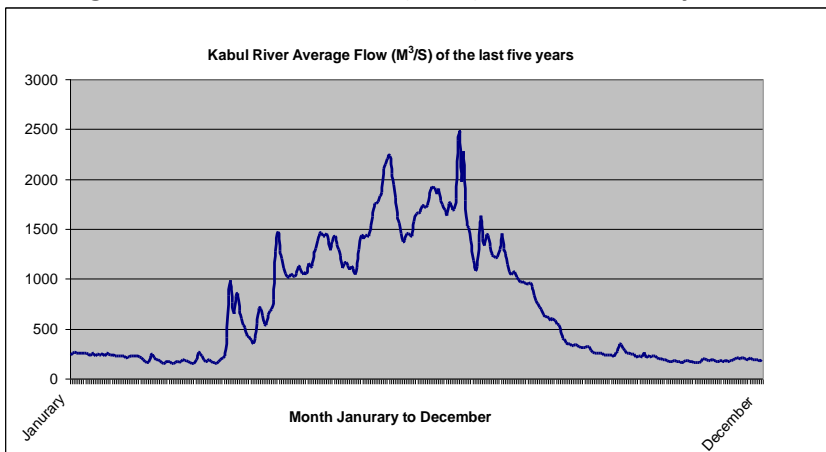
Kabul River System has got a great potential for irrigation. Afghanistan and Pakistan are agrarian countries and major part of population is dependent on agriculture. About 85% population of Afghanistan and 70%

¹⁷ Fateh G. Chitral River diversion to Panjkora River basin for reducing floods in Kabul River. *Fateh Gandapur's Blog on Water Issues of Pakistan*, (2012). URL: <http://fatehuk.blogspot.com/2011/03/chitral-river-diversion-to-panjkora.html>

population of Pakistan are dependent on agriculture.¹⁸ In Afghanistan 12% area is cultivable, 53% of which is irrigated and 47% is rain fed. Out of the total 53% irrigated land, 80-85% is irrigated by canal system, and 15-20% is irrigated by other means. In contrast, total cultivable land of Pakistan is 33%. Out of which 75% is irrigated.¹⁹

To achieve the maximum progress in agriculture, Pakistan has constructed five small and one large dam on Kabul River and its tributaries. Only Warsak Dam is on the main Kabul River (Table 1). This dam is irrigating three districts of Khyber Pukhtunkhwa. The dam provide water to the farmers for almost nine months (February- Oct) a years. During the month of Jun-August the flow rate rose above 1000 M³/Sec (Fig. 3). Water received at Nowshera can be termed as excess and is available for storage.²⁰

Fig. 3 Kabul River flow rate (M³/S) for the last five years



¹⁸ Amin, H., and G.S. Schilz. *A Geography of Afghanistan*” Center for Afghanistan Studies, 1976: 102-123 & Karim, D.K. *A Geography of Pakistan, Environment, People and Economy.*” (Oxford University Press Islamabad, 1991): 75-87

¹⁹ Karim, D.K. *A Geography of Pakistan, Environment, People and Economy.* (Oxford University Press Islamabad, 1991): 75-87

²⁰ Average flow rate is based on analysis five years data recorded at Nowshera station after joining Swat and Jindi Rivers. Therefore, this data can be interpreted for this station only. Similarly, minimum and maximums flow should be determine for each tributary i.e. Shalam, Naguman and Sardaryab

The present Government of Khyber Pukhtunkhwa had announced construction of 350 dams.²¹ It is not clear how many dams fall in Kabul River System. Eight dams are under construction and will be completed shortly. Out of this, five are on River Swat and fall in KRS.²² These dams will affect flow rate of River Swat and Panjkora with ultimate effect on the main Kabul River.

Table 1: Use of Kabul River System for Hydro Power and Irrigation in Pakistan

Dam	Purpose	Install Capacity	River
Warsak	Electricity+ Irrigation	343	River Kabul
Dargai	Electricity + Irrigation	Jaban= 20 Dargai= 20 Malakand III=81	River Swat
Amandara	irrigation	NA	River Swat
Munda	Irrigation	740 (planed)	River Khyalay (Swat+Pangkora)
Bara Dam (diversion)	Irrigation	NA	River Bara
Jinday (small Band)	Seasonal Diversion	NA	River Jinday
Source: Nafees, 2010			

In comparison with Pakistan, Afghanistan had constructed nine dams on KRS, four dams are on the main Kabul River System and five are on its tributaries (Table 2). Two dams are small i.e. Qargha Dam and Band-i-Amir. Qrgha Dam was constructed on Paghman River, the major tributary of Kabul River. Initially used for drinking water supply only. In 2008, Afghan Government with the help of US-Government extended its storage capacity to make it a multipurpose dam. Now, it is used for irrigation, hydropower

²¹ *The Daily Dawn*, 2014. 350 small dams to be built in Khyber Pakhtunkhwa. URL: <http://www.dawn.com/news/1101298>

²² Government of Khyber Pakhtunkhwa. *Annual Development Plan 2015-16*. (Ministry of Energy and Power department, Government of Khyber Pukhtunkhwa, Pakistan, 2015). URL: <http://kpkep.gov.pk/under%20construction.html>

generation as well as for re-creation.²³ The present power generation capacity is 26 KW and could be extended up to 103 KW. Due to this the downstream flow has been decreased to a greater extent. Paghman River was a major perennial tributary of Kabul River; therefore, most of the times the main channel of Kabul River near Kabul city remain dry (Fig. 2). Band-i-Amir was for recreation purpose and IUCN had declared this as a national park.²⁴ In this regards it has no negative effect on water quantity. Other seven dams are large dams and most of them are multipurpose. These dams, if fully operational will certainly have extra negative effect on irrigation and power generation capacity at Khyber Pukhtunkhwa.

Table 2: Use of Kabul River System for Hydro power and Irrigation in Afghanistan

Existing dams in Afghanistan		
S. No	Dam	River
1	Qargha Reservoir	Paghman River
2	Jabul-e-Seraj power and irrigation dam	Tributary
3	Asadabad hydropower plant	Kunar
4	Darunta power and irrigation dam	Kabul River Main
5	Sarobi-II hydropower plant	Panjshair
6	Sarobi-I hydropower plant	Panjshair
7	Naghlu hydropower plant	Kabul River Main
8	Mahipar hydropower plant	Kabul River main
9	Cahk-e-Wardak Hydropower plant	Kabul River main
10	Charkhar power and irrigation dam	Tributary

²³ Sultan, M, and Assadullah A. *New hydrological station at Qargha Dam to help manage Afghanistan's water resources*. (Food and Agriculture Organization, 2008). URL: <http://reliefweb.int/report/afghanistan/new-hydrological-station-qargha-dam-help-manage-afghanistans-water-resources>

²⁴ IUCN. *WCS Applauds Afghanistan's Declaration Establishing Entire Wakhan District as the Country's Second National Park*, (2014). <http://www.iucn.org/>

Planned		
1	Baghdara power and irrigation dam	Tributary
2	Kalagoosh power and irrigation dam	Tributary
3	Kama pwer and irrigation dam	Tributary
4	Gambiri power and irrigation dam	Tributary
5	Shahtoot dam	Tributary
6	Gulbahar power and irrigation dam	Tributary
7	Shah-wa-Arus pwer and irrigation bam	Tributary
8	Kunar Hydropower plant	Tributary

Source: Center for Afghani Study, University of Nebraska at Omaha

Catchments area of Kabul River System in Afghanistan is 60,6 thousands Km which is 9.3% of the total area in Afghanistan, out of which 81.74% is irrigated and 18.26% is rain-fed.²⁵ One-fifth of the geographic area of the Khyber Pukhtunkhwa is under cultivation (20%) and more than one tenth (10%) is wasteland.²⁶ In Khyber Pukhtunkhwa, 44% of the total cultivable land is under irrigation (Anwar, 1991). Kabul River irrigates the cultivable area of three districts i.e. Peshawar, Charsada and Nowshera. In Peshawar 80%, Nowshera 47.38%, and Charsada 84.67% cultivable land is irrigated form Kabul River. In terms of irrigation the total contribution of Kabul River to the total of Khyber Pukhtunkhwa is 16.92%.²⁷

When we talk about irrigation we consider water quantity only. The quality is usually ignored. Different studies reveal that suspended load is increasing day by day due to which canal cleaning is now a routine job (Fig. 4). Every year during November-February there is canal cleaning campaign.

²⁵ Amin, H., and G.S. Schilz. *A Geography of Afghanistan*. (Center for Afghanistan Studies, 1976): 102-123

²⁶ UNESCAP. *Integrating environmental consideration in to the economic decision making process*, Vol.-II. (United Nation Economic and Social Commission for Asia and the Pacific, 2002).

²⁷ Abida U. *Study of Kabul River Gravity Canal for Suspended Load Management and Mitigation Measures*. M.Phil Thesis, (Department of Environmental Sciences, University of Peshawar, 2010)

Among the studied water quality parameters suspended load is high.²⁸ Although, suspended load will increase soil silt and clay contents, and is always a source of micro and macro-nutrients, but is creating problem of siltation in canals, which create hurdle in irrigation.²⁹

Fig. 4 Canal Cleaning at Peshawar



Hydro Power Generation

Table 1 and 2 showed that both the countries, Pakistan and Afghanistan are using Kabul River for hydro power generation. Afghanistan has constructed four dams on main Kabul River stream and generating 180.8-MW electricity. In comparison Pakistan had constructed one dam on the main Kabul River stream i.e. Warsak Dam. Initially the installed capacity was 160 MW.³⁰ Due to deforestation and mismanagement of Kabul River Watershed there was increase in sediment load. That had got negative effect on the dam in terms of decrease in storage capacity. By the end of 1980 the

²⁸ Nafees. M. Role of Kabul River in Socio-economic Activities and Associated Environmental Problems. *Central Asia Journal*, 67, (Peshawar: Area Study Center, University of Peshawar, 2010): 101-112

²⁹ Nafees, M. and Asma A. Evaluation of Heavy Metals Accumulation in Different Parts of Wheat Plant Grown on Soil Amended with Sediment Collected from Kabul River Canal. *Journal of Agriculture Research*, 52(3), (2013): 383-394

³⁰ Nafees. M. *Environmental Study of Kabul River and its Tributaries in North West Frontier Province* (Now Khyber Pukhtunkhwa), Pakistan. M.Phil Thesis, (Peshawar: Department of Environmental Sciences, University of Peshawar, 2004)

reservoir was filled. The power generation was decreased to a minimum of 100 MW.³¹ It is worth mentioning the present generation is on natural flow. Further decrease in flow will decrease the generation rate. As Pakistan is already energy deficient and passing through energy crises. Therefore any further decrease will have severe negative impact and can enhance energy crises.

Impact on Fish Population

Kabul River was famous for its fish but a regular decline has been observed since 1992.³² Study conducted during early nineties reported that there were 156 native freshwater species in Kabul River System (Mirza, 2003). Out of the total fifty four species have been reported in Kabul River and thirty-five were termed as common along the entire stretch of Kabul River (Fazal et al. 1988). Recent studies revealed that the list came down to 10 species only. Out of 10 species, only two species are abundant two are adequate and six species are rare. The main causes of this decline are discharge of municipal, industrial effluent and construction of dams with percent potential threat of 15, 30 and 15% contribution respectively (Nafees, 2012). This heavy decline has got severe adverse impacts on fishing community living adjacent or near the banks of Kabul River. In 1970 fishing was the main occupation of the riparian community with 80% labor force. This percentage declined to only 20% in 2010.³³ A fisherman in early nineties (90s) has got his own business, now working as a labor with the hut owners offering fish along the bank of Kabul River (Fig. 5) or had changed their occupation. Further decrease in water volume or increase in pollution load may cause further decline in fish population.

³¹ Nafees, M., Ghulam K and Khan S. Investigation of Chemical and ecological evaluation of Adezai River. *Peshawar University teacher association Journal (PUTAJ)*, 9(1), (2002): 77-82 & Abida U. *Study of Kabul River Gravity Canal for suspended load management and mitigation measures*. M.Phil Thesis, (Department of Environmental Sciences, University of Peshawar, 2010)

³² UNESCAP. *Integrating environmental consideration in to the economic decision making process*, Vol.-II. United Nation Economic and Social Commission for Asia's and the Pacific, (2002).

³³ Nafees, M., Ahmad, T and Maria, A., 2011. A review of Kabul River Uses and Its Impact on Fish and Fisherman. *Journal of Humanities and Social Sciences*, XIX(2), (University of Peshawar, 2011): 73-84

**Fig 5. Huts Serving Fish at Saydaryab the major
tributary of Kabul River**



At Sardaryab site on Charsadda road there are numerous huts offering cooked/fried fish (Fig. 5). It is supposed that the fish serving along the river bank is captured/ collected from Kabul River. While as per survey conducted during 2010-11 revealed that 70% fish is coming from other parts of Pakistan that include Turbilla Dam and other fish farms of Punjab. Contribution from Kabul River (Sardaryab) was only 30%. Downstream of Warsak-Dam fishing is there but fish catch is very low. This decline is attributed to heavy pollution load received downstream of Budni- Sabi village near Akbar-pura till Khairabad, Attock .³⁴ Recent survey conducted in the same area, revealed that only 10% fish catch came from Kabul River and 90% is arranged from other parts of Pakistan. This polluted zone, established between the aforementioned places (Akbar Pura and Khairabad) is a big hurdle in fish breeding and work as a block zone for fish migration

³⁴ Nafees. M. *Environmental Study of Kabul River and its Tributaries in North West Frontier Province (Now Khyber Pukhtunkhwa)*, Pakistan. M.Phil Thesis, (Department of Environmental Sciences, University of Peshawar, 2004)

between Indus and Swat River. Further decrease in water quantity will decrease the dilution capacity with increase in pollution level. That is why this important economic activity may disappear or the contribution from Kabul River in terms of commercial fishing will decrease further and will affect the fish related business negatively.

Impact on Wild Life and Migratory Birds

Birds have got ecological importance and also playing a vital role in economy in terms of tourism and recreation. Kabul River and its vicinity works as a good habitat for local and migratory birds. In Pakistan about 170 types of birds' species have been reported in Kabul River System³⁵ with 65 migratory species (Altaf, 2013). Out of the total, 13 migratory birds are visiting Kabul River System (Box. 1). In 2008 a detail survey was conducted for 114 bird species in different parts of Pakistan. The survey revealed that the population of Shoveller, Mallard, tufted and shelduck is toward decrease and was termed as rear. Only Gull was found common. Gulls are mostly depending on fish population. As mentioned earlier, a visible decrease has been observed in fish species and fish population in Kabul River, therefore, the decrease in Gulls population is understood.³⁶ Decrease has been observed in bird's population is attributed due to habitat loss in terms of water quantity (due to dams) and quality (mixing of untreated Industrial and municipal waste water)

Box 1: List of Migratory Birds

- | | |
|--------------|---------------|
| 1. Pintail, | 2. Shoveller, |
| 3. Widgeon, | 4. Mallard, |
| 5. Garganey, | 6. Tufted |
| 7. Ruddy | 8. Shelduck, |
| 9. Herons, | 10. Lapwings, |
| 11. Egrets, | 12. Gulls and |
| 13. Terns | |
- (Ashiq, 1993).

³⁵ Saeeda, I. *Birds of Chitral*. World Wide Fund for nature, Pakistan Peshawar, 1999

³⁶ Durrane J., S. Hassan, A. and Ahmad E. Observations on the Birds of Sandspit/Hawkesbay Coastal Wetland Complex, Karachi Coast. *Pakistan J. Zoology*, 40(4), (2008): 229-237

Conclusion

Keeping in view the flow rate and its five year average data revealed that discharge is at minimum during Sept – April. Any further decrease in flow rate during this period will have economic as well as ecological complications. During July and August the flow rate as well as discharge rate rose above 1000 M³/S and is the only part of the year in which the excess water can be stored.

There are already 12 dams on Kabul River System out of which 5 (1 in Pakistan and 4 in Afghanistan) are on the main Kabul River. That has up lifted the economy at the cost of river ecology. All developments, past and future, are irrespective of ecology of the river and its surroundings. The environmental resources have already been affected negatively to a greater extent. Construction of more dam, in any country, Pakistan or Afghanistan, on Kabul River main stream or diversion of any tributary will have negative impacts on Pakistan in general and Khyber Pukhtunkhwa province in particular. In the light of aforementioned arguments and discussions it is concluded that water quantity is the main focus. Water quality was seldom or never considered. Kabul River is a common property of both the countries and both have got the right to use it for economic up lift. But no country has got the right to degrade it. It is therefore recommended that both the countries should join hands for its protection, conservation and focus other economic and ecological activities such as fishery, eco-tourism, recreation and watershed management which primarily associated with River Kabul. The following are recommended for conservation of Kabul River and its future uses.

Recommendations

Both the countries, Pakistan and Afghanistan are required to join hands and think about the conservation of Kabul River. Identify responsibilities, such as watershed management, forestation, and pollution abatement and make the river productive for the riparian societies. To overcome threats to Kabul River, both the neighboring countries are required to sign a treaty on Kabul River by considering the following points.³⁷

Geography of the river; how much territory fall in Afghanistan and how much in Pakistan. What are the present conservation measures adopted by each country and how to make these measures more effective?

³⁷ Mimi, Z.A. and B.I. Sawsalhi. A Decision Tool for Allocating the Waters of the Jordan River Basin between all Riparian Parties. *Water Resources Management*, 17(6), (2003):447–461

1. Hydrology: How much water is contributed by each country? What is the seasonal decrease/increase and what amount can be stored.
2. The climate: Climate affects availability of water and its usage. As the sources of Kabul River are glaciers. Therefore, in winter its availability and use is minimum in both the countries. Therefore the peak timings should be identified for water storage.
3. Past utilization of the water; this is usually discussed under the concept of prior-appropriation. Afghanistan will use the available surplus water with the idea not to damage the economic activities in Pakistan. Similarly Pakistan will use Chirtal River in such a way that could not harm Afghanistan.
4. Needs of the riparian community of the basin countries: People in both the riparian countries are directly/indirectly dependent on Kabul River. Up till now there is no such research or study that can clear this point. Therefore, there is a dire need for conducting such studies and focused it appropriately.
5. How much population was/is dependent on Kabul River System? Development at one place will affect what population at another location.
6. The comparative cost of alternate solution should be calculated. If Afghanistan traps the whole river, what alternate or second option exists with Pakistan and if Pakistan diverts Chitral River, what options exist with Afghanistan and what will be the cost in terms of economic and environmental/ecological consequences of those options. This will clarify the feasibility of the various alternatives and the management of Kabul River in its original form.
7. There is a need to explore alternate resources. Is there any other water body or any other option for irrigation and power generation? If yes why not to use those, if no, what to do with the present resource? Besides fishery, forestation and tourism are also income generating activities and should be properly evaluated.
8. What should be the minimum flow in the winter and summer with the objective not to harm the socio-economic and ecological status of the river in both the countries?

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