Repercussion of meagre flow of the lower Indus River

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Abstract

This study was intended to gauge seawater penetration in the lower Indus region and an overview on economic, social and ecological snags including (i) agriculture which is occupation of over 60% population residing in the Badin, Sujawal and Thatta districts of Sindh (ii) The escalating freshwater scarcity is leading to either displacement of populations or forcing them to live below poverty line due to the diminishing cultivable land (iii) People switched from agriculture profession to fisheries (iv) The lack of access to quality drinking water and the presence of unsuitable underground water pose significant health hazards (v) No-water in lower Indus region has damaged river and estuarine ecosystem that provide geo-ecological services (vi) Since long meagre dischargement of sediment reached toward delta permitted seawater to penetrate thousand acers of cultivable land into saline soil.

The most affected dehs of Thatta district include three Talukas Mirpur Sakhro (14 Dehs), Ghorbari (7 Dehs) and Keti Bunder (31 Dehs). Three dehs Milko, Pirpathai and Pumbri of Mirpur Sakhro are completely under sea water and out of agriculture. Sea water inundation has badly affected Ghorabari Taluka over thirty-two-thousand-acre land of seven Dehs are now briny. Thirty-one Dehs of Taluka Keti Bunder are completely barren. Badin district is divided in two talukas (Badin and Shaheed Fazil Rahu) and ten Dehs namley, Babralo, Dharan, Warayo, Sando, Patiji, Thath, Siantri, Khudi, Palh, Ahmed Rajo, out of which three dehs Babralo, Siantri and Ahmed Rajoare completely barren in a limited period of (2008-2018). Overall outcomes of this study

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reveal that southernmost region of Sindh encounter rampant seawater penetration. Hence, the construction of solid infrastructure such as coastal highways, dense forestation, reinforcement of coastal banks in affected areas, and ensuring continuous freshwater flow towards lower region imperative.

Keywords: Seawater penetration, increased uncultivable land, reduction in fisheries potential, lower Indus riparian.

Introduction

Indus River is a principal river of Pakistan stretches from Himalayan Mountain in the north to the dry alluvial plains of Sindh, Pakistan in the south and finally drains into the northern Arabian Sea. Indus River is the only source of agriculture cultivation, drinking water and maintain Indus delta (estuarine area) where it creates a unique ecosystem that support innumerable aquatic organisms. People living in lower Sindh Indus belt depending on agriculture and fishing or fisheries associated activities. However, since last few decades upstream water development has created economic, social and environmental problems. Coincides climate is not uniform over the Indus River basin it varies from temperate, to subtropical arid and semiarid on the plains of Punjab and Sindh provinces. Additionally, in low lying areas, annual precipitation typically varies 100 to 500 mm, while mountain slopes receive a maximum 2000 mm.[2] rainfall annually. All these factors created severity and destructed livelihood of millions of people depending on fisheries or fisheries related activities living on lower Indus area. Reduced river flow, widespread deforestation, intrusion of seawater, rising sea levels, and pollution constitute the primary factors contributing to the degradation of the Indus Delta. These mangroves forests are can severely protect us from tsunamis and other natural disasters and can help in fisheries productivity. Key factor influencing the oceanographic processes of the Indus River estuary is the fluctuations in Indus River flow since the variations in fluvial discharge have a direct impact on seawater salinity

[2] FAO, 2011. Indus River Basin: Irrigation in Southern and Eastern Asia in figures – AQUASTAT Survey – 2011: 1-14

that can be considered as trigger of ocean / organism life. Indus delta accounted as the sixth largest delta of the, structurally it is fan-shaped textured by huge amount of silt drifted from high mountains reaches through river Indus.[3] In the present scenario the delta covers an area of about 600,000 hectares that is further disseminated in 17 major and several minor creeks, swampy and mangrove forests.[4] In the past, the Indus River was one of the largest river sediments in the world. In the past five to seven decades, it transports 185 BCM of freshwater annually and about 400 MT of sludge/slit were carried to downstream.[5,6] The lives of the peoples living near the lower Indus River were mainly dependent on these resources, nevertheless, the present circumstances are deeply disheartening, with conflicts having erupted as a result. Physically, Indus River estuary can be defined as a partially-mixed with arid sub-tropical coastal climate influence by monsoonal cycle. [7] Further monsoonal cycle can be defined as May-September (summer) south-west monsoon that is highly influential on the physical and environmental scenarios whereas November-February (winter) as north-east monsoon are the triggers of the area. [8] In recent years, there has been a growing emphasis on the issue of seawater intrusion affecting lower Indus riparian areas. [9] [10]This study was aimed to summarize, analyze and address socioecological concerns of the southernmost part of Sindh province.

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[3] Abbasi, A. G., 2002, "Restoration of Sindh's Primary Rights over River Indus", 18th Convention of SANA, Cherry Hill, New Jersey, July 4-7.

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[10] Wang, J., Li, Li., He, J., Kalhoro, NA., Xu, D. 2019. Numerical modelling study of seawater intrusion in Indus River Estuary, Pakistan, Ocean Engineering, 184, 74-84.

Methodology and data sources

Seawater penetration data of respective dehs, taluka and district-wise was obtained from district management offices. Related to this some of the information was obtained from the available literature. The flow and upstream water availability record was acquired from irrigation department. Ecosystem degradation and fisheries associated information was also obtained from published literature e.g. reports, review papers and research articles in renowned newspapers and research journals.

Results and discussions

In this study, various data sources were used to draw meaningful conclusions and to discuss the burning issues of the lower Indus River.

Indus River flow upstream from Kotri Barrage

The lowest water flow (128,711 cf) of Indus River from Kotri Barrage was recorded in 2010 and the highest 377,829 cf noted in 2016, whereas (335,225) flow was noted in 2010-2018 (Fig. 1).

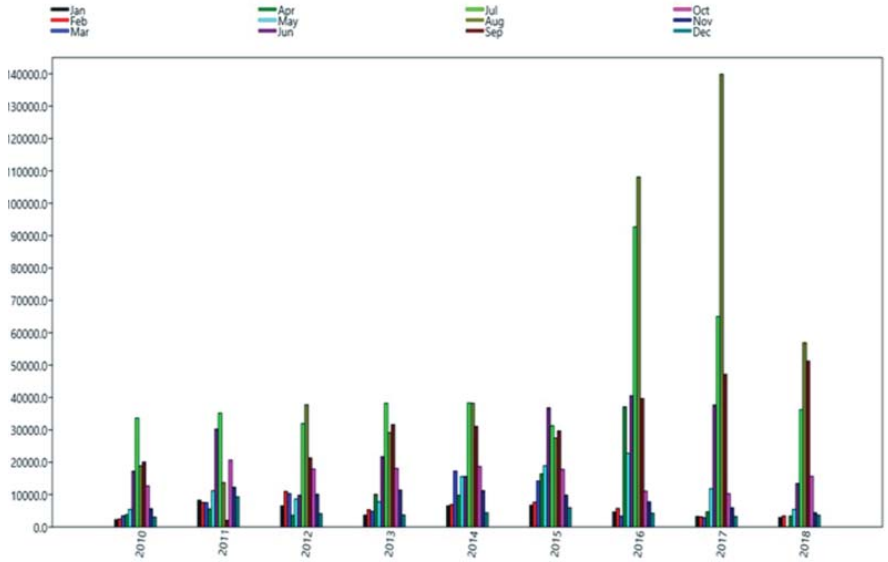

Figure 1. Month-wise water record at Indus River from Kotri Barrage

Data of upstream flow of river Indus from Kotri barrage was recorded as in 2010. However, decal record of meager freshwater flow in to downstream Indus River carries water not for agriculture but drinking and other use as well. Downstream freshwater water flow from 2010-2015 (Fig. 2) validates that insignificant water flow during six-year period has transported very low siltation up to the delta region that can only restrain sea water inundation.

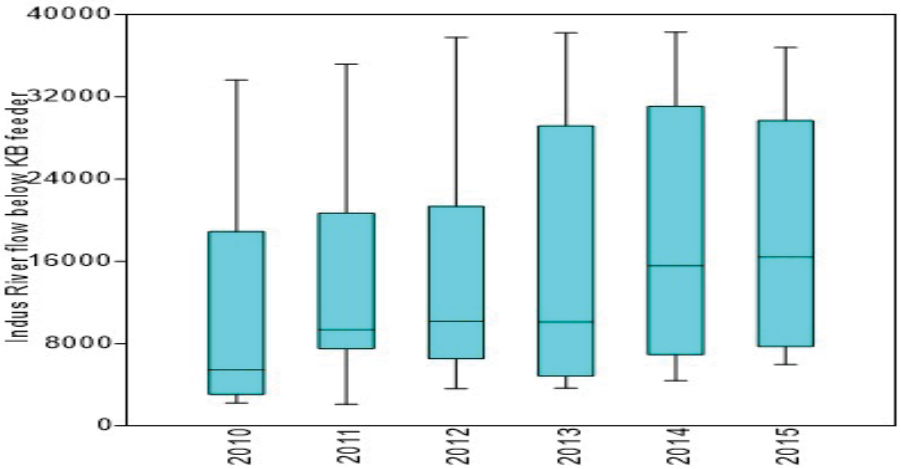

Figure 2. Box-plots showing yearly average upstream flow of the Indus River at Jamshoro

Seawater intrusion in Thatta District

Thatta district is comprises of three Talukas Mirpur Sakhro (14 Dehs), Ghorabari (7 Dehs) and Keti Bunder (31 Dehs). Three dehs Milko, Pirpathai and Pumbri of Mirpur Sakhro are completely under sea water and out of agriculture. Sea water inundation has badly affected Ghorabari Taluka over thirty-two-thousand-acre land of seven Dehs are now saline. Thirty-one Dehs of Taluka Keti Bunder are completely covered by sea water penetration (Fig. 3).

Periodic data of sea water intrusion elucidate the area of three main talukas of District Thatta inundated since last two decades. It can be assumed that if the rate of sea water intrusion steadily occupy agriculture land of Thatta district will severely damage millions of the residents.

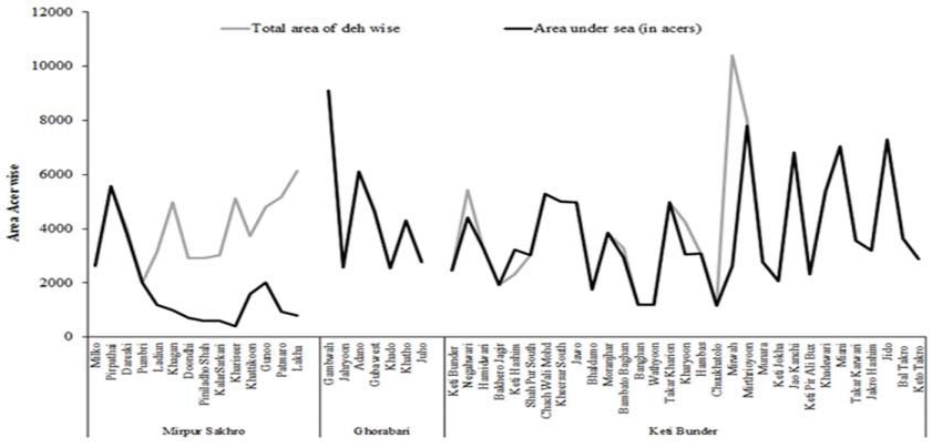

Figure 3. Three talukas of the Thatta district encounter gradual influence of seawater penetration

Seawater Intrusion in Badin District

Badin district is divided in two talukas (Badin and Shaheed Fazil Rahu) and ten Dehs namely Babralo, Dharan, Warayo, Sando, Patiji, Thath, Siantri, Khudi, Palh, Ahmed Rajo, out of which three dehs Babralo, Siantri and Ahmed Rajoare completely engulfed by sea water penetration. In this study decal (2008-2018) data of sea water converted agricultural land of Badin District as saline soil. This land is now out of agricultural cultivation (Fig. 4).

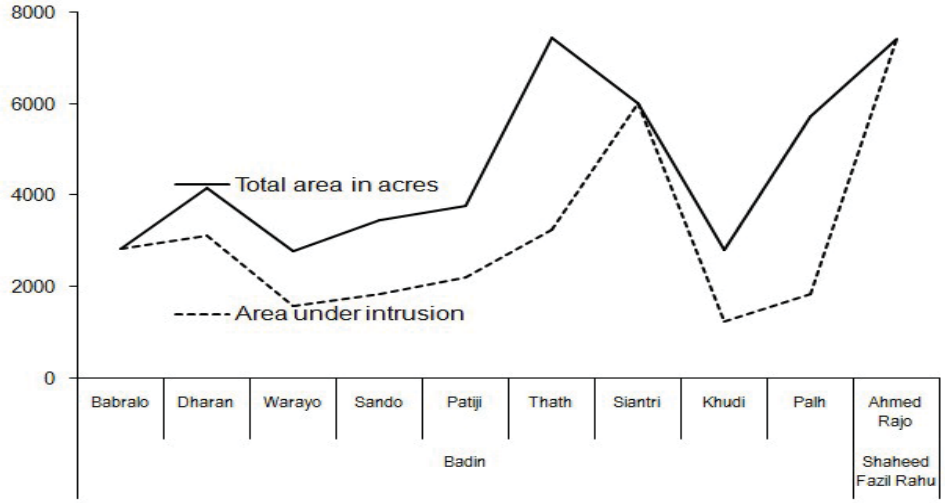

Figure 4. Agricultural land of Badin District encapsulated by the seawater intrusion

Hence, this rise in air temperature leads to elevated sea surface temperatures, altering the aquatic ecosystem and its inhabitants.

Undeniably, meagre flow of the Indus River troubling deltaic area but climate change imposing its impact to the coastal region by changing sea-level. This is due to industrial revolution is the only cause of global warming and sea-level rise. Besides, burning coal and oil and cutting down forests will increase the heat in the atmosphere, which will return to our planet[11]. Therefore, this rise in air temperature leads to elevated sea surface temperatures, altering aquatic ecosystem and inhabitants (Cazenave and Llovel, 2010; Levitus et al., 2009)[12][13]. Persistent Ocean warming is huge, and this thermal expansion is the main driver of global sea-level rise in the 75-100 years after the Industrial Revolution (Cazenave and Llovel, 2010).[14]

Conclusion

Based on the Indus River water data acquired from the Irrigation Department, Government of Sindh and non-cultivable land record of Thatta and Badin districts reveals that the situation has overwhelmed population depending on the agriculture to displace toward other areas for the sake of livelihood. Besides, significant reduction in fish catch, fishers switch to other professions / activities. The overall situation required serious attention of the managers, stakeholders to take reasonable measures to prevent seawater intrusion by constructing solid structures like coastal highway, protected bank along affected areas and persistent freshwater flow will help to deposit silt and increase strength of deltaic region.

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