

Water Security in Punjab: Issues and Challenges

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Abstract

Water resources are epitome of Punjab. But, the mismanagement of water resources is making Punjab – a water deficit state. Increasing urbanisation, industrialisation and agriculture is exerting pressure on water resources of Punjab. Punjab is an agrarian state, depends entirely on its land and water resources for the socio-economic development. Agriculture is the driving force of the economy of Punjab. However, due to extreme exploitation and misuse of resources to develop agriculture, through high yielding varieties of seeds, chemical fertilizers and a significant amount of water is bringing Punjab's economy at plateau stage. Punjab which was a model state for the country, entered into the disaster zone. Therefore, the present research focuses on essential factors like urbanisation, agriculture, irrigation, chemical fertilizers and political opportunism which has affected water resources of Punjab.

Keywords: Contamination, Electricity Subsidies, Irrigation, Minimum Support Price, Pesticides

Introduction

Water is the shaping force of our planet Earth, intrinsically woven into human race (Jagerskog et al., 2016). The presumption of freshwater resources being infinite, considering it covers 70 per cent of the planet, is absolutely false. Only 2.5 per cent of the total water on the earth is freshwater and can be consumed by humans. Out of this total freshwater, 68.7 per cent is frozen in ice caps, 30 per cent is stored as ground water and only 0.3 per cent is available on the surface of the earth. Out of the surface water, 87 per cent is stored in lakes, 11 per cent in swamps and 2 per cent in rivers (Pegram, 2010). With huge advances in technology, humans have tried to harness many of world's natural waterways by building dams and water irrigating systems, due to which ecosystems are being destroyed and sometimes damaged permanently. Consequently, water resources world-wide are determined by various natural processes and anthropogenic interferences (Van Oel, 2009). The freshwater scarcity can be described in terms of rising demands, depletion and pollution of water resources (UNEPFI and SIWI, 2005). Water shortages can be associated with declining groundwater levels, increasing contamination and problems in allocation, leading to serious drought conditions all over the world (United Nations, 2007). But, we cannot say that there is physical water scarcity on earth as there is enough freshwater on planet for 7 billion people. Conversely, it is not evenly distributed and much of it is polluted, wasted and is used inefficiently. Thus, water scarcity can be defined as lack of enough water, that is, physical scarcity or lack of access to water, which can be called as economic scarcity.

Statement of the Problem

The water security is the critical issue driven by population growth, unplanned urbanisation, industrialisation and economic-political situations. In addition to rapid rate of urbanisation, change from dietary habits to varied diet like staple cereals, livestock and fish products, the consumption of water has increased manifolds (United Nations, 2007). It is projected that by 2035, 40 per cent of the world population will reside in water stressed regions (Planning Commission, 2011). Water demands are expected to increase by 400 per cent from manufacturing sector and 130 per cent from household use (Guppy and Anderson, 2017).

Although, India is not a water scarce country, but due to escalating growth in human population, vast irrigation systems, increasing industrialisation and urbanisation, lack of planning and co-ordination in various government departments, and depletion of groundwater resources, India is becoming a water scarce nation. As per Government of India (2012), the per capita water availability in the country is reducing day after day due to increase in the population. With continuously declining per capita water availability, from about 5,177 cubic meters in 1951 to 1,816 cubic meters in 2001, which further reduced to 1545 cubic meters in 2011, India can be categorized as water scarce country. The average annual per capita water availability is estimated to drop down to 1,341 cubic meters by 2025 and 1,140 cubic meters by 2050 (Government of India, 2012). Punjab is facing multiform and diverse water crisis. The very name of Punjab stands for abundance of water (land of five rivers), but the present situation of water resources in this region is highly critical with surface water pollution, groundwater pollution and depletion.

Results and Discussions

Post-Independence, the Green Revolution ushered in late 1960s in Punjab with motive to achieve self-sufficiency in food and cereal crops. With debarkation of Green Revolution, the agrarian economy of Punjab advanced expeditiously. With change in cropping pattern from

rained to water intensive crops, Punjab has witnessed rapid fall in groundwater table. With overwhelming dependence of water for irrigation, groundwater was extracted indefinitely by sinking tubewells (Planning Commission, 2011). Historically, Punjab has never been a rice growing area. Table 1 shows the major agricultural growth drivers in Punjab, which have worked as catalyst in increasing the agricultural production.

Table 1**Agricultural Growth Drivers of Punjab (1970-71 to 2015-16)**

Agricultural Year Indicators	1970-71	1980-81	1990-91	2000-01	2010-11	2015-16
Gross Cropped Area (000'ha)	5,678	6,763	7,502	7,941	7,882	7872
% of Net Irrigated Area to Net Sown Area	71	81	93	93	97.9	99.9
Area Irrigated by Canals (000'ha)	1292	1430	1660	962	1113	1201
Area Irrigated by Tubewells (000'ha)	1591	1939	2233	3074	2954	2936
No. of Tube wells (Lakh)	1.92	6.00	8.00	10.73	13.82	14.7
No. of Tractors (Number)	5,281	1,18,845	2,89,064	4,34,032	5,04,310	5,36,429
Agricultural Consumption of Electricity (In Million KWH)	463.4	1849.7	5104	5534	10116	11513
Consumption of Chemical Fertilizers (000'nutrient tonne)	213	762	1220	1313	1911	1943
Cropping Intensity (%)	140	161	178	186	190	190

Source: Statistical Abstracts of Punjab 1971, 1981, 1991, 2001, 2011, and 2016

The data reveals that the gross cropped area has increased from 5678 thousand hectares in 1970-71 to 7872 thousand hectares in 2015-16. The percentage of net irrigated area to net sown area also witnessed increase from 71 per cent in 1970-71 to 99.9 per cent in 2015-16. The area irrigated by canals witnessed decline from 1292 thousand hectares in 1970-71 to 1201 thousand hectares in 2015-16. Whereas, sharp rise is observed in the area irrigated by tubewells from 1591 thousand hectares in 1970-71 to 2936 thousand hectares in 2015-16. The number of tubewells installed rose from 1.92 lakh in 1970-71 to 14.7 lakh in 2015-16. The increase in number of tubewells also lead to increase in the agricultural consumption of electricity from 463.4 million KWH in 1970-71 to 11,513 million KWH in 2015-16. The consumption of chemical fertilizers also rose from 213 thousand nutrient tonnes in 1970-71 to 1943 thousand nutrient tonnes in 2015-16. The number of tractors in Punjab also rose from mere 5,281 in 1970-71 to 5,36,429 in 2015-16. Due, to above all agricultural inputs, cropping intensity in Punjab rose from 140 per cent in 1970-71 to 190 per cent in 2015-16.

The area under maize and bajra was replaced by rice. Table 2 shows that Punjab had well-diversified agriculture in 1970-1971, whereas in 2015-2016, the agriculture of Punjab shows monoculture cropping pattern. The area under wheat was 2299 thousand hectares in 1970-1971 which rose to 3506 thousand hectares in 2015-2016. Similarly, the area under rice was merely 390 thousand hectares which rose to 2970 thousand hectares in 2015-2016. The maize crop which holds a noticeable position in the cropping system of Punjab has seen a significant decrease from 555 thousand hectares in 1970-71 to 127 thousand hectares in 2015-16. There has been a severe decline in the area of bajra, jowar, groundnut, barley, and gram crop. However, sugarcane, pulses, cotton, rapeseed and mustard, and potato show fluctuations in the area of crops. The production of wheat and rice has doubled in 30 years. Punjab agriculture has achieved progress with the adoption of modern agricultural technology. However, the Green Revolution in Punjab is just confined to the production of wheat and rice.

Paddy became the first preference of farmers due to better and assured returns which replaced other crops.

Due to which, the withdrawal of ground water surpassed the replenishable rates, which led the state to groundwater development stage of 145 per cent, against the national average of 58 per cent. (Narula and Lall, 2009). Groundwater declined at an alarming rate in Punjab, except low lying areas of water logging and salinization in canal command areas. Further, subsidized electricity and minimum support price encouraged rice crop, which resulted in increase in net cropped area of rice by 2.5 times in last two decades (Narula and Lall, 2009). Consequently, Punjab state seems to be doomed in water and energy nexus with skyrocketing fiscal deficits.

Table 2 The shift in Cropping Pattern of Punjab from 1970-71 to 2015-2016
(Area in Thousand Hectares)

Crops/ Year	1970-71	1980-81	1990-91	2000-01	2010-11	2015-16
Rice	390	1183	2015	2612	2830	2970
Wheat	2299	2812	3273	3408	3510	3506
Maize	555	382	188	165	138	127
Bajra and Jowar	207	69	12	6	3	-
Groundnut	174	83	11	4	2.2	1.7
Cotton	397	502	137	358	470	331
Sugarcane	128	71	101	121	70	92
Seasum	15	17	18	19	6.6	8.2
Barley	57	65	37	32	12	12
Gram	358	258	60	6	2.7	1.9
Rapeseed/Mustard	103	136	69	55	32	31.6
Potato	17	40	23	60	64.4	91.6

Source: Statistical Abstracts of Punjab 1971, 1981, 1991, 2001, 2011, and 2016.

With the mechanization of agriculture, there was a shift from centrifugal to submersible pumps which increased the agricultural consumption of electricity. Though the role of electricity subsidies cannot be ignored, and has been used as an electoral incentive by political parties of Punjab nowadays. With flat water tariff rates, electricity subsidies and minimum support prices for rice, tubewell irrigation flourished which exploited both water and power resources of Punjab. This increase in tubewell irrigation is due to high yielding varieties, liberal loans by the State Development Board and subsidies on electricity consumption by tubewells. The development of irrigational facilities with extensive mechanization has increased gross cropped area.

The extravagant use of fertilizers, insecticides and pesticides for ginormous agricultural production has unfolded into groundwater pollution and surface water pollution in Punjab. Freshwater resources are supplemented with chemicals and sewage discharge from industries and urban areas, with major contaminants like nitrate, iron, cadmium, aluminium, and magnesium, which can cause critical health diseases (Planning Commission, 2011). Sewage discharges, chemical run off from agricultural fields and untreated effluents from industries are directly discharged into rivers and streams, which are main culprits of surface water contamination. Large scale use of chemical fertilizers, insecticides and pesticides in agriculture has contaminated and added chronic toxicity in soil and water resources of Punjab leading to groundwater quality degradation. Consequently, high levels of arsenic, uranium, fluoride and selenium poisoning are traced in groundwater of Punjab, which has made groundwater resources unfit for drinking and agricultural purposes.

Conclusion

The forthcoming water crisis in Punjab can not only eclipse the agriculture and economy but, also ruined the ecology, health, life style and social fabric of the state. Introduction of HYV seeds, shift of cropping pattern to water gulping rice in cropping pattern of Punjab, groundwater extraction through tubewells and electricity subsidies are major reasons of depletion and exploitation of water resources. Further, Punjab's economy is been downtrodden by the weight of electricity subsidies which is pushing Punjab into the ocean of debts. Therefore, there is an urgent need for taking up research and studies based on adequate and reliable data. So, it can be concluded that man-made environment is playing a vital role in affecting the water resources of Punjab. The agriculture of Punjab needs a new version to redefine the cropping patterns. Immediate steps should be taken by policy makers to diversify cropping pattern and control electricity subsidies.

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