

## EMERGING WATER INSECURITY IN PUNJAB: ISSUES AND CHALLENGES

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### Introduction

Though Punjab's water crisis has been in the making for the last about three and a half decades yet no serious efforts have been made to address it. Paradoxically, all the stakeholders, including political parties, have been hitherto in a denial mode about the gravity of the emerging water insecurity in Punjab.

Fortunately, the government of Punjab now seems to be seized of the emerging water crisis. The convening of a brainstorming session to discuss the problem by the Chief Minister Captain Amarinder Singh on 21 June 2019 at Chandigarh is a testimony to it. It is for the first time that any Chief Minister of Punjab has convened such a meeting on ground water depletion. The meeting was attended by various stakeholders, including farmer leaders, representatives of industry, experts and scientists, besides a galaxy of cabinet ministers and senior bureaucrats. The in-principle approval by the CM (in his summing up address at the meeting) to constitute Punjab Water Authority (though long overdue) is certainly a step forward.

### Status of net ground water availability in Punjab

It is clear from the data given in table 1 that Punjab was quite comfortable in terms of water availability. However, over the period of time, Punjab's ground water availability got eroded.

**Table 1: Net Annual Ground Water Availability (Million Acre Feet) for Irrigation Development and Number of Over exploited blocks in Punjab**

Year	Million Acre Feet (MAF)	Over Exploited Blocks		Total Blocks
		Number	Percentage	
1984	2.44	53	45	118
1992	0.84	63	53	118
1999	0.22	73	53	138
2013	(-) 11.63	105	76	138

In 1984 Punjab had 2.44 million acre feet (MAF) of ground water which dwindled minus 11.63 MAF in 2013. It was mainly due to over exploitation of ground water. Out of the total 118 blocks the number of over exploited blocks increased from 53 (45%) in 1984 to 63 (53%) in 1992. In 2013 the number of such blocks increased to 105 (76%) out of the total 138 blocks. Clearly, the situation has gone from bad to worse.

Further, in 1984 there were 5 districts doing over draft of ground water while in 2013 there were 15 such districts. The range of overdraft was between 1.34 (Ludhiana) to 1.91 (Kaphthurthla) times in 1984 while it was 1.21 times (Gurdaspur) to 2.11 (Sangrur) times in 2013. The average total draft in Punjab was 149 in 2013.

The overexploitation of ground water led to fast depletion of water table due to which average depth of tube wells increased from 49 feet during 1960-70 to 128 feet in 2013-14 in nearly 15 districts of (predominantly paddy zone). Out of them, pre-monsoon depth of water table went down by 7 meters to 22 meters in 10 districts during 1996-2016.

**Genesis of depleting water table in Punjab**

Historically, Punjab has never been a paddy growing area. Out of the total irrigated area, paddy accounted for 9 per cent (237 thousand hectares) in 1939. Even in 1970-71, 9.62 per cent of the net sown area was under paddy. Nonetheless, paddy emerged as the major crop of Punjab since 1980s and area under paddy went up to 72 per cent of the net sown area in 2015-16.

The green revolution transformed Punjab’s diversified cropping system into wheat-paddy rotation. The country’s increasing demand for food and vested interest of global agri-business, inter alia, were the major factors behind green revolution and promotion of paddy in Punjab. The assured supply of high yielding variety of seeds, fertilizers and public investment in irrigation were aimed at meeting the above objectives. The public procurement under the MSP regime (since mid-1960s) assured the market clearance for the farmers’ produce of wheat and paddy.

Table 2 presents an interesting picture about correlation between area under paddy, number of tube-wells and area under tube well irrigation. The area under paddy increased from 4.5 lakh hectares in 1970-71 to 28.9 lakh hectares in 2014-15 and the number of tube wells increased from 1.92 lakh to 14.1 lakh during the same period. Irrigation intensity increased from 71 in 1970-71 to 99 in 2014-15.

**Table 2: Net Shown Area under canal and tube well Irrigation, number of tube-wells, and area under paddy in Punjab** (No. of Tube-wells in Lakhs, area in lakh hectares)

Years	Canals	Tube-wells	Total	Tube-wells	Area under Paddy	Irrigation Intensity
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**Training Course on Groundwater issues of Punjab with special emphasis on groundwater salinity under National Hydrology Project: July 16 - 18, 2019 at Mohali, Punjab**

1970-71	12.86 (45)	15.91 (56)	2888	1.92	4.5	71
1990-91	16.60 (44)	22.33 (59)	3816	8.0	20.7	93
2010-11	11.13 (27)	29.54 (73)	4070	13.82	28.3	98
2014-15	11.75 (29)	29.43 (71)	4118	14.1	28.9	99

*Figures in brackets are percentage and are rounded up*

Significantly, table 2 also shows that the area under tube well irrigation increased from 56 per cent in 1970-71 to 71 per cent in 2014-15 while during the same period area under canal irrigation declined from 45 per cent to 29 per cent. This can safely be attributed to the increasing demand for ground water due to extraordinary increase in area under paddy and a significant increase in the gross cropped area. One would like to agree with this but why has the area (in absolute sense) under canal irrigation declined from 16.60 lakh hectares in 1990-91 to 11.75 lakh hectares in 2014-15? This needs justification!

**Table 3: Trend growth rate of tube-wells, area, production and yield of rice in Punjab: 1970-71 to 2014-15**

Period	Trend Growth Rate (%)			
	Tube-wells	Area under Rice	Production of Rice	Yield of Rice
1970-71 to 1980-81	14.4*	12.1*	17.5*	5.4*
1980-81 to 1990-91	2.7*	5.1*	6.2*	1.2*
1990-91 to 2000-2001	2.2*	2.6*	2.8*	0.3
2000-2001 to 2014-15	2.1*	1.0*	1.7*	0.7**
<b>1970-71 to 2014-15</b>	<b>4.0*</b>	<b>4.1*</b>	<b>5.6*</b>	<b>1.4*</b>

\*indicates significance level at 1%, \*\* significant at 5% level.

It is interesting to note that the area under rice and the number of tube wells increased concurrently (Table 3). The annual trend growth rate of tube-wells and area under rice during 1970-71 and 1980-81

was 14.4 per cent and 12.1 per cent, respectively. The respective trend growth rate during 1970-71 and 2014-15 was 4 per cent and 4.1 per cent.

**Mind boggling water consumption by rice**

The data in table 4 reveals that paddy is the main consumer of ground water in Punjab. Water productivity of rice (quantity of water required to produce one kg. rice) in Punjab in the triennium (TE) ending 2013-14 was 5337 liters of water whereas all India average was 3875 liters. This is also due to applying higher number of irrigations than the recommended doses.

The water consumption for total rice production in Punjab increased from 16642 (13449 billion liters, 81 %, for central pool) billion liters in 1980-81 to 59047 (43262 billion liters, 73% for central pool) billion liters in 2013-14. It is the case of virtual water export from Punjab to the rest of India. Punjab provided much needed food security to the nation at the cost of its ground water (the most precious non-renewable natural resource). Even the quality of its sub-soil water has got polluted in the process.

**Table 4: Water consumption in rice production in Punjab**

Year (TE)	Production (' in tonnes)	Water consumption in total rice production (in Billion liters)	Water consumption on rice production contributed to central pool	
			(in Billion Liters)	(in %)
1980-81	3118333.3	16642.5	13449.2	80.8
1990-91	6052333.3 (6.86)	32301.3 (6.86)	25724.3 (6.70)	79.6
2000-01	8603333.3 (3.58)	45916.0 (3.58)	37038.8 (3.71)	80.7
2013-14	11063666.7 (1.95)	59046.8 (1.95)	43261.7 (1.20)	73.3

Figures in brackets indicate compound annual growth rate (%).

**Electricity Consumption in Agriculture**

All this has led to an exponential increase of electricity consumption in the agricultural sector (Table5). As compared to 1970-71, the electricity consumption in agriculture increased by 1652 times in 2015-16 while the gross cropped area increased just by 1.38 times during the same period. Clearly,

increase in gross cropped area does not justify such a huge consumption of electricity in agriculture. This needs a serious examination and plausible explanation.

Can it be attributed to the increase in irrigation intensity? Perhaps, no as 71 per cent of the net sown area was under irrigation in 1970-71. The ever increasing demand for water for paddy (and over-dependence on ground water to meet this demand), the higher and higher number of tube wells, sharp depletion of water table, the increasing depth of tube wells, increasing number of submersible motors (up from 6.2 lakh in 2009 to 8.4 lakh in 2014, now may be much higher) with high BHP (ranging from 10 to 25 BHP and even more) seem to be behind such a huge consumption of electricity in agriculture. The transferring of theft of electricity in other sectors to the agriculture is also being perceived as one of the reasons. In-judicious use of water due to provision of free electricity in agriculture is also the reason for depleting water table and hence the increasing consumption of electricity.

**Table 5: Electricity consumption in agriculture in Punjab**  
(Million Kilo Wats)

	1974-75	1984-85	2015-16
Consumption	6.97	2359	11514
Increase	-	338 times	4.89 times
Increase in 2015-16 over 1974-75	-	-	1652 times
Gross Cropped Area (Lakh Hectares)	56.78*	67.63**	78.72
Over the period increase	-	1.19 times	1.38 times

\* 1970-71, \*\* 1980-81

### **Policy intervention**

Though the government of Punjab has been trying to respond to the depleting water table yet the only effective policy response came in 2009 when “The Punjab Preservation of Sub-soil Water Act, 2009” prohibited sowing of nursery of paddy before 10<sup>th</sup> May and transplantation before 15<sup>th</sup> June. The other measures such as crop diversification, resource conservation technologies and micro irrigation techniques are yet to show any substantive results.

For crop diversification, Punjab government constituted two committees (1986 and 2002), popularly known as Johal Committee 1 and 2. But not much ice has been cut so far. The Union Government has also been advising (without any policy intervention, alternative crops and financial support) Punjab to

shift massive area from under paddy. It needs to be recalled that the promotion of paddy in Punjab was mainly due to the policy-mix (focussed on country's food security). Now, how can we expect crop diversification in the absence of a compatible policy set?

### **Way Out**

Punjab needs to shift huge area from under paddy. That would require a compatible policy set and support (both from the Union and Punjab governments) and an alternative crop combination (with MSP and assured market clearance) which could give the framers at least same amount of per hectare return which they are getting from paddy. The free power to agriculture would have to be rationalised if we really want to address the issue of diversification and depleting water table. It would not be possible without bringing farmers on board. And it is here that there is a need to have social movement by the farmers for rationalisation of free electricity and reducing area under paddy. It is of utmost importance for having sustainable agriculture, ensuring livelihood, saving water for future generations and saving Punjab from the looming desertification.

Generating awareness among the stakeholders is a sine qua non for mobilising any social movement for addressing the issue of water scarcity. Harvesting and conservation of water (through the mantra of Reduce, Recycle and Reuse) must be made mandatory. In my own empirical study of 10 districts of Punjab, I found that not only awareness level (about depleting water table, wastage and injudicious use of water, harvesting and conservation) among farmers, domestic water users and industrialists is low but they are least concerned about the problem. Harvesting and conservation of water (through the mantra of Reduce, Recycle and Reuse) must be made mandatory.

The state needs to have comprehensive agricultural and water policies, organically linked with each other, as 97 per cent of ground water is being used in agriculture. The constitution of Punjab Water Authority would also play a significant role in supporting and supplementing the government efforts in addressing the emerging water crisis in the state.