Ground Water Level in Haryana: A Challenge for Sustainability

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ABSTRACT *Groundwater has emerged as the major water source and poverty reduction tool in India's rural areas. Ground water has made significant contributions to the growth of India's Economy and has been an important catalyst for its sustainable socio-economic development. Its importance as a precious natural resource in the Indian context can be gauged from the fact that more than 75 percent of India's rural domestic water requirements, 50 percent of its urban water requirements and more than 50 percent of its irrigation requirements are being met from ground water resources. But over the years there has been overexploitation of groundwater, which has been used to meet the increasing demand for water. This has resulted in declining water table in various parts of the country and become threat for sustainable development. In the present study an attempt has been made to address the issue of declining ground water level in Haryana. Further study also measured the impact of annual rainfall, number of tubewells and area under water hungry crops on depth of ground water level in the state. The study finds that declining ground water level is becoming challenge for the sustainability of the state. The study suggests the immediate attention of policy makers in this direction*

***Key words*:** Ground Water, Crop pattern, Irrigation, water table, Haryana.

I Introduction

Groundwater has emerged as the major water source and poverty reduction tool in India's rural areas. On account of its near universal availability, dependability and low capital cost, it is the most preferred source of water to meet the requirements of various user sectors in India. Ground water has made significant contributions to the growth of India's Economy and has been an important catalyst for its sustainable socio-economic development. Its importance as a precious natural resource in the Indian context can be gauged from the fact that more than 75 percent of India's rural domestic water requirements, 50 percent of its urban water requirements and more than 50 percent of its irrigation requirements are being met from ground water resources. But over the years there has been overexploitation of groundwater, which has been used to meet the increasing demand for water. This has resulted in declining water table in various parts of the country and becoming a threat for sustainable development in the country. It is believed that one of the major causes of the decline in groundwater tables is the introduction of water-intensive crops such as paddy and sugar cane into the cropping pattern in certain regions. Apart from the cropping pattern increasing number of tubewells are also equally responsible for declining ground water level. (Bhalla, 2007). Yet, the relationship between groundwater depth and changes in the cropping pattern and number of tubewells has not been investigated adequately in the literature so far. It is this gap that this study bridges.

The focus is on Haryana, where the depletion of groundwater resources could threaten the long- term sustainability of irrigated agriculture on which the state depends. The primary cause of decline in water table is said to be the introduction of water-hungry crops in Haryana. Since there is close correspondence between expansion of area under paddy in a wheat rotation (which is popularly practised in Haryana) and incidence of water depletion, it is strongly believed by many that paddy-wheat rotation is the main cause of the problem. Numerous studies, for example, Chand (1996), Chand and Haque (1997), Bathla (1996), Kataki, Hobbs and Adhikary (2001), Bhall (2007) and Duxbury (2001) hold that both in Punjab and Haryana the paddy-wheat rotation is unsustainable and is lowering the water table. The increased popularity of these crops may be attributed in part to the government's price policy. It is important to note here that initially, at least, providing remunerative prices for rice and wheat was important not only for ensuring food security, but they also helped in draining out the excess water brought about due to unlined canals and lack of adequate drainage in the state. But

cultivation of these crops over the years has brought about a massive decline in the water level. Therefore, the crops that were earlier encouraged have now become a cause of a depleting resource base. Keeping the above in mind the present study is an attempt to access the impact of area under water hungry crops as well as number of tubewells and of annual rain fall on depth of ground water level in Haryana.

The study is divided into five sections. Section I introduction of study. Section II sets out the data and methodology used. Section III exhibits the scenario of ground water level in India and Haryana. Section IV elaborates the finding of analysis and finally section V concludes the study.

II Objective and Methodology of study

The main objectives of the study are as follow:

1. To study the recent trends in ground water level in Haryana
2. To find the impact of area under water hungry crops, number of tubewells and annual rainfall on the ground level water depth in Haryana over the time.

The study is analytical in nature and based on secondary source of information. Major sources of data are ground water year book (2014) published by central ground water board and ground water cell, agriculture department, government of Haryana and statistical abstract of Haryana. The study is carried out for the period of 23 years (1990-91 to 2013-14). The impact of area under water hungry crops, number of tubewells and annual rain fall on ground water level depth has been analyzed by applying the multiple regression analysis.

III Ground water level in India:

The state-wise status of groundwater resources as on March 2014 is given in table 1.

Table 1: State-wise Status of Groundwater Resources (2014) In Billion Cubic Metres (BCM)

S.No	States	Annual Replenishable Ground Water Resource	Net Availability	Net Draft	Stage of water level development*
1	Andhra Pradesh	33.83	30.76	14.15	46
2	Assam	30.35	27.81	6.026	22
3	Bihar	28.63	26.21	11.36	43
4	Chhattisgarh	12.22	11.58	3.6	31
5	Gujarat	18.43	17.35	12.99	75
6	Haryana	10.48	9.8	12.43	127
7	Jammu & Kashmir	3.7	3.33	0.73	22
8	Jharkhand	5.96	5.41	1.61	30
9	Karnataka	16.81	14.81	10.01	68
10	Kerala	6.62	6.03	2.81	47
11	Madhya Pradesh	33.95	32.25	17.99	56
12	Maharashtra	35.73	33.81	16.95	50
13	Orissa	17.78	16.69	4.36	26
14	Punjab	22.56	20.35	34.66	170
15	Rajasthan	11.86	10.79	14.52	135
16	Tamil Nadu	22.94	20.65	16.56	80
17	Uttar Pradesh	75.25	68.57	49.48	72
18	Uttarakhand	2.17	2.07	1.05	51
19	West Bengal	30.5	27.58	10.91	40

Source: CGWB, 2012, *Net Draft/Net Availability*100

The table depicts that the net draft of groundwater is either in excess of or close to the net available resource, implying that these states are facing a situation of dangerous overexploitation of their available

groundwater resources. The crux of the groundwater challenge in India is that there is extreme overexploitation of the resource in some parts of the country coexisting with relatively low levels of extraction in others. Thus, the stage of groundwater development in Punjab (170%), Rajasthan (135%) and Haryana (127%) have reached unsustainable levels while Tamil Nadu (80%), Gujarat (75%) and UP (72%) are fast approaching that threshold.

Table 2: Proportion of 'Unsafe' Districts (GWD>70%) in Selected States

States	Districts in Unsafe Category		State Area Affected		State Population Affected	
	1995	2014	1995	2014	1995	2014
Andhra Pradesh	0	27	0	27	0	26
Gujarat	5	40	2	56	4	44
Haryana	63	89	46	93	55	97
Karnataka	5	50	4	52	5	61
Madhya Pradesh	0	23	0	16	0	22
Punjab	50	94	43	95	52	97
Rajasthan	35	97	7	97	15	97
Tamil Nadu	29	72	24	73	23	77
Uttar Pradesh	0	49	0	47	0	55
West Bengal	0	18	0	15	0	55
All India	9	30	5	33	7	35

CGWB, 1995, 2012

Table 2 shows that nearly all districts in Punjab, Rajasthan and Haryana are in the "unsafe" category. Seventy-two per cent of the districts in Tamil Nadu and nearly half the districts in Uttar Pradesh and Karnataka are also in unsafe category. While the traditional green revolution states of Punjab and Haryana continues to lead in terms of the proportion of area and population affected by groundwater overuse, what is perhaps more remarkable is that states like Rajasthan, Tamil Nadu and Uttar Pradesh are rapidly moving in the same direction of quantitative depletion of their groundwater resources. The message is thus clear: there is definite evidence on increased pressure on aquifers and the race to drill and pump.

More districts and a larger proportion of population are going to get into the unsafe category unless the rate of groundwater extraction is regulated. It is, therefore, worthwhile to ask how safe are the so-called "safe" districts in terms of their groundwater usage. The quick change of situation between 1995 and 2014 should be taken as a warning of an impending catastrophe ready to strike in the near future. The problem needs urgent attention because groundwater is the major source of drinking water especially in rural areas.

According to the latest available data from the National Sample Survey, 56% of the rural households get drinking water from handpumps or tube wells, 14% from open wells and 25% from piped water systems based on groundwater (NSSO 2006). According to the department of drinking water supply (DDWS), GOI, nearly 90% of the rural water supply currently is sourced from groundwater. Though the share of drinking water in total water use is about 7% while irrigation accounts for over 80%, rapid expansion of groundwater irrigation can threaten drinking water security in the long run, since the resource for both uses is common. Indeed, there is mounting evidence that this could be happening in many parts of rural India, as revealed through the statistics of several habitations "slipping back" from full coverage to partial coverage.

IV Water Depletion in Haryana: A Challenge

Estimates of groundwater depth in the state shows that the groundwater level is generally high in the southern parts and low in the north and north-east, which is a hilly tract. During the pre-monsoon period, it ranges from 5m to 21m below ground level (bgl). What is often not recognised is that the groundwater problem in Haryana has two dimensions. The first is that of rising groundwater table in the areas with low quality aquifers, leading to secondary Stalinisation and water logging. The second is that of declining water tables due to over-pumping of groundwater in fresh water quality aquifer zones. Districtwise average depth of water in Haryana has been shown in table 3.

Table 3: Districtwise Average Depth to Water During June 1974, June, 2014 (Metres)

Sr No	District	1974	2014	Change
1	Ambala	5.79	9.31	-3.52
2	**Bhiwani**	**21.24**	**18.58**	**2,66**
3	Faridabad	5.94	10.61	-4.67
4	Fatehabad	10.48	15.94	-5.46
5	Gurgaon	6.64	22.62	-15.98
6	**Hisar**	**15.47**	**7.58**	**7.89**
7	**Jind**	**11.97**	**10.43**	**1.54**
8	**Jhajjar**	**6.32**	**5.27**	**1.05**
9	K.shetra	10.21	28.79	-18.58
10	Kaithal	6.28	18.34	-12.06
11	Karnal	5.72	15.19	-9.47
12	M.garh	16.11	41.08	-24.97
13	Mewat	5.5	10.31	-4.81
14	Panchkula	7.58	12.19	-4.61
15	Panipat	4.56	14.45	-9.89
16	Rewari	11.75	22.21	-10.46
17	**Rohtak**	**6.64**	**4.2**	**2.44**
18	Sonepat	4.68	7.56	-2.88
19	**Sirsa**	**17.88**	**14.14**	**3.74**
20	Yamuna Nagar	6.26	9.76	-3.5
	State Average	9.35	15.1	-5.75

Source: Ground water cell, GOH

Table 3 reveals that average depth of water among the districts of Haryana is continuously increasing. The stable shows that situation of water level depth is very critical in the districts namely Gurgoan, Kurukshetra, Mahendergarh, Rewari and Kaithal.

The depth has nearly doubled in Gurgaon, Kurukshetra, Mahendergarh and Rewari. Interestingly, the water table has declined both in the regions where the water table was high as well as those where the water table was deep (such as Mahendargarh). In contrast, in the regions of Bhiwani, Jind, Hissar, Rohtak and Sirsa the water table has risen by nearly 2 to 8 metres over the time.

To capture the severity of depletion, it is common to categorise areas as being safe, semi critical, critical and over exploited (Table 4).

Table 4: Categorization of Blocks on the Basis of Groundwater Assessment as on April 1, 2014

Sr No	District	Number of Blocks			
		Safe<70	Semi critical 70-90	Critical 90-100	Over exploited >100
1	Ambala	3	-	-	1
2	Bhiwani	4	-	-	5
3	Faridabad	3	-	2	-
4	Fatehabad	2	-	-	3
5	Gurgaon	-	-	-	4
6	Hisar	8	-	-	1
7	Jind	4	-	2	1
8	Jhajjar	2	-	1	2
9	K.shetra	-	-	-	5
10	Kaithal	-	-	-	5
11	Karnal	-	-	-	6
12	M.garh	-	-	3	2
13	Mewat	3	1	1	1
14	Panchkula	3	1	-	-
15	Panipat	-	-	-	5
16	Rewari	-	1	-	4
17	Rohtak	4	-	-	1
18	Sonepat	3	-	-	3
19	Sirsa	3	-	1	3
20	Yamuna Nagar	1	2	-	3
	Total	43	5	11	55

Source: Ground water cell, GOH

A block is characterised as safe if the rate of groundwater exploitation is below 70 per cent, semi critical if the rate of exploitation happens to be in the range of 70 per cent to 90 per cent and overexploited if the groundwater use is above 100 per cent of its utilisable recharge. Of 114 hydro-geological blocks in Haryana, 48 per cent of them are categorised as over exploited blocks. In fact, in few cases the utilisation ratio exceeds even 100 per cent of recharge – Kurukshetra (178 per cent), Karnal (132 per cent) and Mahendargarh (130 per cent). The situation is also dismal in the districts of Ambala, Panipat and Yamunanagar. 16 blocks out of total 114 blocks are in semi critical and critical category. This leaves only 37 per cent of the area categorised as safe zone. Districts namely Ambala, Hisar, Jind, Rohtak and Sirsa lies in this category.

Further, to find out how much depth of ground water level in Haryana is affected by rainfall, number of tubewells and area under water hungry crops, multiple regressions analysis has been applied. The result of regression analysis has been shown in table 5.

Table 5: Impact of rainfall, area under water hungry crops and number of tubewells on ground water depth in Haryana

Term	Coefficient	Sig*.	R^2
(Constant)	5.388	0.035	0.845
Ind_Rain	-0.257	0.002	

Ind_TW	0.0491	0.000	
Ind_Area	0.832	0.004	
Dependent Variable: Ground water depth, *Significant			

The table shows that the fitted model is statistically significant. The result of analysis shows that rainfall increases the ground water level in Haryana by 0.257 meter. In other words, the negative value of rain co-efficient indicates that rainfall reduce the depth of ground water level in Haryana over the time. On the other side as expected the increasing number of tubewells connections and area under water hungry crops are increasing the depth of ground water level. The table depicts that depth of ground water level in increased by 0.0491 meters and 0.832 meters with installation of one another tubewell and increase of hundred hectares area under water hungry crops respectively.

V Conclusion of the study

The present study an attempt has been made to address the issue of declining ground water level in Haryana. The study also measured the impact of annual rainfall, number of tubewells and area under water hungry crops on depth of ground water level in the state. The water problem in Haryana is distinct as both water logging and water depletion is observed. The study has noted with serious concern the rapidly declining groundwater levels in various parts of Haryana. It is all the more disturbing to find that the cultivation of water-intensive crops is increasing in the regions where the water table is falling. The decline in water table is confined not only to those regions where cultivation of water-intensive crops is more predominant. As seen in the study, Faridabad, Gurgaon and Mahendargarh are the regions where water table is receding but paddy cropping is not much (though increasing). This implies that the cause of declining water levels in parts of Haryana is explained by factors other than an increase in water-intensive crops. The study finds that declining ground water level is becoming challenge for the sustainability of the state. The study suggests the immediate attention of policy makers in this direction

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