

Irrigation Development and Over-Exploitation of Groundwater Resources in Haryana: A Geographical Analysis

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ABSTRACT

Water is an essential input for sustainable development of an agricultural sector. Haryana has made remarkable progress in the field of irrigation mainly after 1966-67 due to increased demand of water for food production. The present research work based on secondary data has been conducted to highlight the various facets of Irrigation Development from 1966-67 to 2014-15, and district-wise Groundwater Availability, Utilization, Level, Stage of Development and Over-Exploitation of Groundwater Resources in Haryana. For deriving rational results, suitable Statistical techniques have been applied for data processing. The development of irrigation has led to spectacular growth of agriculture in the Haryana state. But over reliance on groundwater has resulted in the depletion of groundwater level. Presently 64 (54 percent) blocks of the Haryana state are declared as dark blocks due to over-exploitation of groundwater resource. From 1999 to 2016 the depth of groundwater in state has reached double time at the decline rate about 55 cm per annum. Depleting groundwater resources is a burning issue of the state which demands immediate attention of the policy makers.

1. Introduction

Irrigation is an important man made factor which plays positive role for the success of agriculture in rain deficit areas. The literal meaning of the "Irrigation" is to supply (land) with water by means of artificial canals, ditches, etc, especially to promote the growth of crops. The word "Irrigation" has been derived from Latin word "irrigare" from "rigare" means to moisten, conduct water. In simple terms, Irrigation can be defined as "Artificial application of water to the land or soil for the purpose of supplying moisture essential to plant growth" (Kumar, et al. 2012).

In traditional, agriculture irrigation was recognized only for its protective role of insurance against the vagaries of rainfall and drought. But with the adoption of High Yielding Varieties (HYV), chemical fertilization and multiple cropping, the controlled irrigation has become the chief factor for increasing productivity. Increase in agricultural production and productivity depends to a large extent on the availability of water. It has generally been recognized that farming without irrigation in dry lands is an uneconomic venture (Hooda, 1990). In the modern times it is very clear that irrigation plays a pivotal role in enhancing agricultural production, diversification and increased land use efficiency (Singh and Kaur, 2008).

Haryana is an important agricultural state of the country. Due to paucity of rainfall Haryana is a soil moisture stressed state. To maintain the moisture in the soil throughout the year for successful agriculture, Haryana has made strong arrangements in the form of irrigation development mainly after the introduction of Green Revolution technology in 1965-66. Presently, from irrigation point of view, Haryana is the leading state of the country. The extent and intensity of irrigation is

84.40 and 196 percent respectively, and significantly it is the second highest among all the Indian states. Tubewells and Canals are the main sources of irrigation in Haryana, having share of 58.71 and 41.28 percent net irrigated area respectively.

Because of inadequate supply of canal water, dependency on tubewell irrigation has increased especially since 1970-71 in the Haryana state. As over regular dependency on tubewell irrigation, extraction of groundwater has gone faster than the aquifers can be replenished by natural process. Due to over utilization of groundwater than availability and water level in the state has started declining mainly after 1980-81. Presently about 64 percent areas of the state are suffering from depletion of groundwater level. In such areas groundwater level is declining up to 55 cm per annum. According to a study by National Academy of Agricultural Sciences (NAAS) in 2011, "In Haryana, only 37 percent of the water is exploited within the safe limits while 14 percent over exploitation has reached a semi critical to a critical stage." Due to declining groundwater, shallow tubewells and hand pumps in most areas of the state have dried up. In such circumstances sustainability of agriculture and overall growth of the state has become a question mark. In the present research paper an attempt has been made to study the process of irrigation development and their impact on groundwater resources of the Haryana State. To check the over exploitation of groundwater for the sustainability of agriculture and overall growth of the state, and some suggestions has also been made.

2. Objectives

The main objectives of the present study are:-

1. To study the process of irrigation development and their impact on groundwater resources of the Haryana state.
2. To check the over exploitation of groundwater for the sustainability of agriculture and overall growth of the state.

3. Study Area

The present study has been conducted in Haryana at district level. Haryana state located between 27° 30' and 30° 35' N latitude and 74° 28' and 77° 36' E longitude, in Northwest of India and was carved out in 1966 when the present state of Punjab was reorganized. It is a part of the North Western arid and semi-arid plains with an average rainfall of 545 mm, which receives it mainly through southwest Monsoon. The Haryana state has the Shivalik Hills in the North, the Aravalli Range in South Western, River Yamuna in the East and the River Ghaggar provides a kind of boundary in the West of the state. Haryana state has four different regions that are Northern, Eastern, Western, and Southern regions. The northern region is hilly; the eastern region is getting higher rainfall, fertile soil and slopes north to south with a height between 700 and 900 feet. The northern and southern region of state are facing the problem of groundwater depletion whereas the central region including Rohtak, Jhajjar and a part of Jind, Hisar and Sirsa are facing the problem of rise in groundwater level, creating the problems of water logging and salinization. The south western region is dry, sandy and barren. Haryana is an agriculturally developed state and its agriculture based on fertile land and irrigation facilities. Although there is no Perennial river, but canal irrigation is developed, based on western Yamuna canal system and Bhakhra canal system. After Green Revolution tubewell irrigation emerged an important source of irrigation (Kumar, (2014)). There are nearly 8.5 lakh tubewell in state that are drawing water from the lap of earth. Although tubewell irrigation is urgent need of agriculture in the state but due to adopt of monoculture of rice and wheat and mainly rice crop the groundwater is over exploited. And there is problem occurred groundwater depletion. So we should consider that problem immediately.

4. Database and Research Methodology:

The present research work is based on published and unpublished secondary data which is collected from various offices of the state as well as central government. The related data and associated information used in the study has been obtained from Statistical Abstracts of Haryana (Various Issues), CGWB reports, Journals, Books, Census, newspaper, atlas etc. For deriving rational results, suitable Statistical and Cartographic techniques have been applied for data processing and mapping. To find out the Extent of Irrigation and Irrigation Intensity following formula is used.

$$(i) \quad \text{Extent of Irrigation} = \frac{\text{Net Irrigated Area}}{\text{Net Sown Area}} \times 100$$

$$(ii) \quad \text{Irrigation Intensity} = \frac{\text{Gross Irrigated Area}}{\text{Net Irrigated Area}} \times 100$$

5. Results and Discussion

Irrigation Development:

Haryana state is a soil moisture deficit area throughout the year as it receives 545 mm average annual rainfall. The Geographical conditions of the Haryana state favour the cultivation of variety of Tropical and Temperate crops of the World. With the introduction of Green Revolution Technology (GRT) in 1965-66 in the Haryana state in the form of High Yielding Variety (HYV) of Rice and Wheat crops especially (as this crop combination is the most water consuming than traditional crop combinations) the demand of water for irrigation has increased dramatically. To meet the increased water demand work has been made for the intensive use of available water resources i.e. surface and groundwater. For example network of canals has been strengthened by unlining canals, minors and distributaries in brick lining form. In addition new canals, minors and distributaries have been laid down. Similarly traditional irrigation methods mainly well and tubewells have been replaced by new tubewell technology like submersible. Tubewells which extract fast groundwater than wells have been widely adopted by the farmers mainly after 1970-71. With these developments Haryana experienced increase in extent of irrigation, irrigation intensity and numbers of tubewells.

According to figure 1 the extent of irrigation has increased from 37.80 per cent in 1966-67 to 84.40 per cent in 2014-15. Likewise Irrigation Intensity has been rose from 134 percent in 1966-67 to 196 percent in 2014-15. The trend of Irrigation Intensity from 1966-67 to 2014-15 is better fitted by a Linear trend (figure 2). In both indicators of irrigation development, continuous positive trend is registered from 1966-67 to 2014-15. The main reason for the sharp increase in the extent and Irrigation Intensity during 1966-67 to 2014-15 are the over utilization of groundwater through tubewells. The other indicator of irrigation development is the increase in the number of tubewells. Tubewells which are more reliable, self controlled and flexible source of irrigation are largely adopted by farmers mainly since 1970-71. According to data, there were 0.25 lakh tubewells in 1966-67 in Haryana. But they rose to 8.77 lakh in 2014-15 (figure 3). With the increase in numbers of tubewells, the share of tubewells irrigation to net irrigation also increased from 22.35 percent in 1966-67 to 58.71 percent in 2014-15 (figure 4).

The increase in extent of irrigation has played positive role for the development of agriculture in Haryana state. Table 2 clearly shows that Haryana during 1966-67 to 2013-14 had experienced remarkable increase in the parameters of agricultural development such as Total Gross Cropped Area, Intensity of Cropping, Numbers of Tractors, Density of Tractors, Use of Chemical Fertilizers, Area and production increase in Foodgrains. The total gross cropped area which was 4599 thousand hectares in 1966-67 increased to 6243 thousand hectares in 2013-14. Area under foodgrains rose from 3520 thousand hectares to 4357 thousand hectares during 1966-67 to 2013-14. The Cropping Intensity rose from 123.9 percent to 184.20 percent during 1966-67 to 2013-14. The density of Tractors rose from 1.04 in 1966-67 to 43.40 in the year 2013-14. The consumption of Fertilizers raised from

42 Kg per hectares in 1980-81 to 225 Kg per hectares in 2013-14, an increase of 435 percent in corresponding period.

Position of Groundwater Resources:

Groundwater resources of Haryana are replenished and recharged every year from different sources. They include rain, rivers, canal seepage, return flow irrigation, ponds, rainwater harvesting structures etc. Table 3 reveals that the volume of groundwater draft in the Haryana state is more than that is replenished by recharge from all the five components. According to Central Ground Water Board's latest assessment in 2013 Haryana has 1029666.42 hams (hectare meters) Net Annual Available groundwater resources. As against this availability, Haryana utilizes by over exploiting 1391574 hams groundwater through tubewells. Sector wise consumption shows that out of 1391574 hams groundwater, irrigation alone consumes 1331722 hams (95.7 percent) while domestic and industry 59852 hams (4.3 percent). The spatial distribution of net annual groundwater availability and utilization is not similar in the Haryana state which is visible from table 3 and figure 5. The district wise net annual groundwater availability is found maximum in Jind (102178 hams) followed by Sonipat (80195 hams), Karnal (71946 hams) and Hissar (70178 hams). While the minimum 14553 hams net annual groundwater is found in Panchkula district. On the other hand the maximum annual utilization of groundwater is registered in Kurukshetra (145115 hams) followed by Kaithal (120687 hams), Fatehabad (116123 hams) and Jind (115137 hams) districts. The minimum groundwater consumption i.e. 11652 hams is recorded in Panchkula district followed by Mewat (16196), Faridabad (17009) and Mahendragarh (22158) districts (Figure: 5). While according to CGWB 2011, the district wise pattern of the groundwater draft reveals that the highest annual groundwater draft is observed in Karnal (120143) district followed by Sirsa (116410), Fatehabad (108719) and Kaithal (107746) districts. The volume of groundwater draft in these three districts is about 28 percent of the total groundwater draft of the state of Haryana. The volume of groundwater draft in a district is directly related to the prevailing cropping pattern, area under irrigation and availability of surface water irrigation in that district because irrigation consumes major portion of groundwater draft. The highest gross annual groundwater draft is also associated with the cultivation of water intensive crops (Paddy in Kharif and Wheat in Rabi season) in a district. In Haryana, Karnal district is the most predominated area for the rice and wheat crop combination, especially for summer rice (popularly known as Santhi). The per unit draft of groundwater in this region is very high and vary from 0.27 hams/ha to 0.98 hams per hectare. The unit draft of these areas is also higher than the unit draft of the state as a whole. This area is also known as the "rice bowl of Haryana" So he used 97.9 percent of annual groundwater draft for irrigation purpose. In year 2010-11 the highest production of rice (461000 tonnes) is recorded in Karnal district followed by Kaithal, Kurukshetra and Fatehabad districts. The lowest unit draft of groundwater is observed along the western boundary of the state except the extreme western part. In these areas, it varies from 0.02 hams per hectare to 0.13 hams per hectare which is much lower than the unit draft of the state.

Stage of Groundwater Development:

Because of gigantic gap between net annual availability of groundwater and utilization, the stage of groundwater development (ratio of ground water utilization to net groundwater availability) is very high i.e. 135 in Haryana (table 3). Significantly, Haryana is on the third top stage of groundwater development after Punjab (149) and Rajasthan (140) states. The spatial distribution of stage of groundwater development is not uniform in the state and hence Haryana is divided into three categories. The first category groundwater development more than 150 percent is covering the following districts Kurukshetra, Kaithal, Fatehabad, Sirsa, Bhiwani and Panipat. Here the maximum 281 percent stage of groundwater development is recorded in Kurukshetra district. The second category ranges between 100 to 150 percent is recorded in the following district Karnal, Ambala, Hissar, Gurugram, Palwal, Jind, Sonipat and Yamunanagar. The third category less than 100 percent is noted in the following district Faridabad, Rewari, Mahendragarh, Jhajjar, Panchkula, Mewat and Rohtak district. The minimum 70 percent stage of groundwater development is registered in Rohtak district.

Groundwater Level and Over Exploitation

Table 4 reveals that the groundwater level in the Haryana state has been depleted about double depth in last two or three decade. Due to incessant over exploitation of groundwater especially after 1980-81, the groundwater level in the major part of the Haryana state are in the range of 10 metres to 20 metres. Most of the areas of the district of Ambala, Faridabad, Jind, Karnal, Mewat, Palwal, Panipat, Panchkula and Yamunanagar fall under this range. Deep groundwater level ranges between 20 to 30 metres are found in the following districts Bhiwani, Fatehabad, Gurugram, Kaithal, Rewari and Sirsa districts. Very deep groundwater level more than 30 metres is recorded in the following two districts Kurukshetra and Mahendragarh. Shallow groundwater level ranges less than 10 metres is observed in the Hissar, Jhajjar, Rohtak, and Sonipat districts. On the whole the minimum and maximum groundwater level 4.10 metres and 46.39 are noted in Rohtak and Mahendragarh district.

Groundwater depletion between the years 1974 to 2016 in Haryana is divided into three categories. The first category (below state average) the groundwater depletion below than 9.47 metres are recorded in the following districts Ambala, Bhiwani, Jind, Mewat, Palwal, Sonipat, Sirsa, and Yamunanagar district. The second category (more than state average) the groundwater depletion more than 9.47 metres are recorded in the following districts Karnal, Fatehabad, Faridabad, Gurugram, Kurukshetra, Kaithal, Mahendragarh, Panipat, Panchkula, and Rewari district. The third categories where the groundwater level increase, these district are Rohtak, Jhajjar and Hissar. The Maximum depletion i.e. 30.28 metres is recorded in the Mahendragarh district. While the minimum depletion 0.73 metres is recorded in the Bhiwani district. In the agricultural districts like Karnal where rice and wheat crop combination are predominated, farmers have admitted that rice cultivation is mainly responsible for over exploitation and depletion of groundwater level.

Table 5 shows the categorization of blocks in Haryana state according to the stage of groundwater development and

significant long term decline of groundwater level. Numbers of over exploited blocks are much higher than the blocks which are safe from groundwater development point of view. In this scenario of exploitation, the block wise position of groundwater of Haryana state reveals that out of the total 107 blocks only 40 blocks (37 percent) in 1995 were over exploited (dark blocks), whereas 71 blocks (60 percent) were over exploited in 2011. In contrast 50 blocks (47 percent) safe (white) blocks in 1995 have been reduced to 23 blocks (19 percent) in 2011. In 2013 the percentage of dark blocks are slowly decrease to 54 percent (64 blocks), and the percentage of white blocks increase to 25 percent (30 blocks). It reveals that the Haryana state is not in a good position with regards to the availability of groundwater.

6. Suggestions

Being a natural agricultural state, the future of Haryana agriculture lies in the optimal use of groundwater resources. Towards this direction, following suggestions are made.

1. The present cropping pattern of Haryana i.e. rice and wheat is not viable in respect of groundwater resources. Keeping in mind the ecological conditions, government should encourage the cultivation of low water consuming crops by rewarding remunerative prices and assured marketing in place of present high water consuming crops mainly rice.
2. A conceptual document entitled "Master Plan for Artificial Recharge to Groundwater" has been circulated to all districts and blocks for its implementation. The state government may use this plan for its effective implementation to arrest declining groundwater resources.
3. Flood irrigation is commonly practiced in Haryana which results wastage of a lot of water. To check the wastage of water through flood irrigation, government should promote sprinkler and drip irrigation at large stage.
4. The canal irrigation system, which was planned in view of the then cropping pattern, cropping intensity, groundwater quality and quantity situations needs amendment.
5. To save the water, use of laser levelling, zero tillage, timely transplanting of paddy cultivation, furrow plantation methods etc. should be encouraged at farm level.

6. To recharge aquifers renovation of village ponds, check dams, trenches, borewells etc. should be promoted at large level. There is need to adopt rain water harvesting.
7. Further, the use of flat rates for electricity or highly subsidized electricity, combined with unreliable supplies, adversely affects the use of groundwater. So, there is need to revamp agricultural power supply and pricing structure in state of Haryana.
8. There is an urgent need to formulate solid water policy of Haryana which till date to not seem in the state.

7. Conclusion

Haryana is a rain deficit area of the country and its soil does not possess moisture throughout the year. The geographical conditions of the state favour the cultivation of a variety of tropical and temperate crops of the world. To make agriculture successful, Haryana has made remarkable progress in the field of irrigation during 1966-67 to 2014-15 periods. The 37.80 percent extent of irrigation in 1966-67 has increased to 84.40 percent in 2014-15. Similarly, 134 percent irrigation intensity in 1966-67 has rose to 196 percent in 2014-15. Likewise tubewell irrigation has increased from 22.35 percent in 1966-67 to 58.71 percent in 2014-15. With these developments, Haryana state has made notable progress in the field of agriculture in the corresponding period. But unfortunately, the unamainary growth of tubewells has led to over exploitation of groundwater resources. Presently due to over exploitation 54 percent blocks of the state are declared as dark blocks (over exploited). If the groundwater abstraction continues at the same rate in Haryana the groundwater level may reach a depth from where the lifting of it may not be possible for irrigation purpose. As a result of this, there is a great risk of the conversion of this tremendously productive area into barren region. There is urgent need, for coordinated efforts and wills by various governments and non-governmental agencies, social service organizations and the stakeholders for evolving implementable plan for effective management of this precious natural resource. To sustain the agriculture and overall development of the Haryana state, there is an urgent need for the formulation of eco-friendly agriculture, irrigation and water policy of the Haryana.

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Table 1: Indicators of Irrigation Development in Haryana (1966-67 to 2014-15)

Years	Extent of Irrigation (Percentage of Net Irrigated Area to Net Sown Area)	Irrigation Intensity (Percentage of Gross Irrigated Area to Net Irrigated Area)	Numbers of Tubewells and Pumping Sets (In Lakh)	Net Area Irrigated by Wells and Tubewells
1966-67	37.80	134	0.25	22.35
1970-71	43.00	146	1.04	37.46
1975-76	48.40	156	2.05	40.64
1980-81	59.20	155	3.32	45.31
1985-86	62.20	164	4.06	46.79
1990-91	72.70	163	4.98	48.00
1995-96	77.00	169	5.49	48.98
2000-01	83.90	177	5.89	49.59
2005-06	82.30	186	6.18	54.18
2010-11	82.10	192	7.23	57.15
2012-13	88.30	183	7.52	61.16
2013-14	83.80	195	7.72	56.64
2014-15	84.40	196	8.77	58.71

Source: Statistical Abstract of Haryana (Various Issues) 1966-67 to 2014-15.

Table 2: Parameters of Agricultural Development in Haryana

Sr. No.	Indicators	1966-67	1980-81	1990-91	2000-01	2013-14
1.	Total Gross Cropped Area (in 000 hectares)	4599	5462	5919	6115	6243
2.	Intensity of Cropping (%)	123.9	151.34	165.62	170.57	184.20
3.	Numbers of Tractors (000's)	5	53	130	210	271
4.	Density of Tractors	1.04	9.65	22	33.52	43.40
5.	Consumption of Fertilizers (kg/hect.)	—	42	99	152	225
6.	Area under Foodgrains (000 Hectares)	3520	3963	4079	4340	4357
7.	Production of Foodgrains (000 Million Tons)	2592	6036	9559	13295	16944

Source: Statistical Abstract of Haryana (Various Issues) 1966-67 to 2014-15.

Table 3: Groundwater Availability, Utilization and Stage of Development in Haryana

Sr. No.	District	Net Annual Groundwater Availability	Annual Groundwater Utilization (ham)				Stage of Groundwater Development (%)
			Irrigation	Domestic and Industrial Water Supply	Total in 2013	Total in 2011	
1.	Ambala	56306	49756 (86.6)	7710	57466	49293	102
2.	Panchkula	14553	8862 (76.0)	2790	11652	11862	80
3.	Fatehabad	63229	115758 (99.7)	365	116123	108719	184
4.	Bhiwani	62121	103397 (98.3)	1742	105139	43824	169
5.	Hissar	70178	77990 (99.6)	310	78300	60285	112
6.	Gurugram	23827	28062 (88.4)	3688	31750	53927	133
7.	Mewat	21814	15016 (92.7)	1180	16196	14453	74
8.	Faridabad	17141	14777 (86.9)	2232	17009	16350	99
9.	Palwal	46124	46095 (97.9)	999	47094	46891	102
10.	Jhajjar	42462	35002 (99.2)	295	35297	40943	83
11.	Jind	102178	111148 (96.5)	3989	115137	80873	113
12.	Kaithal	53507	114114 (94.6)	6573	120687	107746	226
13.	Karnal	71946	85311 (97.9)	1853	87164	120143	121
14.	Kurukshetra	51699	135122 (93.1)	9993	145115	74641	281
15.	Mahendragarh	25630	21607 (97.5)	551	22158	22841	86
16.	Panipat	33281	53347 (98.4)	894	54241	51456	163
17.	Rewari	30962	27175 (95.9)	1164	28339	31371	92
18.	Rohtak	47795	33285 (99.7)	99	33384	30743	70
19.	Sirsa	63678	110751 (99.2)	849	111600	116410	175
20.	Sonipat	80195	86500 (97.3)	2361	88861	94535	111
21.	Yamunanagar	51040	58647 (85.1)	10215	68862	65292	135
Haryana Total (ham)		1029666.42	1331722 (95.7)	59852	1391574	1242598	135
Haryana Total (bcm)		10.30	13.32	0.60	13.92	12.43	135

Source: Report on "Dynamic Groundwater resources of India" (as on march 2013), Central Ground Water Board, Ministry of Water Resources, Government of India, Faridabad, 2017 and CGWB 2011.

Note: Figures in parentheses show the percentage of Irrigation to total annual groundwater draft.

Table 4: District wise Groundwater Level in Haryana

Sr. No.	District	Depth to Water Table (In Metres)			Overall Change 1974 to 2016
		June, 1974	June, 1999	June, 2016	
1.	Ambala	5.79	5.45	11.24	-5.45
2.	Panchkula	7.58	11.17	17.15	-9.57
3.	Fatehabad	10.48	6.42	25.98	-15.5
4.	Bhiwani	21.24	16.19	21.97	-0.73
5.	Hissar	15.47	5.87	7.82	+7.65
6.	Gurugram	6.64	15.22	28.87	-22.23
7.	Mewat	5.56	7.14	11.53	-5.97
8.	Faridabad	6.43	8.71	17.65	-11.22
9.	Palwal	5.37	5.72	10.55	-5.18
10.	Jhajjar	6.32	4.49	5.10	+1.22
11.	Jind	11.97	5.92	14.48	-2.51
12.	Kaithal	6.28	7.78	26.69	-20.41

13.	Karnal	5.72	7.59	18.75	-13.03
14.	Kurukshetra	10.21	17.25	35.30	-25.09
15.	Mahendragarh	16.11	25.01	46.39	-30.28
16.	Panipat	4.56	8.53	18.81	-14.25
17.	Rewari	11.75	13.07	26.97	-15.22
18.	Rohtak	6.64	3.80	4.10	+2.54
19.	Sirsa	17.88	9.45	20.48	-2.6
20.	Sonipat	4.68	5.33	9.08	-4.4
21.	Yamunanagar	6.26	7.13	12.96	-6.7
Haryana Total		9.19	9.36	18.66	-9.47

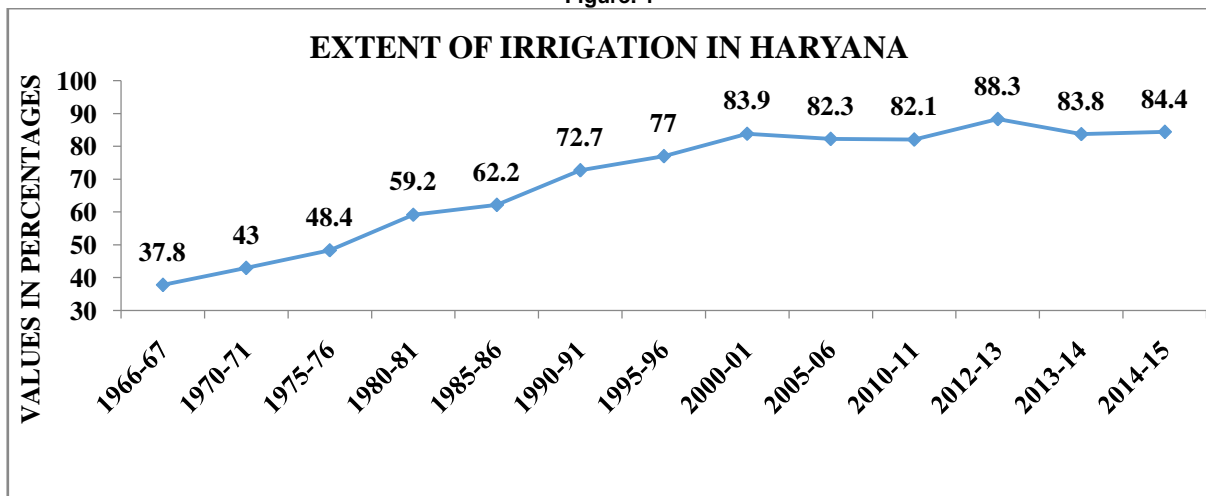
Source: Central Groundwater Board, North Western Region, Chandigarh, 2016.

Table 5: Haryana: Number of Blocks in Different Categories of Groundwater Exploitation

Categories	1995	1997	2004	2009	2011	2013
Over exploited (Dark)	40 (37)	47 (44)	55 (49)	70 (59)	71 (60)	64 (54)
Critical (Grey)	17 (16)	17 (16)	11 (10)	22 (18)	15 (13)	14 (12)
Semi Critical	-	-	5 (4)	9 (8)	7 (6)	11 (9)
Safe (White)	50 (47)	42 (40)	42 (37)	18 (15)	23 (19)	30 (25)
Total	107	107	113	119	119	119

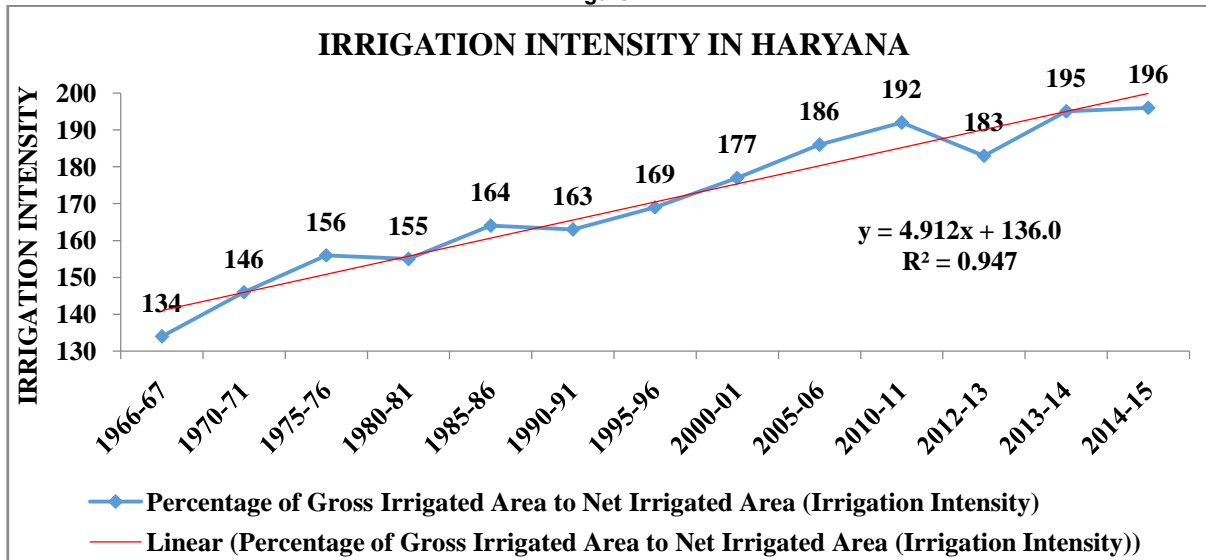
Source: Various reports of Central Ground Water Board, North Western Region, Chandigarh.

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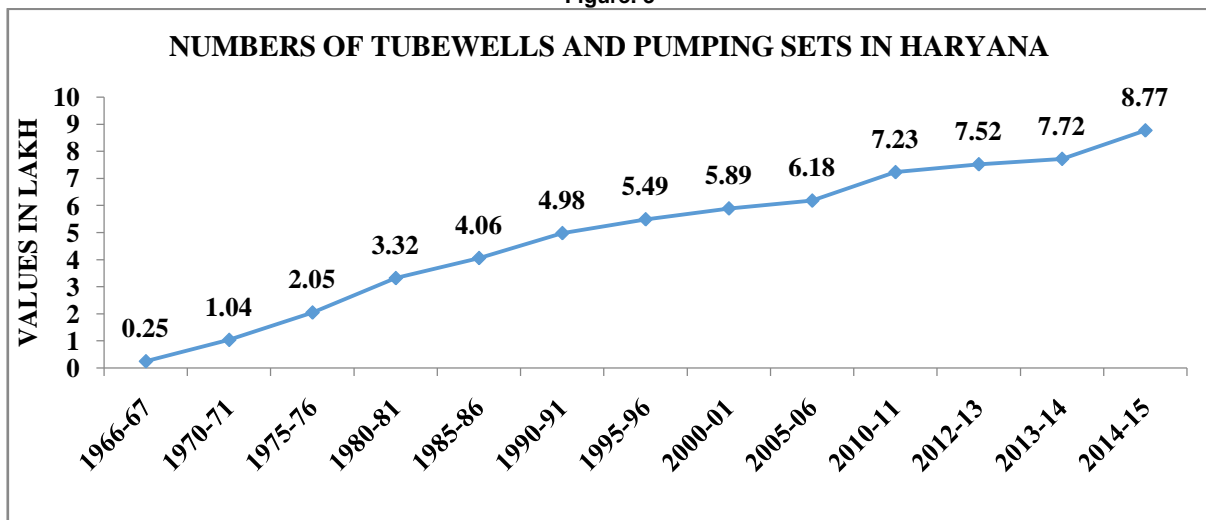
Source: Statistical Abstract of Haryana (Various Issues) 1966-67to 2014-15.

Figure: 2



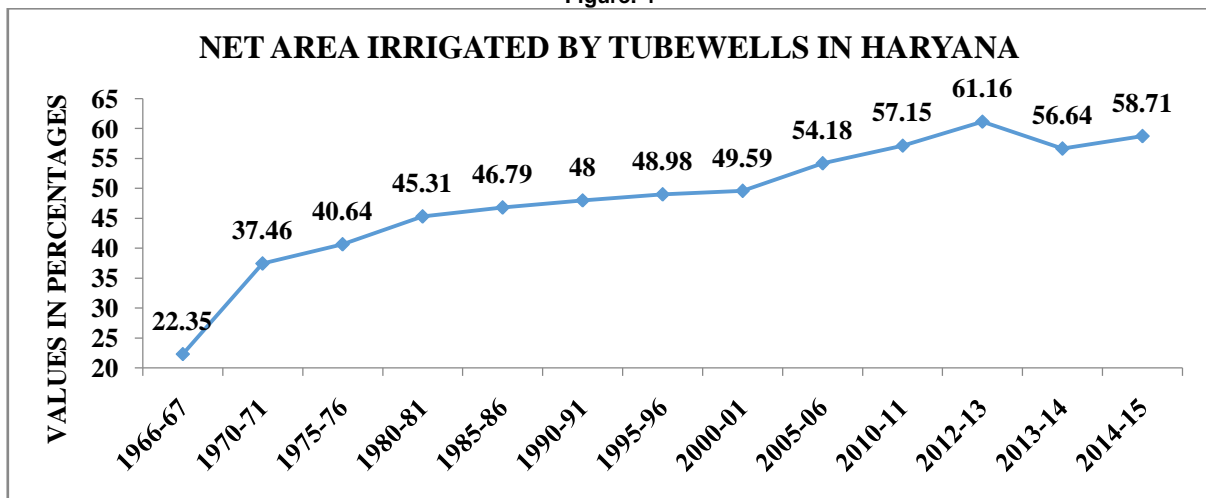
Source: Statistical Abstract of Haryana (Various Issues) 1966-67 to 2014-15.

Figure: 3



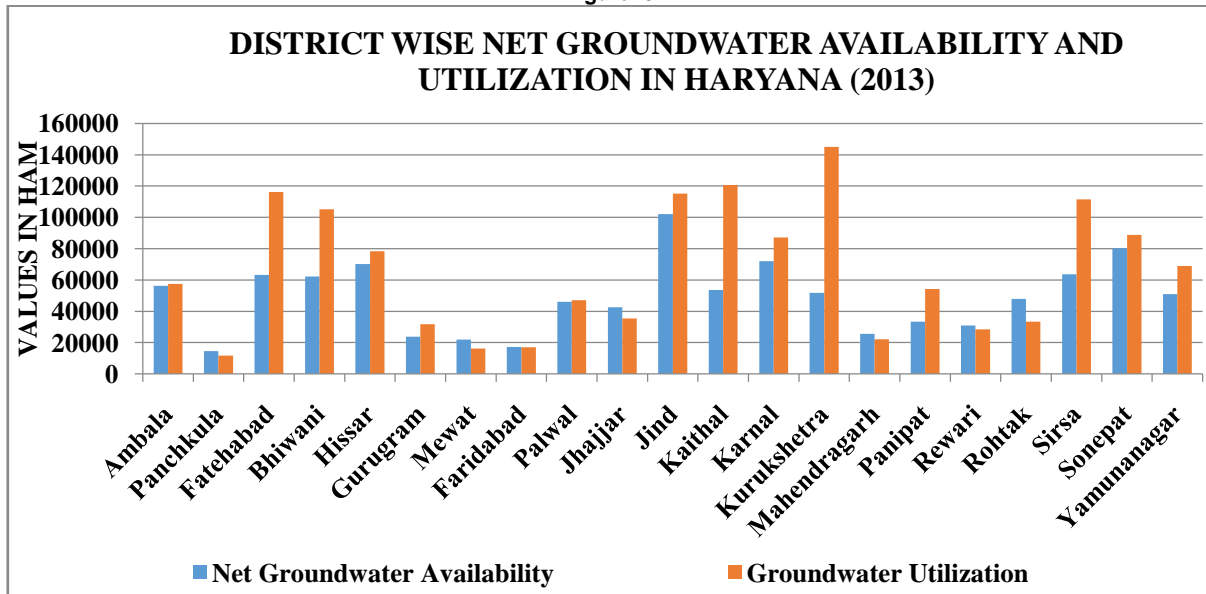
Source: Statistical Abstract of Haryana (Various Issues) 1966-67 to 2014-15.

Figure: 4



Source: Statistical Abstract of Haryana (Various Issues) 1966-67 to 2014-15.

Figure: 5



Source: Report on "Dynamic Groundwater resources of India", (as on march, 2013), Central Ground Water Board, Ministry of Water Resources, Government of India, Faridabad, 2017.