

Depletion of Quality and Level of Groundwater in Punjab

¹Harsh Tripathi, ¹Subhash Venkata Ponnuri*

¹Department of Mathematics, Lovely Professional university

Abstract-

Groundwater is an important source of drinking water, irrigation, and industry in many parts of India. In Punjab, the adoption of the rice-wheat cropping system has led to a manifold increase in the irrigation water demand, and about 73% of it is met from Ground water. Consequently, the level of Groundwater in the state is reducing rapidly due to its overuse and misuse. One more reason is Overusing of Fertilizers it affects the quality of ground level water. Apart from several water management strategies, such as better irrigation and farm management practices, change of cropping pattern, prevention of early paddy planting etc., which is strongly emphasized in this the paper is placed on the use of rainwater flow that is more than non-binding. According to Master Plan for recycling of groundwater prepared for the Punjab country, approximately 1200 MCM of water available in surplus monsoon running. By accepting rainwater harvesting and recycling that is done to groundwater through this water, a negative impact on the groundwater kingdom can be considered, so that to some extent. The Central Ground Water Board has undergone several surveys of operations Punjab projects can be repeated in other parts of the country. Some of this project also has discussed in this paper

Index Terms- Ground Water Pollution, Cropping pattern, Fertilizers & Source of Irrigation.

Introduction:

The Earth planet has nearly 75% as water, but the useful component of this is very small. The water present in rivers and lakes are comes under this category. This water commonly known as Groundwater. It is the most important fresh water resource which is used for domestic, agricultural, human and industrial activities. In Punjab During the last 3 decades, Punjab state has adept a spectacular increase in agricultural production practicing rice-wheat cropping system with convinced irrigation facilities, leading the country in achieving food-sufficiency. This led to manifold increase in the irrigation water demand which resulted in depletion of groundwater level in the most parts of the state at an alarming rate. To some extent the irrigation requirements are fulfilled by introduction of canal irrigation which has the led to the development of water logging and subsequent salinization rendering large chunks of fertile land unproductive mainly in the south-western part of Punjab. Other factors such as improper alignment of canals, seepage flow canals and distributaries, drainage congestion, brackish quality of groundwater, nature and properties of soil, faulty irrigation practices and cultivation of water intensive crops. In Punjab, major part of irrigation uses water comes from ground water. As the cropping intensity of Punjab is more than 200% and secondly major crop rotation is wheat-paddy, there is stress on ground water. This resulted in significant lowering of ground water table. And the usage of fertilizers, Punjab is the second highest fertilizers consumer after Andhra Pradesh it results decrease in the quality of groundwater and soil. Name of some authors those have done work on this area are: Adelana (2015), Singh et al. (1995, 2012), Rani (2019), Dohare et al. (2014), Bhatnagar and Sharma (2002), Kumar et al. (2020), Kaur et al. (2020), Greenman et al. (1967), Dhawan (1993), Krishna and Chopra (2015), Singh and Park (2018) and Gupta (2009).

Why Depletion:

There are so many reasons for depletion of level and quality of ground water. They are given below

Cropping Pattern:

The Green Revolution has brought many changes to the Punjab agricultural system. It changes the complete cropping pattern of Punjab. A cropping pattern for Punjab province in selected areas over time is given in the Table below. The Table shows that in the year 1970-71, about 40 percent of the plantations were under wheat which grew to 44.31% in 2007-08. Rice, which accounted for about 6.87% of the total area cultivated in 1970-71, increased to more than 33.15% in 2007-08, and increased to about 35.85% in 2010-11. The increase in the cultivation of wheat was due to the cost of gram, rapeseed and mustard, while rice was

obtained by removing the area from maize, nuts, sorghum and cotton. The equivalent area under cotton in 1970-71 was 7% of the planted area and increased to 9.34% in 1990-91. After the 1990s the cotton area was severely affected by adverse weather conditions and insect invasion, its share in the Gross-cultivated area declined to 5.97% in 2000-01. With the introduction of the area under cotton began to increase and increased to 7.69% in 2007-08. In 2010-11, it held 6.13% of the Gross cut-off area in the province. Areas under sugarcane and potatoes have not remained stable. Adequate supply of pulses and oil seeds in the cut-off area recorded significant reductions from 7.29 and 5.20% in 1970-71 to 0.25 and 0.71% in 2010-11. It can be concluded that the inequality of the two main grains namely. rice and wheat in the planting pattern have an impact on other crops. This is due to the better related benefits of these crops with less risk of production and marketing compared to other crops such as maize, cotton and pulses.

Shift in cropping pattern in Punjab (1970-71 to 2010-11)

Crop	1970-71	1980-81	1990-91	2000-01	2007-08	2008-09	2009-10	2010-11
Rice	6.87	17.49	26.86	32.89	33.15	34.57	35.58	35.85
Wheat	40.49	41.58	43.63	42.92	44.31	44.57	44.72	44.53
Cotton	6.99	9.60	9.34	5.97	7.69	6.66	6.49	6.13
Maize	9.77	5.65	2.51	2.08	1.96	1.91	1.76	1.69
Sugarcane	2.25	1.05	1.35	1.52	1.37	1.02	0.76	0.89
Potato	0.30	0.59	0.31	0.75	1.14	1.04	1.05	0.81
Pulses	7.29	5.04	1.91	0.68	0.34	0.28	0.24	0.25
Total foodgrains	69.18	68.82	75.55	79.05	80.03	81.58	82.52	82.52
Total oilseeds	5.20	3.52	1.32	1.01	0.76	0.76	0.79	0.71

(Percent)

Fertilizers and Manures:

Intensive farming, and high use of organic fertilizers was introduced in India in the 1960s as part of the Green Revolution. The rapid adoption of organic fertilizers and composting and irrigation varieties has contributed to the dramatic increase in agricultural production in the province of Punjab. Fertilizer application statistics for the province are presented in the table below. The total use of Nitrogen (N), Phosphorus (P) and Potash (K) nutrients in the province in 2007-08 was 13.17 lakh which increased by about 7% to 19.36 lakh tons in 2011-12. In 2011-12, consumption of N, P and K was 14.09, 4.55 and 0.72 lakh tons, respectively. Fertilizer application per hectare in 2011-12 was 246 kg which is the highest number in the country. Nitrogen fertilizer is very important for plant and plant growth which is why it is so widely used which leads to nutrient imbalance. Despite the fact that Punjab is one of the most developed and productive provinces, the N, P, and K ratio of Punjab is one of the badest in the country where nitrogen is high concentrated and very little attention has been given. provided for the use of balanced nutrition. For example, while the recommended ratio between N, P and K is 4: 2: 1 but the actual use ratio of N, P and K in Punjab in 2011-12 was 19.5: 6.3: 1.

Consumption Fertilizers in Punjab

(000, nutrient tonnes)

Year	Nitrogenous (N)	Phosphatic (P)	Potassic (K)	Total (NPK)	Consumption per hectare (kg)
2007-08	1317	341	37	1695	213
2008-09	1332	379	55	1766	223
2009-10	1348	383	56	1787	226
2010-11	1403	435	73	1911	243
2011-12 (P)	1409	455	72	1936	246

Source of Irrigation:

Traditionally, farmers depend on rainfall for irrigation. Thus, crops with a large requirement of water were grown in areas with moderate to heavy rainfall. And hard crops which can withstand shortage of water were grown in dry areas. Things have changed to a certain extent in modern times, with the construction of large dams and barrages across rivers. But now a days most of the farmers are irrigating the land by using Tube wells. It is one of the main reason for depletion of ground water.

Source	1980-81	1990-91	2000-01	2010-11	2019-20
Canals	1430	1660	962	1113	1180
Tubewells	1939	2233	3074	2954	2894

In the above table the count of tube wells was increased by 50% in 2019-2020 compared to 1980-1981. And The count of canals was decreased by 17% in 2019-2020 compared to 1980-1981.

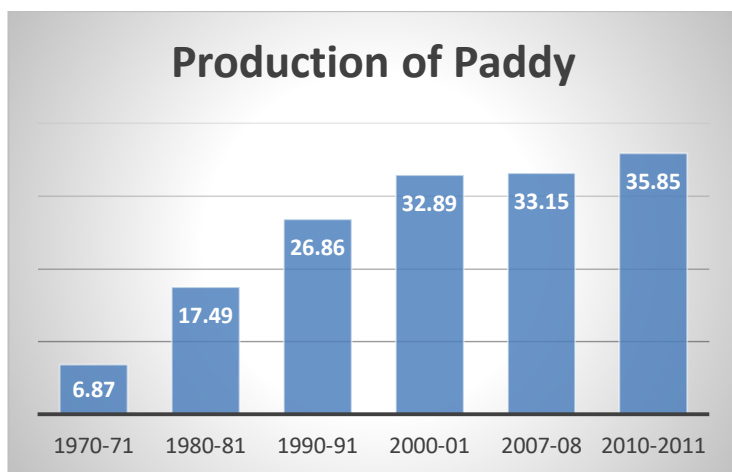
Distribution of blocks in different categories based on underground water resources in Punjab:

The distribution of blocks at different stages based on the Groundwater resources over the last 10 years is provided in the table below. From 2000 to 2010, over exploited blocks are increased from 52.9% to 79.7%. Safe blocks percentage was gradually decreased from 27% to 16% in the span of last 10 years. By year 2010, in the state of Punjab almost 80% of the water was over exploited which is unsafe to drink and use.

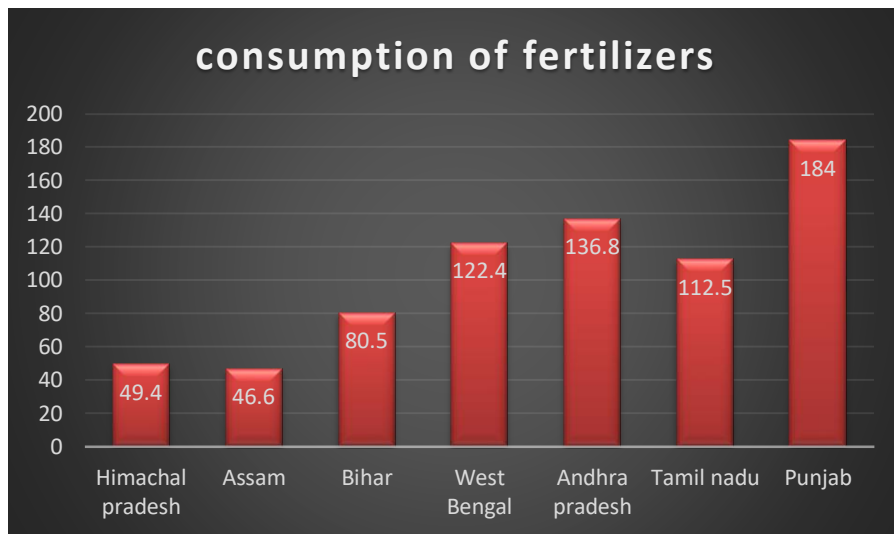
Category	2000	2005	2010
Over-exploited (Dark)	73 (52.90)	103 (75.18)	110 (79.71)
Critical	11 (7.97)	5 (3.65)	3 (2.17)
Semi critical	16 (11.59)	4 (2.92)	2 (1.45)
Safe	38 (27.54)	25 (18.25)	23 (16.67)

Studies and Findings:

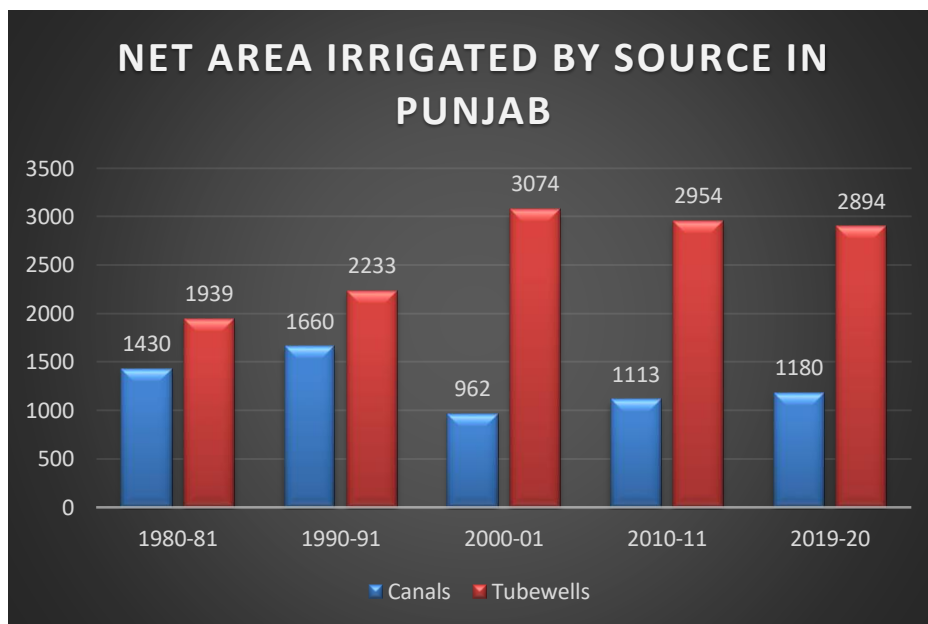
Blame to paddy: In Punjab Green revolution brought many changes. Before Green revolution Punjab is Wheat bowl of India. But, after Green revolution paddy production was gradually increased which was equal to production wheat. According to a water productivity report by National Bank for Agriculture and Rural Development released in 2018. The irrigation requirement of paddy is more compared to other crops. Paddy consumes about 4000-5000 liters of water per kg of grain produced. From 1970-1971 to 2010-2011 production of paddy was increased 421.8%. This is the main reason for Depletion of ground water in Punjab.



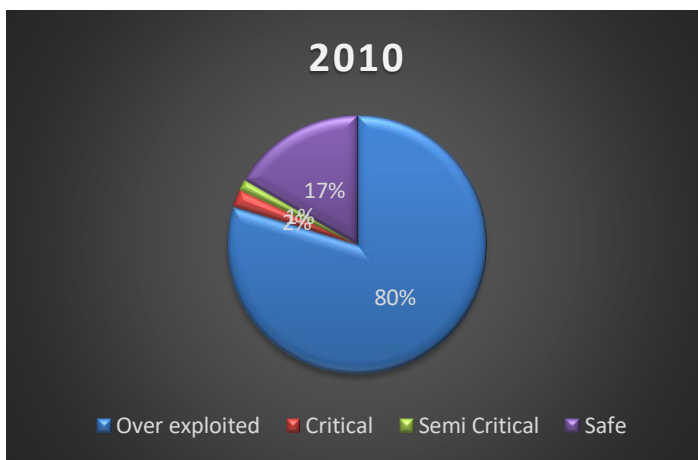
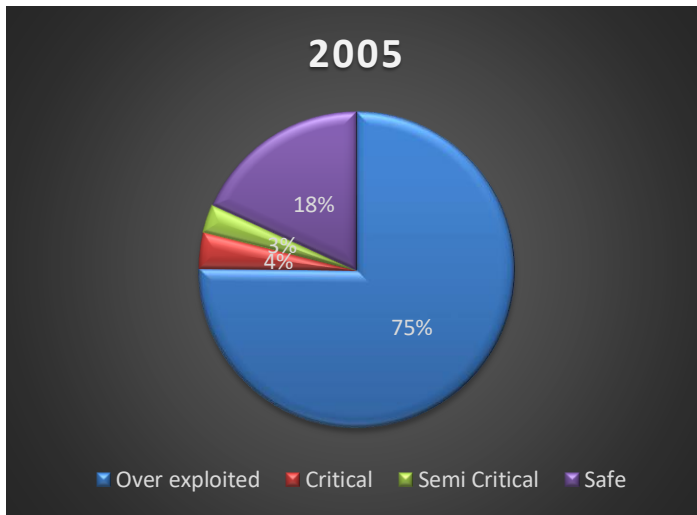
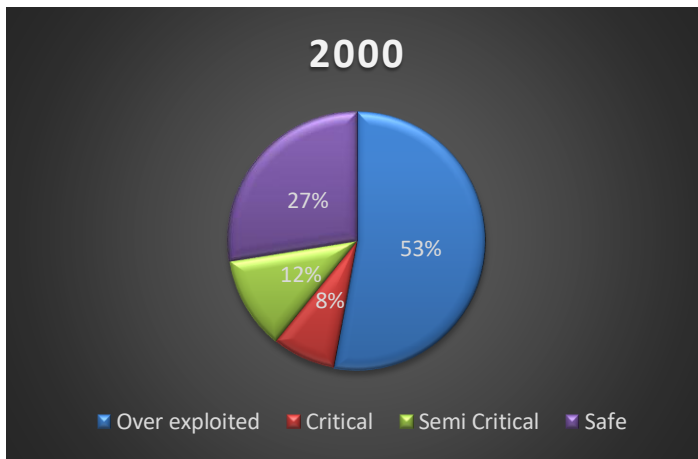
Heavy consumption of fertilizers: Punjab state alone consumes about 9% of the total fertilizers in India and the use is the highest on per unit area basis at 190.1 kg/ha of gross cropped area against 88.2 kg/ha in all India. Due to the high consumption of fertilizers the quality of ground water was depleted. In future they face so many harmful diseases.



Irrigation by Tube wells: Tube well irrigation comes under lift irrigation. Tube well is a small diameter hole drilled in the subsoil formation using some machines called as bore well machine. The area of this type of well is small and unless some mechanical power is used for lifting water, Rate of water withdrawal will be low.



Representation of blocks in different categories based on the underground water resources in Punjab from last 10 years (2000 to 2010):



Precautions:

Revival of drains:

Drains allow groundwater recharge through seepage. Some drains are either defunct or carry less water than their designed capacity due to siltation etc. Such drains can be revived by desilting and repairing them to upgrade their capacity to carry water and to recharge groundwater. The cross section of the drain can be restored or improved and ponds can be created by constructing check dams, Reservoirs at intervals along the drain, leading to increasing local groundwater recharge.

Groundwater recharge structures along canals, drains, rivulets:

A significant amount of water in canals, drains, choes and rivulets during rainy season remains unutilised. This water could be helpful to recharge the groundwater. Recharge structures can be constructed along canals, drains, and rivulets so that excess water during the monsoon (and during the slack irrigation season in canals) can be used to recharge the groundwater aquifer.

Groundwater recharge structures for storm water in urban areas:

Urban areas contain extensive hard surfaces such as roads, pavements, building roof tops etc. that prevent infiltration of rain water into the ground. This leads to extensive storm water runoff from these spaces to drains and rivers. Whereas, private buildings and premises are required to construct rainwater harvesting systems including recharge structures by the local bodies or the environmental authorities, such recharge structures for rainwater runoff can be constructed in public spaces in urban areas to improve groundwater recharge in cities.

Conclusion:

The present study on the Depletion of quality and level of groundwater shows the main reason for depleting level of ground water is Paddy crop and Irrigation by Tube wells. And the reason for depleting quality of ground water is Excess usage of Fertilizers

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