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Environmental Crisis in Punjab in Context of Agriculture: Role of the State and Central Government

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Abstract
Punjab holds an important position in India. The green revolution has resulted in remarkable growth rates in agricultural productivity and output in the state of Punjab. However, Punjab has to cope with the issue of declining soil health, rapidly growing micronutrient deficiencies, and alarming water table depletion as a result of the adoption of intensive technologies. In the state, the green revolution brought about a number of issues that have now come to light. The major deleterious effects have been on our environment, as a result of which the natural balance has been disrupted. Excessive use of chemical fertilizers resulted in degradation of soil health. Similarly, the overuse of pesticides is responsible for contamination of air and water bodies. Burning of paddy stubble also a serious issue in the state. The present paper examines the environmental crisis related to agriculture in the state. The role of central and state government to deal with this issue is also analysed.

Keywords: Environment, Farmers, Agriculture, Punjab

Methodology and Data Collection
The study is based on the primary and secondary data. The secondary data have been obtained from books, research papers, reports, newspapers, and agriculture department etc. Primary data was collected from the respondents at the village level through well designed questionnaire and field observations.
Sampling Design: Multistage stratified random sampling technique was adopted for the study. Block was selected as the first stage-sampling unit, Village as the second stage unit, the farmer households as the third and the ultimate stage of sampling unit.
Selection of blocks: Out of five blocks of district Mansa (Punjab), the three blocks have been selected. The selected blocks are Bhikhi, Budhlada and Sardulgarh.
Selection of villages: The village have been selected on the basis of the population as divided in four categories- up to 1500, 1501-2499, 2500 to 3999 and 4000 and above population in each block. According to this classification, we selected four villages randomly from each block. Thus, total twelve villages were selected for the data collection.
Selection of respondent farmers: The respondent farmers are the ones who possess land. have been selected on the basis of operation holding. These farmers were categorized into three categories – 1-5 acres, 6-15 acres and above 15 acres – on the basis of operation holding. Four farmers were picked randomly from each category. Thus, a total number of 12 farmers were selected from each village.

Introduction

Punjab is a well-known agrarian state in northern India. In the post green revolution period, Punjab's food grain production has increased substantially and it played very pertinent role to feed millions of people. In the late 1960s, a new agricultural strategy known as "green revolution" was introduced in the state. This was supported by the introduction of new, high-yielding varieties of maize, wheat, rice, and bajra (millet), as well as a package of additional inputs such as chemical fertilisers, pesticides, insecticides, and assured irrigation facilities. But these days Punjab is facing several challenges on environmental front. Agricultural activities like excessive use of ground water, use of chemical fertilizers and pesticides, and burning of wheat-paddy stubble created environmental imbalance in the state. The ground water table is declining at alarming rate due to excessive use of the ground water. Excessive use of chemical fertilizers resulted in decline of soil fertility. The worst problem with the pesticides is that it has contaminated drinking water very severely. The studies underscore that the Malwa region, already infamed as the cancer belt, has the highest number of cancer patients. A study by PGI revealed that “chemical toxicity is high in this region. Thus, excessive use of chemicals for agricultural activities is causing serious illness such as cancer.

In the post green revolution era, the state of Punjab has witnessed a considerable change in its cropping pattern. Traditionally, Punjab has been predominantly a wheat growing area. Rice stormed in the cropping pattern since mid-1970’s as a commercial crop and made a major impact on the Punjab agriculture. The area under paddy has increased ten folds during last five decades by replacing crops like cotton, kharif pulses, maize, jowar, Bajra and kharif oilseeds. Green revolution has resulted in the cultivation of many fewer varieties of crops.

Table 1.1 Area under Paddy in Punjab (1960-2018)

Year	Area
1960-61	227
1970-71	390
1980-81	1183
1990-91	2015
1995-96	2184
2000-01	2611
2005-06	2647
2006-07	2621
2007-08	2609
2008-09	2734
2009-10	2802
2010-11	2831
2011-12	2818
2012-13	2845
2013-14	2851
2014-15	2894
2015-16	2975

Area (000’ Hectare)

Source: Department of Agriculture, Government of Punjab

Table 1.1 reveals that area under paddy was increased from 227 thousand hectares in 1960-61 to 2975 thousand hectares in 2015-16. The over production and more area under rice created a large number of problems in Punjab agriculture. The high growth of area under rice replaces the areas under pulses, cotton and fodder crops. This replacement leads to soil degradation at a large scale as legume crops made the soil fertile, which was replaced by the rice crop. Further, the post management of loose stubble left after combine harvesting of paddy pollutes environment and is detrimental to health. In respect of the adverse impact of growing paddy in June to August on the ecology of the state, it leads to degradation of soil, water and air. During the months of June to middle of September, environment of the state becomes totally unliveable. In the months of October-November, in spite of the government ban, the farmers burn paddy stubble that pollute the environment extensively, which creates serious breathing problems for people. It has happened twice that in the end of October the smoke emerging out of burning paddy stubble got trapped under the clouds in the absence of blowing winds.

Table 1.2 Cropping pattern adopted by farmers in three blocks of Mansa District.

S No.	Cropping Pattern	Bhikhi (48)	Budhlada (48)	Sardulgarh (48)	Percentage (144)
a	Wheat-Paddy	95.83%	87.5%	95.83%	93.06
b	Wheat-Cotton	4.17%	12.5%	4.17%	6.94
c	Wheat-Maize	Nil	Nil	Nil	Nil
d	Paddy-Sugarcane	Nil	Nil	Nil	Nil
e	Other Crops	Nil	Nil	Nil	Nil

Source: Personal interview
Note: Figures in brackets shows the total number of farmers in three blocks.

Figure 1.1 Cropping pattern adopted by farmers in three blocks of Mansa District.

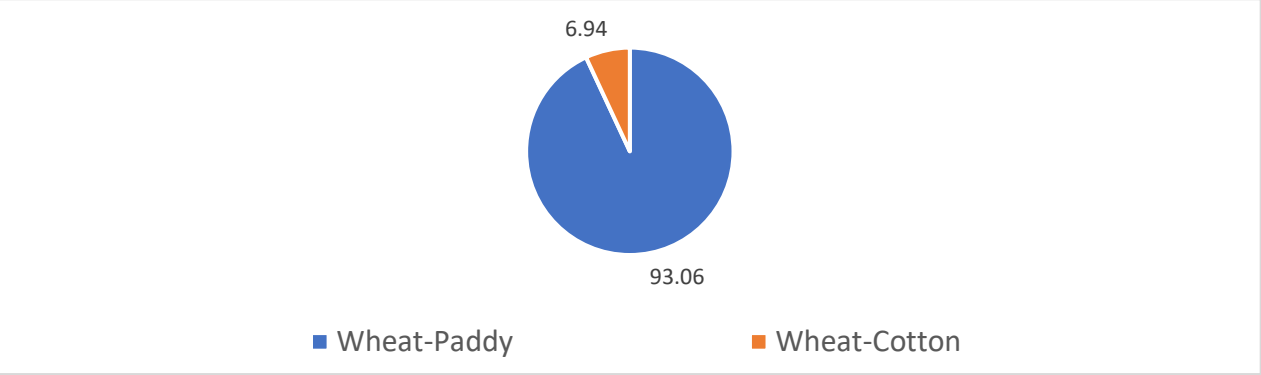


Table 1.2 reveals that 95.83 percent farmers of Bhikhi and Sardulgarh blocks, and 87.5 percent farmers from Budhlada block have adopted wheat-paddy cropping pattern and it is clear from the data that from each block most of the farmers adopted wheat- paddy cropping pattern. On the other hand, 4.17 percent farmers from Bhikhi and Sardulgarh blocks adopted Wheat-Cotton pattern. 12.5 percent farmers from

Budhlada block adopted wheat- cotton pattern. No farmer from these three blocks adopted wheat-maize or Paddy-sugarcane cropping pattern. Figure 1.1 reveals that 93.06 percent of the farmers from three blocks are using wheat-paddy cropping pattern. This has led to a decline in area under other crops like cotton, maize, bajra, jowar, sugarcane etc. Due to green revolution, the farmers of Punjab left their traditional cropping pattern in favour of government supported wheat, rice cropping pattern. When farmers were asked why they have adopted wheat-paddy cropping pattern? Most of the farmers stated that they have adopted wheat-paddy cropping pattern because of price security and marketing facilities. They stated that price for cotton crop is not enough as its input expenditure is very high.

A farmer from Sardulgarh block, said that cotton crop on his 5 acres land was destroyed by white fly in 2017. He then decides not to sow cotton anymore and switched to cultivate paddy. He was not only one. Thousands of other farmers in Punjab bore the brunt of pest attack. Earlier in 2015, the whitefly attack on cotton fields destroyed over 60-70 percent of cotton crop. Due to attacks of whitefly from last 4-5 years area under cotton crop is declining continuously. They said that the government is not doing anything to promote cotton crop.

Ram Singh, 40, a farmer from Budhlada block, said that the minimum support price (MSP) of paddy and the low risk of pest attacks had aided his shift from cotton to paddy. Thus, farmers in Cotton belt are also shifting from wheat-cotton cropping pattern to wheat-paddy cropping pattern. Presently, Punjab has unsuccessful to achieve any degree of crop diversion during the said period. Extensive and revolutionary changes in the cropping pattern were witnessed in Punjab in the wake of the green-revolution. After the green revolution in the 60s and 70s the farmers of Punjab were persuaded to leave traditional organic methods. These changes are causing degradation of soil, nutrient imbalance, excessive use of fertilizers and pesticides leading to several environmental and health problems, and also creating social and economic imbalances.

Excessive use of chemical fertilizers and pesticides:

The initial increase in agricultural production in the state was mainly due to increase in net sown area, however stunning rise of food grain production from 11.92 Million Tonnes in 1980-81 to 29.44 Million tonnes in 2013-14 can be largely attributed to intensive use of farm chemicals. The consumption of chemical fertilizers (NPK) was increased from 213 thousand tonnes in 1970-71 to 1977 thousand tonnes in 2013-14 and 2040 thousand tonnes in 2015-16 (Table 1.3). High usage of nitrogenous fertilizers with relative under-utilization of other fertilizers and micronutrients has led to imbalance in micro nutrient in soils of the Punjab. The various studies undertaken in the state since 1970 has indicated the presence of residues of chemical pesticides like organochlorines, organophosphates, synthetic pyrethroids and carbamates in human beings, milk, water, vegetables and other food products at levels, which are dangerous for human health. Non judicious use of pesticides has also resulted in the development of pesticide resistance in various insects and pests [1].

Table 1.3 Consumption of chemical fertilizers in Punjab (1960-61 to 2015-16)

Year	Nitrogen N	Phosphorus P	Potash K	Total	Consumption (kg/ha)
1960-61	5	…	…	5	…
1970-71	175	31	7	213	37.50

1980-81	526	207	29	762	112.50
1990-91	877	328	15	1220	162.60
1995-96	1020	227	16	1263	166.31
2000-01	1008	282	23	1313	168.33
2005-06	1255	369	63	1687	214
2006-07	1299	354	38	1691	215
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	1416	449	53	1918	243
2012-13	1436	416	33	1885	239
2013-14	1425	469	83	1977	251
2014-15	1730	460	60	2250	247
2015-16	1510	452	78	2040	257

Nutrient (000’ Tonnes)

Source: Department of Agriculture, Government of Punjab

Table 1.4 Consumption of Insecticides/Pesticides in Punjab (1980-2017)

Year	Consumption in Technical Grade (M.T)
1980-81	3200
1990-91	6500
1995-96	7200
2000-01	6970
2005-06	5970
2006-07	5975
2007-08	5900
2008-09	5760
2009-10	5745
2010-11	5600
2011-12	5690
2012-13	5725
2013-14	5720
2014-15	5699
2015-16	5721
2016-17	5843

Source: Department of Agriculture, Government of Punjab

Table 1.4 reveals that use of pesticides/ insecticides is also increased. Punjab consumed 3200 tonnes of pesticides in 1980-81. In 2014-15, Punjab consumed 5699 tonnes of pesticides, in 2016-17 the consumption was recorded at 5843 tonnes. The per hectare consumption of pesticides in Punjab is one of the highest in the country at 74 kg / hectares as suggested in 2016-17 data. The national average for the same time is 60 kg per hectares.

Several studies have established that such high use of pesticides is resulting in high incidence of cancer and birth defects in the state. The state accounts for 90 cancer patients per 100,000 while the national average is 80, according to a report. In 2013, the state has for the first-time initiated headcount of cancer patients [2].

Table 1.5 Farmers response about uses of Fertilizers and Pesticides

S No.	Offshoots	Bhikhi (48)	Budhlada (48)	Sardulgarh (48)	Percentage (144)
a	Chemical Fertilizers	100%	100%	100%	100
b	Pesticides	100%	100%	100%	100

Source: Personal Interview

Note: Figures in brackets shows the total number of farmers in three blocks.

Table 1.5 reveals that almost 100 percent respondents are using chemical fertilizers and pesticides. Pesticides are substances used to control organism which may badly affect public health or organism which attack food and other materials necessary to mankind. When a pesticide is sprayed, much of it pollutes air. Chemical fertilizers are also essential component of agricultural technology. Whereas earlier organic fertilizers were mostly used in fields. These were replaced by chemical fertilizers. Excessive use of chemical fertilizers caused decline in fertile rate of the soil.

Table 1.6 According to farmers problems caused by pesticides.

S. No.	Problems	Bhikhi (48)	Budhlada (48)	Sardulgarh (48)	Percentage (144)
a	Health problems	62.5%	85.42%	87.5%	78.47
b	Others	37.5 %	14.58%	12.5 %	21.53

Source: Personal Interview

Note: Figures in brackets shows the total number of farmers in three blocks.

Data given in table 1.6 indicates that 78.47 percentages farmers said that chemical pesticides cause health problems. According to the data 37.5 percentage farmers stated that use of chemical pesticides causing some other problems like killing of farmer-friendly insects and polluting canal water. These insects help to save crops from pests but due to excessive use of chemical pesticides, these are being damaged. They said that it was also a time when we used to drink water directly from the canal. But today we cannot think about it. Therefore, it is clear from the above that the excessive use of chemical pesticides caused several problems. Despite this, farmers have to use chemical pesticides for the protection of their crops from the insects.

Table 1.7 Farmers' views on the adverse effects of chemical fertilizers on the environment

S. No.	Farmers' Responses	Bhikhi (48)	Budhlada (48)	Sardulgarh (48)	Percentage (144)
a	Yes	89.58%	95.83%	87.5%	90.97
b	No	10.42%	4.17%	12.5%	9.03

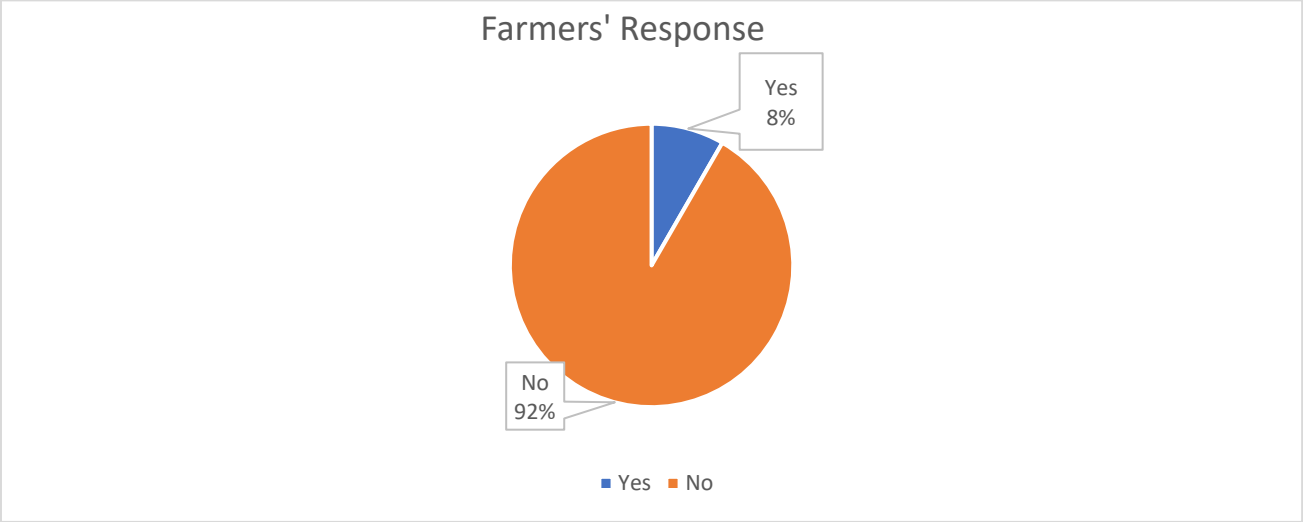
Source: Personal Interview
Note: Figures in brackets shows the total number of farmers in three blocks.

Table 1.8 Farmers' views on the adverse impacts of Pesticides on the environment.

S No.	Farmers' Responses	Bhikhi (48)	Budhlada (48)	Sardulgarh (48)	Percentage (144)
a	**Yes**	91.67%	97.92%	79.17%	89.58
b	**No**	8.33%	2.08%	20.83%	10.42

Source: Personal interview
Note: Figures in brackets shows the total number of farmers in three blocks.
Table 1.7 indicates that 90.97 percent farmers from all three block are aware about the dangerous impacts of chemical fertilizers on the environment. Similarly, table 1.8 indicates 89.58 percent farmers of all three blocks are accepting that pesticides are responsible for environment pollution. 10.42 percent respondent were not agreed with this. During the field work it was observed that farmers, who did not agree that chemical fertilizers and pesticides are harmful for the environment, felt that why only farmers are blamed for environment pollution. That is why they expressed their negative views about this question. Some farmers said that smoke released from the factories and sewage discharged from the cities had a bad effect on the environment.

Figure 1.2 presenting farmers' response about training by government for the usage of chemical fertilizers and pesticides.



There is problem of overuse of chemical fertilizers and pesticides by a large number of farmers. Therefore, training programs are necessary to make them aware about their proper use. But when it was asked from the farmers whether they got training from government to use pesticides and fertilizers, only 8 percent of famers were agreed that they got training. On the other hand, 92 percent of farmers said they did not receive any assistance in this regard. So, government should conduct training programs for farmers on regular basis.

Burning of Wheat/Paddy Stubble

The paddy-wheat cropping pattern is extensively practiced in Punjab, and it generates a huge amount of

agricultural wastes in the form of straw and stubble. According to a study conducted by IARI (The Indian Agricultural Research Institute), paddy stubble production was in excess of 22,289 gigagrams (Gg) annually in India, out of which 13,915 gm is burned in fields. The two states of Punjab and Haryana alone produce 48% of the entire amount of stubble in the country. Further, according to a study by IARI, about 40 million metric tonnes of farm yield waste is produced every year in Punjab alone. Farm residue burning causes off-site health hazard impacts, such as coughing, emphysema, asthma, bronchitis, eye irritation, corneal opacity, and skin diseases. The inhalation of small particles can also intensify persistent cardiac and pulmonary ailments, and furthermore, is related to the premature deaths in people who are already suffering from these illnesses. Annually, 3.3 million people die prematurely due to air pollution world-wide [3].

Table 1.9 Farmers' responses about burning of Wheat-Paddy stubble

S. No.	Farmers' Response	Bhikhi (48)	Bhudhlada (48)	Sardulgarh (48)	Percentage (144)
a.	**Yes**	85.42%	87.5%	91.67%	88.19
b.	**No**	12.5%	12.5%	8.33%	11.11
c.	**No response**	2.08%	Nil	Nil	0.69

Source: Personal interview

Note: Figures in brackets shows the total number of farmers in three blocks

Table 1.9 indicates that 85.42 percent farmers in Bhikhi block, 87.5 percent farmers in Bhudhlada block and 91.67 percent farmers in Sardulgarh block accepted that they burn wheat-paddy stubble. Thus, it is clear from the data that overall 88.19 percent farmers burn wheat-paddy stubble in all three blocks. 12.5 percent farmers from Bhikhi and Budhlada blocks and 8.33 percent farmers from Sardulgarh block accepted that they do not burn the wheat-paddy stubble. 2.08 percent farmers from Bhikhi block refused to give any answer. According to data only 11.11 percent farmers don't burn wheat-paddy stubble and they use some other methods. Thus, it can be said that the incidence of wheat-paddy burning is quite high. When it was asked from the farmers why they burn it? The farmers offer several reasons for burning wheat-paddy stubble. Some of them said that there is no other option. Most of the farmers said that we don't have equipements or we are not able to buy costly equipements for the proper management of the stubble. Following table 1.10 indicates that 10.42 percent farmers in Bhikhi, 8.33 percent in Budhlada and 12.5 percent farmers in sardulgarh use equipements for the incorporation of stubble into soil.

Table 1.10 Farmers' responses about the use of equipements for incorporation of stubble into soil

S No.	Farmers' Responses	Bhikhi (48)	Bhudhlada (48)	Sardulgarh (48)	Percentage (144)
a	**Yes**	10.42%	8.33%	12.5%	10.42
b	**No**	89.58%	91.67%	87.5%	89.58

Source: Personal interview

Note: Figures in brackets shows the total number of farmers in three blocks

Thus, overall 10.42 percent farmers said that they use equipements for incorporation of stubble into soil. So, it is clear from the data, most of the farmers are not using equipements for the incorporation of straw into soil. They burn stubble after harvesting wheat-paddy crops. Most of the farmers said that it costs too much to incorporate stubble into soil, so we cannot afford it. Farmers are in hurry to burn paddy stubble because of sowing next crop on time. Expressing their views, farmers said that if government helps them to destroy it by other means then why should they burn it? They blamed government for not providing a proper solution in the form of an alternative.

Punjab Government, its various Departments and other institutions like Punjab Agricultural University, Punjab Farmers Commission etc., are all making efforts to devise some alternate economic uses of rice stubble. These include the stubble treated with urea as a fodder for animals, its use in biothermal energy production, paper manufacturing, mushroom cultivation, bedding for animals, etc. Punjab government is also providing subsidy to the farmers to promote the use of equipments which help in checking the burning of crop residues, like rotavators, happy seeders, zero–till-drills and straw reapers. The Punjab Pollution Control Board (PPCB) has taken various measures to limit the amount of industrial pollution in the state but needs to do more to address agricultural pollution [4]. The Punjab Pollution Control Board (PPCB) has in recent years been imposing penalties on farmers found involved in burning crop residue, in accordance with a National Green Tribunal order of 2015 banning stubble burning.

In a written answer, Central Ministry of Environment, Forest and Climate Change informed that Ministry of Agriculture & Farmers Welfare in 2018 launched scheme for providing subsidy for purchase of crop residue management machinery and establishment of custom hiring centres (CHCs) in NCT of Delhi and the States of Punjab, Haryana and Uttar Pradesh. During 2018-2022, total fund released to Delhi and other States under the said Scheme is Rs. 2440.07 crores using which, over 2 lakh crop residue machineries have been delivered to individual farmers and CHCs, and over 39,000 CHCs have been established.

Central Pollution Control Board has framed guidelines for providing one-time financial assistance for setting up of paddy straw based pelletization and Torrefaction plants which may help in addressing the supply chain issues and the issue of open burning of paddy straw in agriculture fields in Northern Region. A maximum amount of Rs. 28 lakhs or 40% of the capital cost considered for plant and machinery of a 1 TPH plant, whichever is lower, shall be given as onetime financial support by CPCB, subject to a maximum total financial support of Rs. 1.4 crore per proposal. A corpus of Rs. 50 crores have been earmarked for utilisation through the guidelines.

Depletion of Water resources in Punjab

Punjab's sufferings are worsening on the water front. A draft report of the Central Ground Water Board concluded that the state will be reduced to a desert in 25 years if the exploitation of its underground water resources continues at the current rate. Although Punjab is known as land of five rivers which is sign of availability of rich water resources but in recent decades state is suffering from the problem of water depletion. The agricultural activities are causing ground water depletion because more water is needed in agriculture for irrigation especially for paddy. Thus, high water demand is attributed to the water intensive commercial crops promoted during the green revolution.

Table 1.11 shows water level in three blocks of Mansa district as stated by farmers.

S. No.	Water Level (In feet)	Bhikhi (48)	Budhlada (48)	Sardulgarh (48)	Percentage (144)
a	45-50	2.08	20.83	8.33	10.42
b	51-60	8.33	18.75	29.17	18.75
c	61-70	14.58	16.68	31.25	20.83
d	71-80	10.42	6.25	18.75	11.80
e	81-90	10.42	14.58	8.33	11.11
f	91-100	29.17	20.83	4.17	18.05
g	101-110	8.33	2.08	Nil	3.47
h	111-120	12.5	Nil	Nil	4.17
i	121-130	4.17	Nil	Nil	1.39

Source: Personal interview

Note: Figures in brackets shows the total number of farmers in three blocks.

The problem of ground water is becoming more and more critical in Punjab. The ground water table in past 20 to 25 years has recorded alarming decline from 5-7 feet to 150 feet or even more. The ground water level is different at different areas. A farmer from village Moola Singh wala (Block Bhikhi), stated that when he was 30 years old the water level was only 5-7 feet in their village. According to him now water level is 90 feet in their village. Thus, according to him the water level is depleted by 80 to 85 feet in 35 years in their village. Similarly, Bhajan Singh, 70, a farmer from village Dharampura in Budhlada Block revealed that 35-40 years ago water level in their village was only 3-4 feet but now it is 55-60 feet. Bhola Singh, 46, a farmer from village Hirke in sardulgarh block, stated that water level is declining by 3 feet per year. Thus, the problem of depleting of water table is very serious issue. However, the water level is different at different places in Mansa district. But it is clear from the data that there is decline in water table in all three blocks. Table 1.11 indicates that 25 percent farmers from Bhikhi block revealed that the water level has been crossed 100 feet in their area. According to 2.08 percent farmers of Budhlada block the water level is crossed 100 feet in their area. According to 18.05 percent farmers from all three blocks, water level in their area is 91-100 feet. Most of the farmers revealed that it was only 5-7 feet 30-35 years ago. Farmers aged between 50 to 70 are witnessing decline in water table because they are observing the situation from many years.

Table 1.12 Tubewells operated in Punjab 1981-2017

District	1981	1991	2001	2011	2016	2017(P)
0	1	2	3	4	5	6
Sangrur	26,938	66,953	93,026	105513	112055	118421
Ludhiana	34,610	65,277	78,095	98267	106514	112691
Firozpur	25,016	69,978	77,118	103853	92639	98380
Gurdaspur	27,082	51,236	68,816	89181	89719	92146
Amritsar	41,746	89,871	1,22,396	80685	81664	92054
Patiala	31,634	63,584	63,424	80143	86527	91903

Jalandhar	36,133	66,509	66,185	76378	80849	84559
Tarn Taran	—	—	—	65913	71623	75656
Bathinda	4,254	13,377	13,958	49692	60012	73624
Moga	—	—	42,956	63073	65359	68347
Shri Muktsar Sahib	—	—	10,070	55630	63491	65688
Hoshiarpur	15,535	28,969	33,044	43511	49275	54478
Kapurthala	16,592	31,932	40,850	48485	51481	54076
Barnala	—	—	—	37288	42957	46339
Faridkot	15,488	37,374	15,867	32000	37459	41683
Mansa	—	—	8,900	29597	33974	41157
Fatehgarh Sahib	—	—	22,820	28843	31759	33621
Fazilka	—	—	—	—	27044	31075
S.B.S. Nagar	—	—	18,416	24553	26862	28930
Rupnagar	8,297	15,922	18,534	18345	19908	22007
S.A.S Nagar	—	—	—	12317	14337	15696
Pathankot	—	—	—	—	8573	9161
Punjab	2,83,325	6,00,982	7,94,475	1143267	1254081	1351692

P-Provisional

Source: Punjab State Power Corporation Limited

Table 1.12 shows that in 1981 the number of tube bells operated in Punjab were only 2,83,325 and in 1991 they were 600982 but the estimated number of tube wells reached 1351692 in 2017 which are responsible for water depletion in Punjab.

Table 1.13 Farmers' responses about change in taste of ground water

S. No.	Response	Bhikhi (48)	Budhlada (48)	Sardulgarh (48)	Percentage (144)
a	**Yes**	93.75%	100%	89.58%	94.44
b	**No**	6.25%	Nil	10.42%	5.56

Source: Personal Interview.

Note: Figures in brackets shows the total number of farmers in three blocks.

Table 1.13 indicates that 94.44 percent farmers from all three blocks agreed that there is change in taste of ground water. Thus, depletion in water table resulted in change of taste of water which is another matter of serious concern. Most of the farmers stated that earlier they used Hand pumps to extracting water from

ground for drinking and domestic use. According to them, now the scenario has been completely changed as hand pumps became useless. According to Central Ground Water Board North Western Region Chandigarh, ground waters from the districts of Bathinda, Firozpur, Faridkot, Fazilka , Mansa and Muktsar have low potable rating. Ground water is generally not suitable for drinking due to high EC or high fluoride or nitrate or combination of all. When it was asked from the farmers 'Are you suffering from the problem of drinking Water? Farmers presented their views as given in following table.

Table 1.14 Farmers' views on the problem of drinking Water.

S. No	Responses	Bhikhi (48)	Budhlada (48)	Sardulgarh (48)	Percentage (144)
a	Yes	72.92%	58.33%	45.83%	59.03
b	No	27.08%	41.67%	54.17%	40.97

Source: Personal Interview.

Note: Figures in brackets shows the total number of farmers in three blocks.

The table 1.14 indicates that 72.92 percent farmers in Bhikhi block, 58.33 percent farmers in Budhlada block and 45.83 percent farmers from Sardulgarh block stated they are suffering from the problem of drinking Water. According to 59.03 percent of the farmers from all three blocks there is problem of Drinking Water in their Area.

Table 1.15 Classification of blocks on the basis of water level.

Study Year ⟹ / Category of Blocks ⇓	1984	1986	1989	1992	1999	2004	2009	2011	2013	2017	2021
Overexploited	53	55	62	63	73	103	110	110	105	109	117
Critical	7	9	7	7	11	5	3	4	4	2	6
Semi Critical	22	18	20	15	16	4	2	2	3	5	10
Safe	36	36	29	33	38	25	23	22	26	22	17
Total	118	118	118	118	138	137	138	138	138	138	150

Source: Ground water assessment report 2020

According to Ground water assessment report 2020, Out of 150 blocks of the state taken for study, 117 blocks are "Over-exploited", 6 blocks are "Critical", 10 blocks are "Semi-critical" and 17 blocks are in "Safe" category. There is an urgent need to act promptly to establish a proper mechanism to recharge ground water in the state. The number of Over-Exploited Blocks has increased with time as per various Ground Water Estimation Studies carried out from time to time, as shown in table 1.15.

Punjab Agricultural University research from 1998 to 2018 has found groundwater that was at three to 10 metres has fallen to below 30 metres in two decades. All blocks in districts, including Amritsar, Tarn Taran, Ludhiana, Fatehgarh Sahib, Barnala, Patiala, Kapurthala, Moga, Jalandhar and Sangrur are over-exploited. Muktsar is the only district in Punjab in which all blocks are in the safe category. The worst-affected districts are Sangrur, Barnala and Patiala where the annual groundwater level fell by 106.5cm, 103.3, 100.2cm (an annual fall of 1 metre), respectively. In Mohali, Fatehgarh Sahib, Jalandhar, Tarn

Taran and Ludhiana districts, the water table is falling annually by 59.8cm, 70.4, 68.4, 56.7 and 56.1cm, respectively [5].

The Right to a healthy environment is the core of the Right to life. It is in many ways connected to the Right to clean drinking water and the right to health. The Right to a clean environment has been adopted by the Indian Constitution under Article 21. The will of the Constitution to provide a clean and safe living environment is expressed in many Acts and through many landmark cases discussed in this article.

Agencies such as the Central Groundwater Authority (CGWA) and Central Groundwater Board (CGWB) are institutionally responsible for enforcing protection of surface and groundwater resources. The Punjab Water Resources Regulation and Development Authority (PWRDA) has been established under section 3 of Punjab Water Resources (Management and Regulation) Act, 2020 Act. The Authority will ensure conservation, management and regulation of water in the State in accordance with the Integrated State Water Plan (ISWP). The Punjab Preservation of Sub-Soil Water Ordinance, 2008- The Ordinance provides for the prohibition of sowing nursery of paddy before 10th May and transplanting paddy as notified by State Government, i.e., before 15th June. The contravention of the provisions of the Ordinance invites penalty, in addition to the expenses incurred for destroying the nursery of paddy sown or transplanted before the specified or notified dates. However, weak or absent coordination between agencies and a lack of regulatory oversight are significant challenges for such enforcement. Lack of clarity over their status, technical capacity shortfalls, understaffing, marginalization and outdated mandates make these regulatory institutions ineffective in supporting sustainable groundwater management [6].

Punjab government announced financial aid of Rs. 1500 per acre to each of farmer who will adopt direct seeding of rice (DSR) method. At least 20% of the total water usage can be saved by the DSR method. With the DSR technique, fields are drilled with the help of machines and paddy seeds are sown. Simultaneously, insecticides are sprayed. Paddy saplings are prepared at the nursery and then uprooted and replanted into the fields according to the traditional procedure used by farmers.

Around seven years ago, the Central Ground Water Board identified 4.55 lakh potential groundwater recharge structures, but the state has constructed just 103 such structures, meeting just 0.02 per cent of the total requirement. Despite its groundwater depletion crisis, the state government doesn't have a road map in place to tackle the problem, the Comptroller and Auditor General of India has observed in its findings. In consultation with states, the Central Ground Water Board developed a master plan in 2013 which identified 4.55 lakh potential recharge structures, including nearly 80,000 shafts, rooftops of 3 lakh houses and 75,000 government and institutional buildings. Despite the water board's initiative, the state government constructed only 103 groundwater recharge structures between 1992 and 2015. Of the 103 structures, the Department of Soil and Water Conservation constructed 73 small rainwater harvesting dams [7]. It shows the negligence of government towards a very serious problem which state is facing today.

It can be concluded that the farmers of Punjab had to leave traditional methods of farming with the introduction of new techniques in the 60s and 70s. This resulted in depletions of water table, degradation of soil, nutrient imbalance and several environmental problems. The study reveals that 93.06 percent farmers from three blocks adopted wheat-cotton pattern. This has led to decline in area under other crops like maize, cotton, bajra, jowar etc. The farmers stated that due to the lack of market facilities and price security they have shifted from traditional pattern to wheat-paddy cropping pattern. The study reveals that almost 100 percent respondents are using chemical fertilizers and pesticides. The study shows, although 90.97 percent farmers are aware about the negative impacts of pesticides and fertilizers, still they use these pesticides and fertilizers. Because they think that without using these chemical inputs, they can't gain

profit. According to study, 94.44 percent farmers from all three blocks agreed that there is change in taste of ground water. The study exhibits that 88.19 percent people burn stubble because they can't afford costly equipements for proper management of crop residues. They also blamed government for not providing appropriate solutions to tackle this problem. Thus, most of the farmers stated that modernization agriculture resulted in environmental imbalance in the state and it has put our natural resources into danger. Further, modern techniques are very expensive which leads to economic burden on the farmers. Although government has taken some important steps to improve the situation but these are not enough because problem of environmental degradation is quite serious in the state.

References:

1. 1.Environmental Information System, Punjab. http://punenvis.nic.in/index2.aspx?slid=5619&mid=1&langid=1&sublinkid=936 (last seen on 26 October 2022)
2. Alok Gupta. (2014, June 15). Punjab farmers try religious route to shun pesticides. Down To Earth. https://www.downtoearth.org.in/news/punjab-farmers-try-religious-route-to-shun-pesticides-44752 (last seen on 3 october 2022)
3. Singh J. (2018). Paddy and wheat stubble blazing in Haryana and Punjab states of India: A menace for environmental health. Environmental Quality Management. 1-7. https://doi.org/10.1002/tqem.21598 (last seen on 4 November 2019)
4. Kumar, Parmod., Kumar, Surender., & Joshi, Laxmi. (2015). Socioeconomic and Environmental Implications of Agricultural Residue Burning: A Case Study of Punjab, India, New Delhi: Springer, p. 130
5. Khanna, Mohit. (2021, Jul 30). Punjab groundwater level dips 1m every year: Study. Hindustan Times Retrieved from https://www.hindustantimes.com/cities/chandigarh-news/punjab-groundwater-level-dips-1m-every-year-study-101627645511290.html
6. Rongchen Liu., Sanyal, Anirban., & Singh, Nirvikar. (2020). Environmental Issues, Economic Policies and Agricultural Development: The Case of Punjab, India. Indian Public Policy Review, Vol. 2 (2), p. 337.
7. (The Tribune Report Feb 2020).