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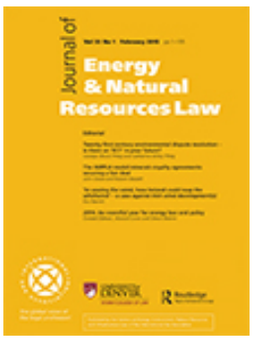

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Groundwater management in India's Punjab and Haryana: a case of too little and too late?

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The North Indian states of Punjab and Haryana (P&H) are a part of the water-rich Indo-Gangetic river basin. Despite this abundance, both states are on the cusp of a severe water crisis due to groundwater over-extraction. The proliferation of tubewells to support irrigation is responsible for more than 90 per cent of the groundwater extraction in both states. What started as a boon during the Green Revolution has given rise to a host of socio-economic and environmental issues. Overexploitation of groundwater is not a simple problem that the laws can quickly fix. In 2020, both P&H passed legislation to manage their water, including groundwater; however, these legal responses are far from what is required. This article examines the law on groundwater in P&H, focusing on the fallouts of silo-based decision-making where the different facets of water management are left to various authorities resulting in working at cross-purposes and inefficient decision-making. We argue that there is an urgent need to (1) delink groundwater rights from land rights and (2) adopt an integrated resource management strategy if P&H are to utilise their groundwater sustainably.

Keywords: groundwater; tubewell capitalists; tanker-mafia; waterlogging; stubble burning; integrated water management; Green Revolution; groundwater rights

1. Introduction

The agriculturally progressive states of Punjab and Haryana (P&H), located in India's north-western region, are among the Indian states facing acute groundwater crises. P&H, as neighbouring states, share a chequered history. In 1858, Haryana was integrated with the Punjab province by the British as a 'political punishment' for its role in the First War for India's Independence.[1] For the next century, Haryana remained a politically undermined entity. In 1966, India's Parliament enacted the Punjab Reorganization Act, which bifurcated Punjab into two new states, namely P&H, and some of the territories of the erstwhile State of Punjab were transferred to the new State of Haryana.[2]

1 Government of Haryana, 'History' www.haryana.gov.in/history accessed 3 July 2021.
2 *Mangal Singh and Ors. v Union of India (UOI)*, [1967] 2 SCR 109 (Supreme Court of India) 17 November 1966.

P&H sits atop one of the world's richest fluvial aquifers as part of the Indus and Ganges river basins (IG Basin). The IG Basin is one of the world's largest transboundary freshwater systems and accounts for a quarter of total global groundwater withdrawals.[3] P&H are two of the smallest Indian states, and they constitute 1.5 and 1.4 per cent of the country's total land area, respectively. Still, they are among the biggest producers of wheat and rice in the country. Agriculture contributes more than 28 per cent of Punjab's gross domestic state product (GSDP).[4] It also provides gainful employment to a large segment of the population in the state and is significant to both the state and India's overall economic development. In Haryana, despite the continuously decreasing share of agriculture in the state's GSDP due to greater industrialisation, most of its population continues to depend on agriculture for their livelihood.[5]

In the past half-century, due to the Green Revolution, P&H have transformed from states facing recurring famines to states spearheading India's national food security movement. P&H contribute nearly 12 per cent of the country's total rice production[6] and seven per cent of India's national food grain production,[7] respectively (where food grain includes both cereals and pulses). In 2020, Punjab became the second largest contributor of wheat to the central pool with 12.7 million metric tons (MT), followed by Haryana, which contributed 7.4 million MT.[8] The agriculture sector in Punjab is highly developed, as 85 per cent of the total geographical area is under agriculture, and nearly 100 per cent of the net sown area is irrigated.[9] Similarly, in Haryana, the overall land-use pattern has seen an increase by almost 81 per cent in the total area under agricultural use.[10]

The name Punjab is derived from the Persian words *Panj* 'Five' and *Ab* 'water', meaning 'the five rivers' or the land of the five rivers.[11] Punjab falls in the Indus Basin and is drained by three major rivers – Sutlej, Beas and Ravi – and the non-perennial Ghaggar. The Sutlej is the most important river that flows through Punjab. When the river enters Punjab, its quality is Class B, i.e. its water is suitable for 'organized outdoor bathing'. However, as the river runs its course through the state, the quality deteriorates to Class E, i.e. only suitable for 'irrigation, industrial cooling and controlled water disposal'.[12] This is due to the discharge of industrial pollutants,

3 AM Macdonald and others, 'Groundwater Quality and Depletion in the Indo-Gangetic Basin Mapped from In Situ Observations' (2016) 9 Nature Geoscience 762, 762.
4 Department of Planning, *Punjab Economic Survey 2019–20* (Government of Punjab 2020), 8.
5 Indian Council of Food and Agriculture, *Report on Haryana Agriculture and Farmers' Welfare*, Indian Chamber of Food and Agriculture, 5 www.icfa.org.in/assets/doc/reports/haryana-agriculture-and-farmers.pdf accessed 28 June 2021.
6 Department of Planning (n 4) 38.
7 Omvir Singh and Amrita Kasana, 'GIS – Based Spatial and Temporal Investigation of Groundwater Level Fluctuations Under Rice-Wheat Ecosystem over Haryana' (2017) 89 J. Geol. Soc. India 554, 554.
8 Ministry of Consumer Affairs, Food & Public Distribution, 'Procurement of Wheat by Government Agencies Reaches All-time High' (*Press Information Bureau India*, 17 June 2020) www.pib.gov.in/PressReleasePage.aspx?PRID=1632102#:~:text=Procurement%20of%20wheat%20from%20farmers,LMT%20achieved%20during%202012%2D13 accessed 7 February 2021.
9 Department of Planning (n 4) preface.
10 World Bank Group, *Demographic and Economic Overview of the Corridor States: Punjab, Haryana, Uttar Pradesh, Bihar, Jharkhand and West Bengal* (The World Bank 2014), 10.
11 Government of Punjab, 'Know Punjab' www.punjab.gov.in/know-punjab accessed 3 July 2021.
12 Directorate of Environment and Climate Change, *Action Plan for Clean River Sutlej* (Government of Punjab 2019), 14.

sewage and wastewater into the river. The fate of the Beas River, which flows through Punjab, is similar.[13]

Haryana is drained by two major rivers, Ghaggar and Yamuna. It is believed that the Harappan civilisation once flourished on the banks of the Ghaggar.[14] However, today, the Central Pollution Control Board has identified stretches along the Ghaggar River as among the country's most polluted sites.[15] In several districts, groundwater sources near the Ghaggar are contaminated and unfit for drinking.[16] The Markanda River, the main tributary of the Ghaggar River, also drains a part of this state.

Groundwater holds an extraordinary significance to P&H because of its historical, religious and cultural importance. In the Mahabharatha, it is mentioned that as Bhishma lay dying on a bed of arrows, to quench his thirst, Arjuna shot an arrow into the earth, letting forth a spring of fresh gushing water. Bhishma drank this water.[17] This water source subsequently became the *Bhishmakunda* tank and is visible today in Haryana's Kurukshetra district.

During the last few decades, the phenomenal growth in the agriculture sector in both P&H has led to voluminous and unsustainable groundwater abstraction for irrigation and other purposes. The British Geological Survey indicates that while the water table within the Indo-Gangetic Basin aquifer has remained relatively stable throughout the 2000s, the largest depletion has occurred in the North Indian states of P&H.[18] A 2011 study conducted by the National Aeronautics and Space Administration (NASA), United States of America concluded that during the past few decades, the groundwater beneath Punjab, Haryana, and Rajasthan has decreased by more than 88 million acre-feet. This is nearly eight times the amount that Lake Mead, the largest reservoir in the United States, holds.[19]

The data contained in the Dynamic Ground Water Resources of India 2017 report is illuminating.[20] It indicates that Punjab's total annual groundwater recharge is 23.93 billion cubic metres (bcm), while the annual groundwater extraction is 35.78 bcm. Groundwater development in Haryana follows a similar trend: while the total annual groundwater recharge is 10.15 bcm, the total groundwater extraction is 12.50 bcm.[21] As in Punjab, irrigation is responsible for a major proportion of the groundwater extraction – estimated at 11.53 bcm. Due to this aggressive exploitation,

13 Ministry of Water Resources, *Water Quality Issues and Challenges in Punjab* (Government of India 2014), 62.

14 Anirban Chatterjee and others, 'On the Existence of a Perennial River in the Harappan Heartland' (2019) 9 Sci Rep www.nature.com/articles/s41598-019-53489-4#citeas accessed 22 December 2020.

15 Vishwa Mohan, 'None of the River Ganga Polluted Stretches among the top 25 Dirtiest Patches, CPCB Finds It Cleaner than Other Rivers' Times of India (7 October 2019) www.timesofindia.indiatimes.com/india/none-of-the-river-ganga-polluted-stretches-among-the-top-25-dirtiest-patches-cpcb-finds-it-cleaner-than-other-rivers/articleshow/71473795.cms accessed 6 January 2021.

16 *Stench Grips Mansa's Sacred Ghaggar River* (Suo-Moto Case) Original Application 138/2016 (National Green Tribunal) 2016.

17 Alexandra Van Der Geer and others, 'Fossil Folklore from India: The Siwalik Hills and the Mahabharata' (2008) 119 Folklore 71, 81.

18 MacDonald (n 3) 765.

19 Kayvon Shargi, 'India's Disappearing Water' (*NASA Viz*, 26 July 2011) www.svs.gsfc.nasa.gov/vis/a010000/a010700/a010764 accessed 6 February 2021.

20 Central Ground Water Board, *Dynamic Ground Water Resources of India 2017* (Government of India 2019).

21 *Ibid* 73.

many 'dark zones' have emerged in both states. Dark zones are areas where the groundwater extraction is more than 100 per cent, i.e. areas that are 'over-exploited'.[22] Out of the 128 blocks in Haryana, nearly 78 blocks fall into this over-exploited category.[23] Groundwater extraction in these areas exceeds the replenishment rate (annual recharge). In Punjab, 109 out of 138 blocks are over-exploited or dark.[24]

These statistics are alarming because the annual groundwater recharge is significantly higher in the IG alluvial belt. Since both P&H use more than 90 per cent of their groundwater for irrigation rather than industrial and domestic use, the agricultural sector's impact on groundwater becomes a key focus area.

In this article, we analyse the groundwater scenario in the twin states of P&H, the crises, and the legal and policy response. We begin with an overview of the nature of groundwater rights in India. We then examine how the Green Revolution and the inequitable nature of groundwater rights have contributed to the current groundwater crisis plaguing both states. In the next section, we discuss the legal mechanisms that both states have developed to regulate and manage groundwater. The first is regulation through the Preservation of Subsoil Water Acts passed by both states in 2009. Recently, P&H enacted water acts, respectively, aimed at the comprehensive regulation and management of groundwater. We analyse the sufficiency of the legal framework that the states have designed to tackle the groundwater crisis. Finally, we put forth a case to delink groundwater rights from land rights and ensure integrated water resource management to resolve the groundwater crisis that hamstrings both of these states.

2. Groundwater rights and the Green Revolution: compounding the confusion?

The use of groundwater on the sub-continent is well documented since the Indus Valley civilisation began. In Kautilya's Arthshastra, we find mention of water being taxed as a state good in the context of irrigation. With the arrival of the British and the introduction of the common-law legal system, there was a profound change in groundwater regulation. Before this, land and water were generally not treated as private property. Specifically, concerning groundwater's legal status in India, it became based on the common-law approach to the land ownership doctrine. Under this paradigm, groundwater belongs to the landowner, since legally, the term 'land' includes water.[25] And in this regard, the common-law approach to the land ownership doctrine reflects three principles to determine groundwater rights:

- the rule of capture – under which the first person to withdraw groundwater would have rights over it, irrespective of the source of the water beneath the land;
- prior appropriation – which permits legal ownership over a water resource to the first person to put it to beneficial (productive) use; and
- the riparian rights doctrine – under which water is allocated to those who own land along its course, generally in the context of a river or lake or some such water body.

22 *Ibid* 11.
23 *Ibid* 57.
24 *Ibid* 63.
25 Alice Jacob and SN Singh, *Law Relating to Irrigation* (1st edn, Indian Law Institute 1972).

Since groundwater is mostly an invisible resource, the predominant legal principle that governs rights concerning this resource is the rule of capture. And even today, groundwater is treated as a chattel attached to the land property:[26] the rights belonging to the landowner based on the *ad coelum* principle, namely that a landowner owns everything above and below the surface of the land.[27]

This intertwined nature of land and groundwater rights has persisted even after independence. At the time of the adoption of India's Constitution, water was treated essentially as a local matter, and the primary legislative responsibility for water was entrusted to the states. The Union could assume jurisdiction only over interstate rivers and their dispute resolution. There was no specific legislative entry on groundwater. However, it was implied that the term 'water' in Entry 17 of the State List could encompass groundwater, giving the states the legislative mandate on groundwater governance. Thus, groundwater regulation and management and any attendant changes to the existing nature of groundwater rights is a matter that falls within the exclusive legislative prerogative of the states, and the union government has very little say in the matter.[28]

However, given the legislative apathy on the part of the states to legally regulate groundwater, the central government, right from the 1970s, circulated model groundwater bills to the states. This was a federal attempt to goad them to enact groundwater laws, subject to necessary modifications based on their unique circumstances, specific issues and priorities. Some states, such as Karnataka, Kerala, Andhra Pradesh and Himachal Pradesh, enacted groundwater statutes based on the model bill, thereby creating a framework for groundwater regulation and management.[29] However, most of these state statutes are first-generation groundwater laws that focus primarily on groundwater regulation. Their core mandate is to identify and notify groundwater over-exploited areas and subject extraction in these areas to a permit system. Only a few state groundwater statutes in India have transcended this framework to secure holistic and integrated groundwater management.[30] More importantly, none have attempted to recast and delink groundwater rights from land rights, with the

26 N Nagaraj, Frasier Marshall and RK Sampath, 'A Comparative Study of Groundwater Institutions in the Western United States, France and Peninsular India for Sustainable and Equitable Resource Use – Some Lessons for India' (Water, Law and the Commons, Delhi, 10 December 2006).

27 The maxim 'ujus est solum, ejus est usque est ad coelum et ad inferos' means that the owner of the soil is presumed to own everything up to the sky and down to the centre of the earth. See Herbert Broom, Brooms Legal Maxim 259–60 (1993); Chhatrapati Singh, Water Rights and Principles of Water Resources Management (Bombay: NM Tripathi 1991) 14.

28 Ministry of Jal Shakti, Central Water Commission, 'Water Information' (*Government of India*) www.cwc.gov.in/water-info accessed 17 June 2021.

29 The Karnataka Ground Water (Regulation and Control of Development and Management) Act, 2011; Kerala Ground Water (Control and Regulation) Act, 2002; The Andhra Pradesh Water, Land and Trees Act, 2002; Himachal Pradesh Ground Water (Regulation And Control of Development and Management) Act, 2005.

30 The Andhra Pradesh Water, Land and Trees Act, 2002 [applicable to the states of Andhra Pradesh and Telangana] is a comprehensive piece of legislation which imbibes this philosophy. The act has as its avowed aim as the promotion of water conservation and tree cover and it also seeks to regulate the exploitation and use of ground and surface water with a view to protect and conserve water sources, land and environment. See also Nitin Sethi, 'Controlling Water' *Down To Earth* (15 May 2002) www.downtoearth.org.in/news/controlling-water-14541 accessed 4 July 2021; Anuradha Kumar, 'A Law for Water Conservation' *Frontline* (8 June 2002) www.frontline.thehindu.com/other/article30245149.ece accessed 4 July 2021.

consequence that groundwater continues to remain private property.[31] This is despite the fact that groundwater under the Federal Model Groundwater Bill of 2016 circulated to all states clearly states the union government's intention to treat groundwater as a common pool resource and not as one amenable to private ownership.[32] Groundwater is a common heritage of the people held in public trust by the state for the use of all, and the government is responsible for its equitable use and allocation in the public interest.[33] Furthermore, the model bill requires the government to ensure that any person's groundwater use on their land does not deprive others of their right to groundwater for life when they are all dependent on the same aquifer.

India's activist judiciary has also intervened in the matter. In 1996, concerned about the alarming decline in groundwater levels across the country, the Supreme Court of India directed the National Environmental and Engineering Research Institute (NEERI) to offer recommendations to arrest any further decline. Based on these recommendations, the Supreme Court directed the central government to constitute the Central Groundwater Board as an Authority under Section 3(3) of the Environment Protection Act, 1986 (EP Act, 1986) to regulate and control indiscriminate groundwater extraction.[34] Since then, the Central Groundwater Authority has been regulating groundwater development and management by issuing 'No Objection Certificates' for groundwater extraction to industries, infrastructure and mining projects. It has framed guidelines applicable to states and union territories, where the state government or the union territory administration is not regulating groundwater development.

The Central Groundwater Authority has also notified 162 critical or overexploited areas in several parts of the country, including in P&H, to control and regulate groundwater development.[35] Under Section 5 of the EP Act, 1986, the concerned deputy commissioners or district magistrates of these areas are directed to regulate groundwater development. Construction of new groundwater structures is prohibited in these notified areas. Permission to drill tubewells is granted only to government agencies responsible for supplying drinking water.[36]

This being the general nature of groundwater rights and the constitutional and legal framework, we now move to analyse the Green Revolution's impact on groundwater. The Green Revolution refers to transforming India's agriculture to attain self-sufficiency in food grain production. It introduced modern technology and new cultivation

31 *Hindustan Coca-Cola Beverages. v Perumatty Grama Panchayat,* 2005 (2) KLT 554. The Kerala High court Division Bench held that '[A] person has the right to extract water from his property, unless it is prohibited by a statute … . Abstract principles cannot be the basis for the Court to deny basic rights, unless they are curbed by valid legislation'.

32 Model Bill for the Conservation, Protection, Regulation and Management of Groundwater, 2016 www.jalshakti-dowr.gov.in/sites/default/files/Model_Bill_Groundwater_May_2016_0.pdf accessed 4 July 2021.

33 *Ibid*, Section 9 'Legal Status of groundwater' states that 'Groundwater, as a common pool resource, is the common heritage of the people held in public trust, for the use of all, subject to reasonable restrictions to protect the fundamental right to water for life. In its natural state, groundwater is not amenable to ownership by the state, communities or persons'.

34 *MC Mehta v Union of India* (1997) 11 SCC 312.

35 Ministry of Jal Shakti, 'About Central Ground Water Authority' (*Government of India*) www.cgwb.gov.in/aboutcgwa.html accessed 17 October 2020.

36 *Ibid*.

methods such as the bio-engineered high-yielding variety of seeds (HYV), chemical fertilisers and pesticides, mechanisation and intensified irrigation. Within a decade of its initiation, India went from being food insecure to a food surplus country. States like P&H witnessed a record upsurge in food grain production and came to be referred to as the 'Granaries' or the 'Bread-baskets of India'.[37]

The Green Revolution also brought far-reaching changes in the cropping patterns in P&H. The traditional crops such as millet and indigenous varieties of rice and wheat were supplanted by mono-cropping of HYVs of rice and wheat. The minimum support price (MSP) policy for crop procurement, which began in 1966, also induced farmers to move to water-intensive crops. This increased wheat production in Punjab by nine per cent between 1966 and 1974, while rice, which was not commonly grown before this, developed at a remarkable rate of 18 per cent.[38] Similarly, Haryana also witnessed an increase in rice and wheat production. The area under HYV wheat in Haryana increased from two per cent to 90.4 per cent between 1966 and 1978. The area under HYV rice recorded a staggering increase, from 0.2 per cent to almost 72 per cent, during the same period.[39] This increase in agricultural yield prompted India's government to target both P&H as the epicentre of the national programme to intensify rice and wheat production to attain food security.

Rice and wheat are water guzzlers. Rice consumes nearly twice the amount of water as wheat. Consequently, both rely heavily on irrigation. This irrigation requirement is met in states like P&H primarily with groundwater, facilitated by the proliferation of tubewell irrigation, which enabled a shift in cropping patterns favouring the rice–wheat system. Following the land consolidation programme in the 1950s, farmers gradually began to rely on better technology such as tubewells to augment groundwater supply. The introduction of this technology provided farmers with greater control over the quantity and duration of the water supply. Soon after, tubewell irrigation became widespread, prompting economist Robert Repetto to assert that 'the Green Revolution is more [a] tubewell revolution than [a] wheat revolution'.[40] This is evident from the number of tubewells that proliferated in P&H. From a meagre 50,000 in the early 1960s in the Punjab, their number increased to more than 70,000 by the early 1980s. By the beginning of 2005–06, there were approximately 1.2 million tubewells in the state.[41] Haryana witnessed a similar increase.

Thus, while the Green Revolution brought prosperity for P&H, it also sowed the seeds of various problems that have since become visible, particularly groundwater overexploitation. The Green Revolution's fallouts, when juxtaposed with the inequitable nature of groundwater rights, have led to severe socio-economic issues as well. These predominate the groundwater landscape and are explained below.

37 Department of Planning (n 4) 7.
38 Rinku Murgai, 'The Green Revolution and the Productivity Paradox: Evidence from the Indian Punjab' (2001) 25 Agri Econ 199, 199.
39 Mahesh V Joshi, *Green – Revolution and Its Impacts* (APH Publishing Corporation 1999), 11.
40 Koichi Fujita and Tsukasa Mizushima (eds), *Sustainable Development in India: Groundwater Irrigation, Energy Use, and Food Production* (1st edn, Taylor & Francis 2020).
41 Water Resources Department (Punjab) and Central Ground Water Board, *Ground Water Resources of Punjab: As on 31st March 2017* (Government of Punjab 2017), ch 1.

2.1. *The rise of the tubewell capitalists*

Groundwater-driven agricultural productivity rests firmly on access to electricity to operate the tubewells. Given the beneficial economic and food security consequences of mono-cropping, many Indian states, including P&H, implemented agricultural power subsidy policies to encourage groundwater irrigation.[42] Until the 1970s, the state electricity utilities levied electricity charges on tubewell owners based on metered consumption, i.e. based on the amount of electricity consumed. However, as the number of tubewells increased rapidly in the next decade, the state electricity utilities removed electricity metres, stopped recording and introduced flat tariffs for agricultural electric supply. The idea was that the state electricity utilities would gradually increase the flat tariff according to the electricity generated and the transaction costs.[43] However, partisanship soon took over. Several states began adopting competitive populist policies to provide subsidies to gain popular support, and some even provided free and unmetered supply.[44] An unmetered power tariff (flat tariff) induced farmers to use electricity recklessly because the marginal cost of electricity use was almost zero (except for labour cost). This led to the intensive mining of groundwater and consequent drastic fall in the water table. These power subsidy policies virtually sounded the death knell of aquifer health and stability.

In 1997, the Punjab government started providing free electricity to its agriculture sector. This led to the spread of tubewells in the state. Free electricity created a market for tubewell irrigation. The number of tubewells rose significantly, especially after 1977, leading to an overall increase in the state's rice-wheat crop rotation.[45] Meanwhile, despite huge investments, canal irrigation or surface water irrigation progressively declined.[46]

Haryana also provided subsidised electricity on tubewells, albeit at flat rates, i.e. based upon the power rating of the farmer's ground pump. Presently, farmers in Haryana are required to pay a paltry sum of INR 15 (for tubewells with motor capacity up to 15 brake horsepower (BHP)) and INR 12 (tubewells with motor capacity above 15 BHP) per month on unmetered connections.[47]

The agriculture sector in Punjab is responsible for consuming 28 per cent of the total electricity produced in the state.[48] Further, there are about 1.4 million tubewells presently installed, out of which around 1.2 million tubewells are operated by state-

42 Shruti Sharma, Sagan Tripathi and Tom Moerenhout, *Rationalizing Energy Subsidies in Agriculture: A Scoping Study of Agricultural Subsidies in Haryana, India* (International Institute for Sustainable Development 2015).

43 Mohinder Gulati and Sanjay Pahuja, *Direct Delivery of Power Subsidy to Agriculture in India* (Sustainable Energy for All 2015), emphasis on executive summary.

44 *Ibid*.

45 Anandita Sarkar and Arjit Das, 'Groundwater Irrigation – Electricity – Crop Diversification Nexus in Punjab: Trends, Turning Points, and Policy Initiatives' (2014) 49 EPW 64, 69.

46 *Ibid* 67.

47 Haryana Distribution and Retail Supply Tariff for the Financial Year 2019–20 www.herc.gov.in/WriteReadData/Pdf/DR20190501.pdf accessed 19 October 2020. As per the order of the Haryana Electricity Regulatory Commission, the electricity tariff shall remain unchanged in the state of Haryana for the 2020–21 financial year.

48 Department of Planning (n 3) 54: 'In 2016–17, electricity consumed by the agricultural sector in Punjab increased by six per cent over the previous year to reach 12,196 GWh. This was 28 per cent of total electricity sold in the state, higher than the corresponding 21 per cent registered at the all-India level'.

supplied power. Similarly, out of the 800,000 tubewells installed in the state in Haryana, more than 500,000 tubewells are operated by state-supplied power.[49] It is further estimated that Haryana's average power bill has surpassed 100,000 rupees per tubewell.[50]

Overall, the electricity subsidies provided by P&H to support agriculture, the resulting increase in water-intensive cropping and better pumping technology have contributed to the drastic fall in the water table in both states. Concerning Haryana, the Central Ground Water Board (2016–2017) reports that around 76 per cent of the observational wells in the state have indicated a significant water-level decline during the past decade,[51] and almost 8–13 per cent of the wells indicate a decline of more than 4 metres. The Punjab State's groundwater department statistics show that in several parts of the state, the water depth had gone down from three per cent in 1973 to 25 per cent in 1990, and by 1994 the decline was 46 per cent.[52]

Reports since 1998 warned that the gap between water use and sustainable yield of the aquifer in Punjab was so high that the resources would be entirely depleted by 2025.[53] The power subsidies had other negative impacts as well. Caught in a vicious cycle of subsidy and interest payments, they were largely the reason for the state electrical utilities' financial failure, affecting the electricity supply. Supply is erratic, with frequent interruptions and voltage fluctuations in many parts, which has become a significant constraint on electric tubewell irrigation, causing motor burn-outs and pump failures.

The primary idea behind power subsidies was to secure the economic and social development of the poor and backward farmers, including those belonging to scheduled castes (SCs), scheduled tribes (STs) and other backward classes (OBCs). However, such subsidies inevitably went into the wealthy farmers' coffers despite this well-intentioned objective. As the evidence suggests, wealthy farmers overcame systemic deficiencies and drew the maximum from the subsidies.[54] This issue of large and medium-sized farmers appropriating the 'lion's share' of subsidies intended for poor farmers was highlighted recently by a group of experts (GOE) constituted by the Government of Punjab to study the post-COVID long-term economic strategy.[55] The GOE noted that 'while the state's collective power subsidy bill for marginal, small and semi-medium farmers stands at INR 2,653 crores, the big and medium farmers get free power worth INR 3,407 crore every year'.

There is yet another and more dangerous dimension to generous power subsidies. Due to the sharp decline in the groundwater available in shallow aquifers, the

49 Department of Economic and Statistical Analysis, *Statistical Abstract of Haryana 2018–19* (Government of Haryana 2020), 441.

50 *Uttar Haryana Bijli Vitran Nigam Ltd. and Dakshin Haryana Bijli Vitran Nigam,* Case No. HERC/PRO – 38 of 2019 (Haryana Electricity Regulatory Commission) 17 September 2019.

51 Based on the decadal mean data for May 2006–2015.

52 'Parched Punjab' (*Down To Earth Blog*, 15 October 1999) www.downtoearth.org.in/coverage/parched-punjab-20535 accessed 25 October 2020.

53 *Ibid*.

54 Ministry of Finance, *Economic Survey 2014–15* (Government of India 2014), ch 3.

55 Kanchan Vasdev, 'Big Farmers Pocket Lion's Share of Farm Power Subsidy' *Indian Express* (Chandigarh, 18 August 2020) www.indianexpress.com/article/cities/chandigarh/big-farmers-pocket-lions-share-of-farm-power-subsidy-6559269 accessed 29 October 2020.

groundwater levels in several areas of P&H have dropped to alarming levels, necessitating a shift in technology to deep tubewells and more powerful, expensive pumps such as submersibles, which have replaced the centrifugal pump used previously to draw groundwater.[56] The data regarding ownership of deep tubewells suggests pronounced discrimination against the small farmers who cannot afford deep tubewells, forcing them to limit or even forgo agriculture and seek other livelihoods.[57]

According to the Minor Irrigation Census 2013–14, the number of deep tubewells belonging to the SCs, STs and OBCs stood at astonishingly low figures of 563, 60 and 1012, respectively.[58] The number was 13,356 for the rest of the farmers in Haryana.[59] The figures relating to medium tubewells owned by SCs, STs and OBCs are equally stupefying. During 2013–14, the number of medium tubewells owned by STs was 14, while it was 32 for SCs and 188 for OBCs.[60] The situation is similar in Punjab, where SCs, STs and OBCs owned 8308, 861 and 12,435 deep tubewells, respectively, while the rest of the farmers owned over 400,000 deep tubewells.[61]

The above figures exhibit a worrisome trend that must be examined in light of groundwater rights, land rights, and their intrinsic relationship. As far as land rights are concerned, colonial revenue policies ensured that the *zamindars* (feudal landlords) held most large landholdings at India's independence. Even though land ceiling laws and reforms were undertaken since the 1950s, land redistribution could not secure equity. As colonial precepts on land persisted, the control of underground water resources remained with the landowners.

As mentioned earlier, groundwater is not a common pool resource in India; instead, it is private property.[62] The landed farmers are, in effect, the owners of groundwater beneath their land. By investing in expensive boring and pumping technology beyond the financial capabilities of poor farmers, along with the power subsidies they received, wealthy farmers were able to bolster the negative rights that accrued to them as a result of archaic groundwater rights. Consequently, these landed farmers were effectively able to prevent groundwater from becoming any other person's property.

In India, agricultural landholdings are divided into five categories for purposes of the agriculture census: marginal (less than 1 ha), small (1–2 ha), semi-medium (2–4 ha), medium (4–10 ha) and large (over 10 ha). Since land is the only source of wealth passed on from one generation to the next, land fragmentation over generations has significantly lowered the average landholding size. Fragmentation makes it unsustainable to introduce mechanised production and technology as landholdings should be

56 Tubewells are categorised as shallow, medium and deep based on the depth and volume of water accessible. While medium tubewells access water at a depth of between 35–70 metres, deep tubewells access water at a depth of 70 metres and more and are designed to withdraw water at a rate of 100–200 cubic metres per hour.

57 See eg Jasveen Jairath, 'Private Tubewell Utilisation in Punjab: A Study of Cost and Efficiency' (1985) 20 EPW 1703.

58 Ministry of Water Resources, River Development and Ganga Rejuvenation, *5th Census of Minor Irrigation Schemes Report* (Government of India 2017), 237.

59 *Ibid*.

60 *Ibid* 201.

61 *Ibid* 237.

62 Planning Commission of India, Report of the Expert Group, 'Groundwater Management And Ownership' (2007) 46.

of a minimum size to be feasible. In Punjab, as per the census data from 2015–16, 33 per cent of landholdings are small and marginal, while 33.6 per cent are semi-medium. In Haryana, 68.5 per cent of farm landholdings are small, marginal or semi-medium. Again, in Punjab, only 3.5 per cent of private farmland is owned by Dalits or SCs. The rest of the farmland ownership is dominated predominantly by upper-caste Sikh Jats.

If most farmers are small, marginal or semi-medium farmers and the distribution were equitable, most of the tubewell ownership would rest with them. However, that is not the case. For example, in Haryana, medium farmers own more medium and deep tubewells than do the small and marginal farmers combined. The disparity is evident in the actual numbers. As of 2013–14, small and marginal farmers owned 1003 medium tubewells and 1931 deep tubewells.[63] However, medium farmers alone owned 1597 medium tubewells and 7612 deep tubewells.[64] The inequity in the distribution of medium and deep tubewells further impacts the productivity of small and marginal farmlands, increases the cost of irrigation for these farmers, and puts them at a disadvantage compared to farmers with more sustainable and more extensive landholdings.

Quick to exploit the advantages offered by their superior status in society (i.e. their caste), the nature of groundwater rights and the flat power tariff or free power, several groundwater users, predominantly the affluent farmers (big and medium), have evolved into a distinct and powerful political class. Often referred to as the tubewell capitalists, these groups browbeat the establishment into continuing to supply power to them at subsidised rates. In 2019, while hearing a petition seeking the exclusion of affluent farmers from a power subsidy worth INR 7000 crores for agricultural pump sets, a former Chief Justice questioned the P&H governments on the necessity of such 'free or subsidized power given to the rich farmers'. He observed that 'subsidy should be for the needy and not for the rich and affluent'.[65] Nevertheless, state governments' attempt to regulate electricity use or revise the tariff structure by cutting out subsidies is vigorously resisted as anti-poor, even though the poor do not draw the benefits.[66] Thus, these tubewell capitalists operate and appropriate in a minimal regulatory environment. At the same time, small farmers are unable to eke a livelihood from agriculture and are forced to seek alternative employment.

2.2. *The emergence of the tanker mafia*

Even though water is a basic human necessity, it is a finite resource. Unplanned urbanisation, burgeoning population, inadequate public infrastructure and rising water scarcity have led to the mushrooming of water markets in several parts of India. P&H is no exception to this phenomenon. Informal water markets run by water vendors operate in

63 Fifth Minor Irrigation Census Report (reference year: 2013–14), Ministry of Water Resources, River Development & Ganga Rejuvenation, Government of India (November 2017). 203 and 239.

64 *Ibid*.

65 Indo-Asian News Service, 'Court Questions Punjab, Haryana on Free Power to Rich Farmers' (*Outlook* 21 May 2019) www.outlookindia.com/newsscroll/priyanka-best-version-of-my-dream-self-in-future-hina/1538388?scroll accessed 3 December 2020.

66 In a recent study on 'Optimization of Agriculture Power subsidy and Irrigation Water Intensity' in Haryana commissioned by the Department of Economic and Statistical Analysis, it was found that 'a majority of the marginal & small farm households were interested in metered supply and even they were ready to pay for assured quality supply. But most of big farmers were not interested in paid supply. They were interested in the existing system of subsidised power supply'.

an 'extortionist mafia' fashion that runs parallel to formal water supply systems. They even sabotage the formal water supply networks to create artificial scarcity, to make a windfall on profits.

Several justifications exist to support these water markets. For one, they supply drinking water to settlements left out of the official water supply chain. Second, in circumstances where the governments fail to ensure regular and uninterrupted supply, they step in to do the necessary.[67] However, informal markets and their participants often maximise their profits at the cost of wrecking the aquifers' stability and eco-health.

This widely prevalent tanker mafia phenomenon owes its origin to the interlinked nature of land and groundwater rights, rapid urbanisation and the inadequate capacity of formal water supply systems. These informal water markets are flourishing in several urban centres in P&H, and the regulation of the tanker mafia has emerged as a significant issue. This section will focus on how these water markets thrive by essentially abusing the common-law nature of groundwater rights, by drawing on the example offered by Haryana's metropolis – Gurugram – which has emerged in recent years as one of India's most significant cyber hubs.

Rampant urbanisation and civic authorities' failure to meet the growing water needs of Gurugram have enabled private tankers to have free run there. During the past decade, the population of Gurugram has increased from 1.5 million to 2.5 million.[68] The district has also experienced an expansion in its slum population, which stood at 30,888 according to the 2011 census. The overwhelming rate of urbanisation and expansion has not been matched by a similar increase in the district's water resources, resulting in water scarcity. The district's main source of water supply is groundwater drawn through tubewells.[69] Currently, around one-third of residents in Gurugram lack piped water connections.[70] Further, many residents who have access to piped water have reported the supply to be highly erratic, unreliable and, in some cases, unpotable.[71] Many people in the district – including several residents with piped water connections – depend on private vendors to meet their basic needs. However, these private vendors operate outside any government regulation or control,[72] and they extract vast amounts of groundwater by digging illegal tubewells.

The common law that ties groundwater rights to land rights provides the ideal climate for these illegal and inequitable water markets. The sole investment for

67 Siddharth Tiwari, 'Wash Your Hands? Clean Water Goes off the Taps in Gurugram' *Times of India* (Gurugram, 24 March 2020) www.timesofindia.indiatimes.com/city/gurgaon/wash-your-hands-clean-water-goes-off-the-taps-in-city/articleshow/74783216.cms accessed 2 July 2021.

68 Anumita Roychowdhury and Shubhra Puri, *Gurugram: A Framework for Sustainable Development* (Centre for Science and Environment 2017), 7.

69 Central Ground Water Board, *Gurgaon District at a Glance* (Government of India), emphasis section 4.8.

70 Roychowdhury and Puri (n 68) 15. The report notes that only about two-thirds of residents have access to piped water.

71 Sukirti Dwivedi, 'Gurgaon Residents out on Streets Against Water Crisis' (*NDTV*, 23 June 2019) www.ndtv.com/gurgaon-news/gurgaon-residents-out-on-streets-in-protest-against-water-crisis-2057882#:~:text=%22Piped%20water%20supply%20comes%20barely,once%20costs%20%E2%82%B9%20800%2D2%2C500 accessed 17 January 2021.

72 See Sumit Vijiwa, Anshika John and Anamika Barua, 'Whose Water? Whose Profits? The Role of Informal Water Markets in Groundwater Depletion in Peri-Urban Hyderabad' (2019) 21 Water Policy 1081.

these private water vendors is to purchase water-laden lands or enter into private agreements with landowners, usually farmers, to pump out the water. And here, the power subsidies meant to support agricultural operations are also abused. Thus, with very little investment, the negative externalities are passed on to society at large. Simultaneously, the water vendors sell the water at exorbitant rates, sometimes 40 per cent more than what the government charges.[73]

Private vendors also charge discriminatory prices for the same quantity of water, in different seasons and on different days. For instance, a water tanker of 5000 l during regular times may cost anywhere between INR 800 and INR 1000. It may increase to around INR 2500–3000 during periods of water shortages (usually artificially created).[74] These unstable pricing practices further marginalise impoverished communities and slum dwellers, who may sacrifice other necessities to purchase water.

As a result of excessive groundwater withdrawal, the district's water levels have declined by over 82 per cent in the past ten years.[75] The entire district has been categorised as 'over-exploited' by the CGWB, as the groundwater depletion has exceeded 100 per cent.[76] In fact, the groundwater development in Gurugram has reached over 200 per cent, which means that the net annual groundwater withdrawal is almost double the net annual recharge.[77] Consequently, the groundwater water table in the Gurugram district has been decreasing by over 2.5 metres every year during recent years. In 2011, the Punjab and Haryana High Court banned the use of groundwater for construction activities and restrained the authorities from approving buildings unless they gave an undertaking in a legal affidavit not to use groundwater.[78] This order has received little attention and almost no compliance.

2.3. *Groundwater contamination and other environmental impacts*

Another fallout of overexploitation is geogenic groundwater contamination. There are increasing reports of groundwater contamination due to rising levels of fluoride, uranium and arsenic in several parts of P&H.[79] The current levels of uranium and fluoride in samples taken from Punjab exceed the safety limit set by the World Health Organization (WHO) for drinking water.[80] A study by Duke University suggests

73 Leena Dhankhar, 'Sabotage, Extract, Supply, Repeat: How Gurugram's Water Mafias Operate' *Hindustan Times* (Gurugram, 11 June 2019) www.hindustantimes.com/gurgaon/sabotage-extract-supply-repeat-how-gurugram-s-water-mafias-operate/story-Hrpfbwfj3BTVNoQKqev6jL.html accessed on 19 January 2021.

74 'Tankers Raise Rates Sharply to Cash in on Water Shortage' *Times of India* (30 May 2017) www.timesofindia.indiatimes.com/city/Gurugram/tankers-raise-rates-sharply-to-cash-in-on-water-shortage/articleshow/58901900.cms accessed 25 January 2021.

75 Gurugram's groundwater table has fallen by 82 per cent in the past decade.

76 Central Ground Water Board (n 20) 121.

77 Department of Town and Country Planning, *Sub-Regional Plan for Haryana Sub-Region of NCR – 2021* (Government of Haryana 2021).

78 *Sunil Singh v MOEF and others*, CWP No. 20032 of 2008 (High Court of Punjab and Haryana) order dated 16 July 2012; see also Town and Country Planning Department, 'Office Order' (13 September 2012) www.tcpharyana.gov.in/Policy/Misc-2147-order-release%20of%20building%20plan-20.09.2012.pdf accessed on 13 February 2021.

79 Ministry of Water Resources, *Concept Note on Geogenic Contamination of Groundwater in India* (Government of India 2014), annexure – 1.

80 Ravishankar Kumar and others, 'Source Apportionment, Chemometric Pattern Recognition and Health Risk Assessment of Groundwater from Southwestern Punjab, India' (2021) 43 Environ

that while the primary source of uranium in the groundwater in Punjab is geogenic, the groundwater table's decline due to increased pumping enhances uranium mobilisation.[81]

P&H find themselves in a unique position where their ecosystem vulnerabilities span two extremes of the water resource spectrum. While groundwater overexploitation is pushing large parts of both states towards desertification, P&H also faces severe waterlogging and high salinity levels in the water and the soils.[82] Waterlogging occurs when seepage and deep percolation from canal irrigation systems and excessive rainfall increase the amount of water added to underground aquifers beyond the quantity drained out of the region. Waterlogging is not restricted to agricultural lands; it also plagues cities in P&H. For example, indiscriminate and unplanned development in Gurugram has led to encroachment upon natural drains, channels and water bodies. This reduces the absorptive capacity of the city to manage its stormwater and wastewater. A study of four localities in Old Gurugram – Khandsa Village, Sarai Alawardi, Sheetla Colony and Surat Nagar Phase 1 – found persistent waterlogging throughout the year due to inadequate sewerage infrastructure.[83] This, in its turn, leads to groundwater contamination and vector-borne diseases. Excess water can also transport underground salts to the surface, causing the agricultural land to turn saline. This secondary salinity has adversely affected productivity, particularly in south-western P&H, due to excessive use of canal water. Similarly, indiscriminate groundwater exploitation can lead to saline groundwater moving from deeper to shallower aquifers, increasing salinity.[84] This is a significant issue in Haryana.

Overexploitation leads to other environmental impacts. For instance, overexploitation can reduce the essential base flow into rivers and streams, especially those that receive their flows in dry seasons from groundwater. The political consequence of reduced flow in rivers and the general reduction in groundwater resources has led Punjab to demand a fresh tribunal to assess its water availability. This has created further impediments to resolving the limbo that surrounds the Sutlej Yamuna Link (SYL) Canal project, discussed next.

2.4. *Groundwater over-exploitation and the SYL canal*

The issue of allocating surface water resources from the Sutlej River and its tributary Beas to Haryana emerged with Haryana's separation from Punjab. Punjab opposed this

Geochem Health www.link.springer.com/article/10.1007/s10653-020-00518-1#citeas accessed 2 February 2021.

81 Subhojit Goswami, 'Uranium Contamination in Punjab Could Be Due to Geological Processes: Study' (*Down To Earth Blog,* 15 July 2018) www.downtoearth.org.in/news/environment/uranium-contamination-in-punjab-could-be-due-to-geological-processes-study-61134 accessed 5 February 2021.

82 Himanshu Kulkarni and Mihir Shah, 'Punjab Water Syndrome: Diagnostics and Prescriptions' (2013) 48 (52) EPW 64.

83 Prachi Jhamb, 'Causes, Effects and Possible Solutions of Water-Logging in Old Gurgaon' (Master's in economics thesis, TERI School of Advanced Studies 2018), see explanation of the linkages in the model.

84 See Rina Kumari and others, 'Anthropogenic Perturbations Induced Groundwater Vulnerability to Pollution in the Industrial Faridabad District, Haryana, India' (2018) 77 (187) Environ Earth Sci www.link.springer.com/article/10.1007/s12665-018-7368-8#citeas accessed 23 February 2021.

because of its water requirements and inadequate water resources, citing the riparian principle as the Sutlej does not flow through Haryana. However, in 1976, the union government allocated 3.5 million acre feet (MAF) of water to Haryana out of undivided Punjab's 7.2 MAF total water availability. The water was to be supplied to Haryana through the SYL Canal, a 214-km canal that links Sutlej with the Yamuna, cutting across both states. Of its total length, 92 km of the canal is in Haryana and the remaining 122 km is in Punjab.

In 1980, Haryana completed its portion of the SYL Canal, but the Punjab government skipped deadlines and moved the Supreme Court to reassess its water-sharing obligations. It even backed out of the tripartite agreement between Haryana, Rajasthan and Punjab to share river water resources. The Ravi–Beas Water Tribunal, headed by Supreme Court Judge Balakrishna Eradi, was set up to reassess water availability and recommend how the water was to be shared. In 1987, the tribunal upheld the legality of the earlier water-sharing agreement and recommended increasing P&H's shares to 5 MAF and 3.83 MAF, respectively. Subsequently, Punjab did not complete its portion of the canal and was embroiled in violence and militancy.

Haryana approached India's Supreme Court, and orders were passed in 2002 and 2004. Keeping in mind the water requirement in the state and the legally binding nature of the agreement concluded between the parties, the Supreme Court directed Punjab's government to complete the canal. However, the state legislature passed the Punjab Termination of Agreements Act, 2004, to discharge all obligations under the 1981 agreement. This act was held illegal by the Supreme Court upon a Presidential Reference. The Supreme Court has since directed Punjab to complete its portion of the SYL Canal.

The SYL Canal issue is politically charged because, with each passing year, both P&H have overexploited their water resources and face the threat of increased desertification. This is even more the case in Haryana, which has been denied its rightful share of the waters, forcing it to dig deeper to mine groundwater. In its petition before the Supreme Court, Haryana claimed that if the canal had been completed in 1983, then it could have 'been in a position to produce an additional 100 lac tonnes of food-grains, the value of which would work out to Rs. 5000 Crores'.[85] More than 18 years have elapsed since then; Haryana's losses only mount, and its dependence on groundwater has only increased. Clearly, if water resources are not managed sustainably, this dispute will worsen, along with the entire region's water. All this provides a compelling case for an ecosystem-based scientific and integrated approach to water management.

2.5. *Discussion*

The interconnected nature of land and groundwater rights is the primary factor that has facilitated groundwater overexploitation. This has contributed to the water crisis's epic proportions that threaten to engulf both P&H. If the legal system were to treat groundwater as common property rather than private, groundwater extraction monitoring and resultant regulation would have been easier and more

85 *State of Haryana v State of Punjab and Ors* (2002) 2 SCC 507.

effective. That would have allowed for more equitable distribution of the resource, thereby ensuring that the human right to water is realised. It would have also eliminated negative externalities, curbed the rise of tubewell capitalists and the tanker mafia, minimised geogenic water contamination and ensured that benefits like power subsidies truly benefit the intended.

3. Groundwater law and policy in P&H

3.1. *Groundwater exploitation, legal regulation and the fallout of the subsoil legislations*

Given its water-intensive nature, rice crop cultivation was naturally considered the primary factor behind the increasing groundwater use in P&H. However, this view obscures the reality that it is not just the rice crop *per se* but its transplanting date that decides the rise or decline in the water table.[86] Earlier, farmers in P&H used to practise the early transplantation of rice. They transplanted the rice crop during the summer season's peak, i.e. in May. As a result, rice cultivation depended entirely on groundwater. In the absence of rainfall or surface water irrigation, groundwater was extensively withdrawn for preparing the rice field through regular irrigation until the onset of the monsoon (mid-June). Further, due to the hot and dry season and no rainfall, rice fields would experience considerable evapo-transpiration losses.[87]

All of these unsustainable irrigation practices proved detrimental to the groundwater level and the state's overall water and food security. To curb the rapidly falling groundwater level, P&H in 2009 enacted their respective state legislations to preserve the subsoil water by banning the paddy crop's transplantation before the monsoon's onset. The primary objective of the P&H versions of the Preservation of Sub-Soil Water Act, 2009 is to prohibit paddy nursery sowing and paddy transplanting before specific notified dates. The core provision in both is setting a date in May as the earliest date before which a farmer cannot sow the paddy's nursery.[88] The legislations also empower an authorised officer to enter a farmer's field to assess any violations. If violations are found, the officer can direct the delinquent farmer to destroy the nursery. In non-compliance, the authorised officer can destroy the nursery or the transplanted paddy and recover costs.

In Punjab, the act has had considerable success in addressing declining groundwater tables,[89] even though loopholes allowing exploitation by wealthy farmers exist in the legislation. This is evident from Haryana's experience with its law, which is less effective when dealing with wealthy and politically connected farmers. For example, Section 6 of the Haryana Subsoil Water Act empowers an authorised officer to destroy the nursery or transplanted paddy of any farmer who has

86 SK Jalota, AK Jain and BB Vashisht, 'Minimize Water Deficit in Wheat Crop to Ameliorate Groundwater Decline in Rice-Wheat Cropping System' (2018) 208 Agricultural Water Management 261, 262.

87 It is a combination of two separate processes whereby water is lost on the one hand from the soil surface by evaporation and on the other hand from the crop by transpiration.

88 Haryana Preservation of Subsoil Water Act 2009, s 3 (Haryana Subsoil Act); and Punjab Preservation of Subsoil Water Act 2009, s 3 (Punjab Subsoil Act). Both the legislations prohibit farmers from sowing paddy nursery before the 15th and 10th May of a year, respectively.

89 See Amarnath Tripathi, Ashok Mishra and Geetanjali Verma, 'Impact of Preservation of Subsoil Water Act on Groundwater Depletion: The Case of Punjab, India' (2016) 58 Environ Manage 48.

violated the law and has defied the authorised officer's orders. In reality, it is difficult to uproot the entire paddy crop as it is sown over a large area. Therefore, in place of destruction, officials started levying penalties.[90] This levying of penalties betrays the legislative intent behind the Prevention of Subsoil Water Act.

Nevertheless, both legislations, which represent the first attempt by both states to regulate groundwater exploitation and arrest the falling water tables, have by and large been able to prevent the sowing and transplantation of paddy before the notified dates. However, this apparent success in curbing one environmental problem has unwittingly led to the magnification of another, namely the enormous air pollution that has emerged as a yearly affair that snuffs out lives in both these states and their neighbouring regions during the winter months. The ban imposed by the subsoil water legislation on the sowing and transplantation of rice crops has intensified the practice of stubble burning among the farmers due to the reduced period between rice harvest and wheat sowing.

By delaying the rice crop plantation schedule[91] from early May to mid-June, the ban has considerably delayed the harvesting period of paddy crops from October to the early weeks of November.[92] As a result, there has been an automatic shift in the crop residue burning period from the last fortnight of October to the first three weeks of November. The frequency and intensity of crop residue burning has thus increased,[93] escalating the air pollution problem.

According to the Haryana Economic Survey 2019–20, high levels of particulate matter (PM) 10 and PM2.5, which stood at 384 and 306, respectively, were recorded in the state in October 2019. These were almost double the PM10 and PM2.5 levels (134 and 80.34) recorded in September. The sudden spike is attributable to residual crop burning. In November 2019, the PM10 and PM2.5 crossed the 550 and 510 mark, reaching dangerously high levels due to the increase in stubble burning. From these numbers, a direct inference can be drawn between the stubble burning and the air pollution level in both the states, nearby Delhi, and the National Capital Region (NCR) region. This is higher during the first few weeks of November than in October, primarily because of the greater frequency of farm fires in November.

According to satellite data from the Punjab Remote Sensing Centre, Punjab was the largest stubble-burning state in 2020, with 76,000 fire counts between 21 September and 24 November.[94] The air quality monitor System of Air Quality and Weather Forecasting and Research (SAFAR) under the Ministry of Earth Sciences publishes daily figures regarding stubble burning in north-west India. Delhi's PM2.5 level

90 Neeraj Mohan, 'Paddy Cultivation in Full Swing in Karnal Villages' *Hindustan Times* (Karnal, 3 June 2020) www.hindustantimes.com/chandigarh/paddy-cultivation-in-full-swing-in-karnal-villages/story-PuYZ1TKVFfC5VsMSrbtatM.html accessed 29 August 2020.

91 Mayank Aggarwal, 'While Trying to Save Water, Legislations Unexpectedly Lead to Increasing Air Pollution, Says Study' (*Mongabay*, 30 August 2019) www.india.mongabay.com/2019/08/while-trying-to-save-water-a-legislation-unexpectedly-leads-to-increasing-air-pollution-says-study accessed 29 August 2020.

92 Balwinder Singh and others, 'Tradeoffs between Groundwater Conservation and Air Pollution from Agricultural Fires in Northwest India' (2019) 2 Nature Sustainability www.nature.com/articles/s41893-019-0304-4#citeas accessed 30 August 2020.

93 *Ibid*.

94 Shivam Patel, 'Crop Burning Season Over, Why Is Delhi Air Still Bad?' *Indian Express* (New Delhi, 7 December 2020) www.indianexpress.com/article/cities/delhi/crop-burning-season-over-why-is-delhi-air-still-bad-7094604 accessed 4 September 2020.

reached a maximum of 42 per cent on a single day in November 2020. It was above 15 per cent on 12 days in the month, which correlates with the higher number of stubble-burning cases in Punjab in 2020.

Along with particulate matter, the open burning of crop residue is a potential source of greenhouse gases and other trace gases. According to the World Bank, stubble burning or biomass burning is the second-largest source of trace gases in the atmosphere.[95] Such gaseous pollutants in the atmosphere can negatively affect natural ecosystems and human health. For example, nitrogen oxide causes respiratory problems such as asthma and lung irritation. PM, as microscopic solids or liquid droplets, is highly harmful due to its small size.

The adverse effects of PM are more pronounced than other pollutants because PM is lightweight and can persist in the air for extended periods, causing smog.[96] PM also travels long distances with the wind, leading to air pollution in far-away areas.[97] During October–November, wind changes in North India and the temperature falls, make it difficult to disperse the PM.[98] PM10 can easily penetrate human lungs, causing respiratory and cardiovascular diseases.[99] PM2.5 is even more harmful as it can get into one's lungs and bloodstream and cause premature death. Higher PM2.5 levels due to stubble burning have resulted in around 7000–16,000 premature deaths and six million asthma attacks annually in the Union Territory of Delhi.[100]

In sum, the legislative attempt to regulate groundwater resulting in a narrow time frame during which residue burning is carried out has resulted in disastrous consequences. Delhi and the Northern Capital Region's entire landscape remain covered in a thick dark layer of pollution for most of October and November. While courts, including the Supreme Court and the National Green Tribunal, have expended their energies to examine the problem of haze pollution, they have not examined the interconnected issues of groundwater depletion in P&H, misguided regulations and air pollution.[101] This situation is an unfortunate but typical example of isolated piecemeal management of natural resources and ecosystems, underscoring the importance of integrated approaches.

3.2. *Groundwater legal regulation and the integrated approach in P&H*

Decades after the problems associated with groundwater overexploitation came to light, the states of P&H finally passed legislation in 2020 to manage their water

95 Emilie Cassou, 'Agricultural Pollution Field Burning' (*World Bank Blog*) www.openknowledge.worldbank.org/bitstream/handle/10986/29504/124342-BRI-p153343-PUBLIC-march-22-9-pm-WB-Knowledge-Burning.pdf?sequence=1&isAllowed=y accessed 4 September 2020.

96 S Bhuvaneshwari, Hiroshan Hettiarachchi and Jay N Meegoda, 'Crop Residue Burning in India: Policy Challenges and Potential Solutions' (2019) 16 (832) Int. J. Environ. Res. Public Health, 5.

97 *Ibid*.

98 Ila Patnaik, 'This Is the Real Culprit behind Delhi's Poisonous Diwali Air and PM Modi Has a Fix for It' (*The Print*, 18 October 2019) www.theprint.in/ilanomics/real-culprit-behind-delhis-poisonous-diwali-air-modi-has-fix-for-it/307502 accessed 12 September 2020.

99 Shuvabrata Chakraborty and Samir K Srivastava, 'A Novel Approach to Understanding Delhi's Complex Air Pollution Problem' (2019) 54 (36) EPW 32, 32.

100 Hiren Jethva and others, 'Connecting Crop Productivity, Residue Fires, and Air Quality over Northern India' (2019) 9 Scientific Reports www.nature.com/articles/s41598-019-52799-x#:~:text=Rising%20levels%20of%20crop%20fires,air%20quality%20over%20northern%20India accessed 4 October 2020.

101 *MC Mehta (Stubble Burning & Air Quality) vs Union of India* [2020] 7 SCC 573.

resources. Entitled the Punjab Water Resources (Management and Regulation) Act (Punjab Water Act), the purpose of this law is to manage and regulate Punjab's water resources, ensuring its judicious, equitable and sustainable utilisation and management.[102] As far as the Haryana Water Resources (Conservation, Regulation and Management) Authority Act, 2020 (Haryana Water Act) is concerned, it provides for the creation of the Haryana Water Resources (Conservation, Regulation and Management) Authority (Haryana Water Authority) for conserving, managing and regulating water resources. A similar authority was created by the Punjab Water Act as well. Thus, by casting their focus on water in general and not solely on groundwater, both legislations seem to have adopted an integrated approach. While the Haryana Water Act expressly underlines the Haryana Water Authority's importance in securing its legislative objectives, the Punjab Water Act adopts the same approach in less explicit terms. This aspect is fortified via the establishment of the Punjab and Haryana Water Authorities,[103] both featuring corporate characteristics.[104]

As far as the authorities' functions in the two states are concerned, they can issue directions[105] and provide advisories to the government.[106] These directions deal with the development, management, conservation and use of water. Specifically, some of the directions in these legislations deal with: (1) restrictions on groundwater utilisation; (2) water conservation, groundwater recharge, recycling and reusing water, and rainwater harvesting;[107] (3) optimal use of water for domestic, irrigation and industrial use;[108] (4) installing and maintaining instruments for volumetric measurement of groundwater extraction; (5) registration of existing groundwater users and conditions relating to the operation of existing water extraction structures; (6) specifying areas in which groundwater water utilisation can occur subject to conditions and safeguards; (7) increasing water efficiency in agriculture; and (8) publishing reports to generate public awareness about water management.

While these aspects are common to both legislations, the Haryana Act further empowers the authority to issue furthr directions on micro-irrigation techniques, sustainable technologies and energy-efficient systems.[109] This is extremely important given the overwhelming reliance on groundwater irrigation and the need to improve its efficiency and sustainability. In addition, the Haryana Act calls upon the authority to use modern technological tools to map aquifers in the state, prepare a hydrological map and integrate these inputs into the comprehensive water resources plan to create a sustainable water regime for the state.[110]

Advisories common to the two states may involve (1) the sustainable operation and maintenance of water infrastructure and water delivery systems; (2) pollution

102 Punjab Water Resources (Management and Regulation) Act 2020 (Punjab Water Act), preamble.
103 Haryana Water Resources (Conservation, Regulation and Management) Authority Act 2020 (Haryana Water Act), s 3(1); see also Punjab Water Act, s 3(1).
104 Haryana Water Act, s 3(2) and Punjab Water Act, s 3(3).
105 Haryana Water Act, s 12(4); Punjab Water Act, 15(2).
106 Haryana Water Act, s 12(5); Punjab Water Act, 15(7).
107 Haryana Water Act, s 12(4)(g) and 21 (6); Punjab Water Act, s 15(2)(viii) and 13(6)(i).
108 The Haryana Water Act uses the more comprehensive term water, while the Punjab Act prefers to use surface water.
109 Haryana Water Act, s 12(4)(i).
110 Haryana Water Act, s 12(14).

prevention and degradation of water resources; (3) optimum utilisation of the irrigation potential; (4) adopting the latest technologies for the water sector; or (5) promoting water conservation awareness.[111] The Haryana legislation also empowers its authority to issue water audits on irrigation, multipurpose water projects and canal systems.[112]

One of the essential functions of the authority is setting tariffs and charges for water supply and management. The position in the law of the two states on this matter varies considerably. Under the Haryana law, the authority can recommend to the government the tariff for all surface water uses and the use and disposal of treated wastewater.[113] The Punjab authority, on the other hand, issues tariff orders for surface water and charges for groundwater use. The Punjab authority can specify the charges that entities can impose for supplying water for commercial or industrial use.[114] While fixing tariffs for water supplied for domestic, drinking and agricultural purposes, the authority must consider the relevant government policy.[115] In determining the tariff, both authorities are to consider the principles of economy, efficiency, equity and sustainability, as far as possible, and the tariff should be based on volumetric measurement of water consumption, designed to ensure economy in its use.[116] In determining the tariff, the Punjab Water Act expressly states that the requirements of disadvantaged and economically weaker sections of the society should be considered.[117]

A critical aspect with far-reaching legal consequences is that the Punjab Act empowers the Punjab Water Authority to levy groundwater use charges. With the state government's approval, the authority may fix charges for groundwater extraction by any person. However, no charges are leviable on water extracted by households for their drinking and domestic purposes, using non-energised means or a pump of up to 2 horsepower from a single tubewell in the household where piped water supply is not available.[118]

Under both legislations, the Punjab and the Haryana authorities consist of a chairperson and members (two in Punjab and four for Haryana).[119] To carry out these appointments, each act creates a separate body called the Selection Committee,[120] headed by the state's Chief Secretary and others,[121] on whose recommendations the concerned state government makes the appointments.[122] Given the nature of these authorities' functions, they are supported by staff[123] and have a separate fund for finances.

Besides these, the Punjab Act provides for creating certain other bodies, which are absent in the Haryana legislation. There is a provision for an Advisory Committee on

111 Haryana Water Act, s 12(5)(i), 12(5)(iii), 12(5)(v), 12(5)(vii), 12(5)(viii); Punjab Water Act, s 15(7)(i), 15(7)(iii), 15(7)(v), 15(7)(vi).
112 Haryana Water Act, s 12(5)(xii).
113 Haryana Water Act, s 18 (1).
114 Punjab Water Act, s 17(1).
115 *ibid* s 17(1) proviso.
116 Haryana Water Act, s 18(2) and Punjab Water Act, s 17(4).
117 Punjab Water Act, s 17(6).
118 *Ibid* s 17(5).
119 Haryana Water Act, s 3(4) and Punjab Water Act, s 3(2).
120 Haryana and Punjab Water Acts, s 5.
121 Haryana Water Act, s 5(1); Punjab Water Act, s 5(1).
122 Haryana Water Act, s 4(3); Punjab Water Act, s 4(3) and 5(3).
123 Haryana and Punjab Water Act, s 8.

Water Resources, headed by the Punjab authority's chairperson and up to five experts. The Punjab authority is to consult this advisory committee on policy questions and regulatory directions.[124] However, the advisory committee provides only non-binding recommendations,[125] and it also apprises the authority regarding government programmes and proposals relating to water resources development, conservation and management.[126] The Punjab Act empowers the government to establish the Punjab State Council for Water Management and Development to facilitate this act's objectives. It is a high-powered body headed by the Chief Minister and comprises ministers from relevant ministries.

This council is an overarching body that considers and steers state policies and programmes regarding supplying quality water to all persons at affordable costs and prices.[127] It also ensures the optimal judicious use of the state's water resources,[128] approves, reviews or modifies the Punjab State Water Policy[129] and the Integrated State Water Plan (ISWP), and compensates consumers for government decisions that may affect them.[130]

With its focus on decentralisation, the Haryana Water Act provides for a District Water Resources Planning Committee for each district in the state, tasked with preparing the District Water Resources Plan. Committee members can also identify and demarcate areas that suffer from water quality issues and pollution hazards to prevent and control water pollution.[131]

A unique feature of both legislations is that they provide for developing an ISWP, which is periodically revised.[132] In Punjab, the Department of Water Resources prepares the ISWP,[133] while in Haryana, it is the Haryana authority's responsibility.[134] This plan's importance can be gauged in that both the authorities in the states are required to develop, manage and conserve their water resources by following the plan.[135]

In addition, the Haryana legislation provides for a State Groundwater and Surface Water Plan[136] and a Water Security Plan (WSP).[137] The objective of the WSP is to ensure that sufficient quantities of safe water are available to sustain life and livelihoods. Water security is ensured during emergencies.[138] This WSP is prepared at the lowest administrative level in consultation with elected local representatives.[139] If an aquifer falls within the jurisdiction of more than one administrative unit, the

124 Punjab Water Act, s 12(2).
125 *Ibid* s 12(2) proviso.
126 *Ibid* s 12(4).
127 *Ibid* s 13(5).
128 *Ibid* s 13(5).
129 *Ibid* s 13(6)(i).
130 *Ibid* s 13(6)(iii).
131 Haryana Water Act, s 14(3)(iii).
132 *Ibid* s 11(6) and Punjab Water Act, s 14(4).
133 Punjab Water Act, s 14(1).
134 Haryana Water Act, s 11(1).
135 Haryana Water Act 12(1) and Punjab Water Act 15(1).
136 Haryana Water Act, s 13.
137 *Ibid* s 15.
138 *Ibid* s 15 (2).
139 *Ibid* s 15 (3).

WSP is prepared by integrating inputs from all levels of the authority under whose jurisdiction the aquifer falls. These provisions are absent in the Punjab Water Act.

An interesting feature of the Haryana Water Act, conspicuous for its absence in the Punjab Act, is that it emphasises the need for self-regulation to protect, conserve and regulate groundwater and surface water resources in water-stressed areas.[140] These self-regulation measures can take the following forms: preventing wastage of ground and surface water; avoiding over-irrigation; and adopting water conservation practices such as farm-bunding, farm ponds, and using low-water crops, drip, sprinkler irrigation systems, recycled water and rainwater harvesting.[141] The Haryana Water Act also empowers the authority to make recommendations to the government regarding monitoring and implementing stipulated quality standards for wastewater disposal.[142]

Even though both water acts empower their respective authorities to promote rainwater harvesting, the Haryana Water Act takes this mandate further. It specifies that the authority should sensitise different groundwater users regarding suitable rainwater harvesting technologies for use in stressed areas. Furthermore, groundwater users can obtain technical drawings and rainwater harvesting system designs from the authority.[143]

As the discussion in section 2 revealed, waterlogging is a significant cause of concern in P&H. However, the Punjab Water Act contains no provisions to deal with waterlogging. The Haryana Water Act, on the other hand, calls upon the authority to encourage waterlogging mitigation measures and prevent activities that can lead to potential waterlogging.[144]

Both legislations contain elaborate provisions for securing compliance, including imposing penalties.[145] There is a provision to appoint an Enquiry Officer for conducting inquiries.[146] The laws also confer power on the respective state governments to make rules on a wide range of matters.[147]

3.3. *Discussion*

While both the P& H Water Acts are well intentioned and are cast in almost the same legislative mould, the analysis in the succeeding sections reveals some of their glaring defects. For any legislation to be effective, the administrative system it envisions must be (1) simple, with an easy-to-follow hierarchy; and (2) sufficiently independent. A coherent bureaucratic structure aids the implementation of the legislation's objectives by clearly defining the powers under the act and the person or body responsible and accountable for its exercise. It allows the streamlined formulation of plans and their implementation and enforcement. Minimal interference by the political executive and control over funding allows scientific bodies to achieve their goals instead of following unpredictable political motives that change with the election season. The P&H

140 *Ibid* s 21 (2).
141 *Ibid* s 21 (2)(ii).
142 *Ibid* s 12(9).
143 *Ibid* s 21(3).
144 *Ibid* s 21 (7) and (8).
145 Haryana Water Act, s 22 – 26 and Punjab Water Act, s 20–27.
146 Haryana Water Act, s 19 and 20; Punjab Water Act, s 20 and 21.
147 Haryana Water Act, s 30 and Punjab Water Act, s 35.

Water Acts appear to have completely ignored these basic tenets of efficient legislation.

3.3.1. An unnecessarily complicated administrative setup

The bureaucratic setup under the acts is mired in multiple bodies with a cross-cutting scope of operation – the opposite of operational utility and simplicity. Both legislations set up multiple bodies and plans. There is no clear demarcation in their objectives or explanation of how these objectives are to be achieved. For example, the Punjab authority has the power to engage consultants. Under Section 12(5), it can also simultaneously set up other expert committees nominating the members, if necessary. This is in addition to the government-notified Advisory Committee on Water Resources headed by the chairperson of the authority, which can comprise up to five experts. The authority must consult the Advisory Committee on policy questions and regulatory directions, but these recommendations are non-binding.

This unnecessary structural complication is made worse by the different plans that both acts envisage, again without clear differentiation between their objectives. For example, in the Haryana Water Act, the District Planning Committees must formulate the District Water Resources Plans. These are in addition to the ISWP made by the authority. The ISWP, however, must first be approved by either the state government or a different authority established by the government for the specific purpose of granting such approval. This is in addition to the State Groundwater and Surface Water Plan and the State Water Security Plan, both prepared by the authority.

All this creates unnecessary confusion regarding the required bodies to be set up, plans to be formulated, and opinions to be considered before the water authorities can make decisions. The situation is made worse by the lack of independence of the water authorities.

3.3.2. Independent or shackled – where does the ultimate decision-making power rest?

Under both legislations, the ultimate decision-making power rests with the respective state governments. The state governments decide on the members' appointment to the water authorities in both P&H and determine their tenure and service conditions. Even the appointments to the many different bodies discussed above are directly or indirectly under the state government's control. This is more express in the Punjab Water Act. All decisions taken by the several bodies created by the statute are ultimately subject to the Punjab State Council for Water Management and Development, headed by the Chief Minister and comprising ministers from the relevant departments. This state council does not include any subject experts, thereby paving the way for decision-making based on political considerations rather than expert scientific advice.

Even in terms of non-administrative power to take subject-matter-related decisions, the water authorities do not have the final say. The Punjab Water Authority cannot issue directions regarding groundwater extraction for drinking and domestic use or ban its use for these purposes. The Haryana Act allows for more detailed powers and duties of the authority. However, it makes government approval a pre-condition for the issuance of directions regarding the conservation, use, development and management of water resources. The multiplicity of administrative bodies and

redundant channels of approvals, coupled with the limited scope to take final decisions, will delay any meaningful action or implementation. This allows political considerations rather than scientific expertise to guide resource management.

3.3.3. The issue of financial independence

While the acts establish water authorities for the specific purpose of water resource management, they do not provide sufficient administrative or financial independence, thereby rendering the authorities almost toothless. The funds available to the authorities under both acts are maintained separately. The sources include grants, loans, fees, fines and charges. The Haryana Act allows private corporate social responsibility funds to be applied to the Haryana Water Authority's functioning and work.[148]

The primary application of these funds should be to secure the objective of water conservation and management, ideally to be determined by the Haryana Water Authority. However, the Haryana government may make rules for carrying out any or all the act's purposes, particularly the manner of appropriating the authority's funds, among other things. This curtails the water authority's financial independence. If the water authorities cannot decide how to apply their funds to meet their objectives, they cannot be financially independent. A post-expenditure monitoring or planned budgetary allocation system would likely have been more efficient.

3.3.4. Lack of enforcement capacity

Under the Haryana Water Act, there are provisions for self-regulation, conservation, rainwater harvesting and waterlogging. The Punjab Water Act provides for none of these; rather, they are to be secured by the authority through recommendations, encouragement, restrictions and advisories. But the act remains toothless as it empowers the government to relax any restriction imposed under the act after consulting the authority. This consultation is not explicitly binding.

The Punjab Water Authority can disconnect electricity supply or ban any industrial process that utilises water in the premises under Section 23 for failure to comply with its directions, providing it with some enforcement power, unlike the Haryana authority. However, this provision cannot overcome the overall lack of enforcement capacity within the act.

3.3.5. Tariff for supply and management of water

The authorities exercise considerable discretion under the two acts in terms of setting tariffs for commercial and industrial use. Tariff applications are judged individually and can be grouped at the discretion of the authority. This might lead to unequal treatment of similarly placed applicants. The procedure for tariff order gives a broad scope for discretion, which could lead to corruption and misuse. Standard rates would have been a better option. There is no concrete policy on what should guide the setting of tariffs.

148 Haryana Water Act, s 34 (2).

3.3.6. Addressing irrigation as a cause for groundwater overexploitation

These water acts do not comprehensively address the question of groundwater overexploitation due to irrigation. This is evident from the fact that irrigation is only mentioned four times in the Punjab act (and only twice outside of the definitions): the authority can issue directions for 'optimal use of surface water for irrigation, industrial or domestic use'; and it can issue advisories to the government for 'optimum utilization of the irrigation potential created in the state'. The words 'exploit' or 'exploitation' are not mentioned even once in the Punjab Act. The Haryana Water Act does not directly address irrigation-related overexploitation of groundwater either. However, it does encourage micro-irrigation and optimal irrigation techniques through advisories to the government in that regard.

3.3.7. Community participation, inclusion and the delinking of land and groundwater rights

For community participation, information is critical. In this respect, the Punjab act envisages the authority disseminating information, especially scientific information, to the public in an accessible manner. The Haryana act has similar general provisions. It remains to be seen to what extent the authorities will implement these obligations.

Strikingly, neither the Haryana Water Act nor the Punjab Water Act addresses the adequate representation of women or the SC or ST community members in the various regulatory bodies that they create. Their inclusion is essential given that the land and water ownership patterns are unfavourable to these communities.

The nature of groundwater rights greatly hinders inclusion and, consequently, equity. As seen in section 1, under the law, groundwater rights are connected to land rights. Both legislations sidestep questions relating to the private ownership nature of groundwater rights. In this respect, an interesting provision in the Punjab Water Act (no corresponding provision in the Haryana statute) is Section 17(5), under which the Punjab Water Authority 'may fix charges for extraction of groundwater by any person', with the approval of the government and subject to certain exceptions. Since the law does not address or alter the fundamental nature of groundwater rights by delinking them from land rights, a question arises: Under what legal authority can the Punjab Water Authority levy charges on groundwater extraction by a person on his/her land? Fixing charges for groundwater extraction in such circumstances is nothing short of an expropriation of private property that may warrant payment of compensation by the state, posing multiple legal issues and potential future challenges.

3.3.8. Integrated resource management:

While the definition of 'water' under both legislations includes surface and groundwater, their conjunctive management details are not spelled out. Problems affecting the groundwater cannot be resolved in isolation and must be integrated with surface water and soil, land and waste management. In this era where there is increasing knowledge regarding the interrelationships among the different components of the ecosystem, the states should have used this opportunity to frame a comprehensive Water Resource Code that interacts with the ecosystem's various components to

provide for the management of both the quality and the quantity of water. These acts do not cross-reference other legislation on pollution, agriculture, pond management, wastewater or other related issues. A case for integrated resource management requires congruity between different sectoral legislations.

4. Conclusion

In sum, the Green Revolution's development potential, when combined with groundwater rights' existing nature, has facilitated private enterprise and increased agricultural productivity. However, it has also led to adverse environmental consequences in both P&H. These include the falling groundwater table, air pollution, the emergence of tubewell capitalists and the tanker mafia, worsening water quality, strained water relations between states and economic inefficiencies that have practically bankrupted the power sector in both states. A legal framework to rectify these imperfections was long overdue. Nevertheless, it was only in 2020 that both P&H decided to enact water laws. As the discussion reveals, both states have lost an opportunity to rectify the inequitable nature of groundwater rights, since their respective water statutes have sidestepped this issue.

The second major drawback is that these legislative initiatives entrench localised, disconnected decision-making processes. These water acts do precious little to manage surface and groundwater holistically. Quality management is absent in these statutes. Both P&H and their neighbouring regions are already the victims of environmental crises created by localised decision-making due to the Sub-Soil Acts' faulty design. The statutes are nowhere near transformational nor able to address the looming water security threat. In the face of these circumstances, the water acts of P&H seem a case of too little too late – an instance of sloppy drafting not conceived on sound water management principles.