

Chloride Concentration in Ground water of Punjab Satluj Floodplain (India) from 1970 to 2011

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Abstract- Chloride concentration beyond permissible consumption limit affects the taste and corrodes the metals. In Punjab Satluj floodplain chloride concentration is ranged between 8.9-96 mg/L in 1970 which increased to 6.7-309 mg/L during 1980 and then reduced to 13-121 mg/L in 2011. Mean value of Chloride concentration in this area was 41.34 in 1970, 58.99, 67.53 and 38.81 in 1980, 2000 and 2011 respectively. Standard Deviation was 29.37 in 1970, 71.5 in 1980 and reduced to 29.81 during 2011. Fluctuations in the concentration of chloride content in the ground water of Punjab Satluj floodplain can be linked with the vertical and horizontal flow movements of groundwater, application of potash fertilizers and also from the road salts.

Index Terms- Groundwater, Chloride, Floodplain, GIS, Spline

1. INTRODUCTION

Regional aspect based this study has been focused on the part of Punjab Satluj floodplain that located between 30°32' N to 31°35' N and 75°05' E to 76°44' E latitudes and longitudes respectively and covers 1042.75 square kilometers area of Indian Punjab. That included parts of Phillaur Block of Jalandhar District; Aur, Nawanshahr and Balachaur Block of Shahid Bhagat Singh Nagar District; Chamkaur Sahib Block of Rupnagar District and Machhiwara, Ludhiana II and Ludhiana I Block of Ludhiana District of State Punjab Country India. This part is lying in those areas where successful execution of Green Revolution has been noticed. Here agricultural and allied activities has been boosted with the extensive and intensive use of High Yielding Variety of seeds, Chemical fertilizers, insecticides, pesticides, field mechanization and consolidation of small land holdings etc. (Gill, 2015). All that factors made a leap extent in agricultural activities with 151.01% expanded agricultural land from 1955 to 2011. This increase helped to curb the food security problem to an extent but also adversely affects the water, soil and biota of that area (Kaur and Brar, 2013). This research work explains a section of above said phenomena, while considering increase use of Potash fertilizer and flux in spatial distribution of chloride concentration in ground water of Punjab Satluj floodplain area.

2. METHODOLOGY

Secondary data sources have been used for data collection and collected data set has been analyzed, processed and displayed in Geographic Information System (GIS). Fifty wells have been identified for checking chloride concentration from 1970 to 2011 from Department of Soil and Conservation, Punjab and Central Groundwater Board, India. Spline

interpolation technique has been applied for preparing isolines.

3. DISCUSSION AND ANALYSIS

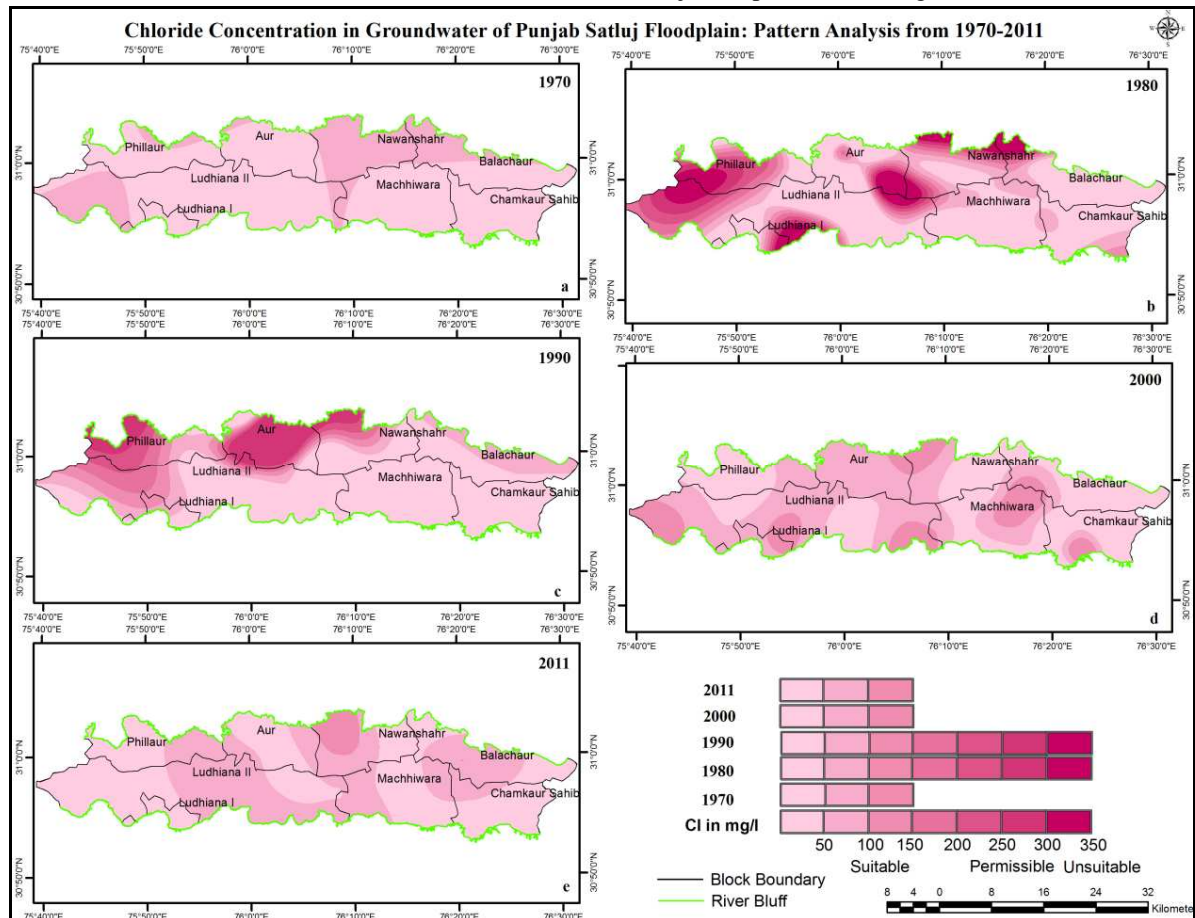
Excessive addition of chloride ions took place through the application of potash fertilizers into the agricultural field (Forrest et al., 2006) and from the road salts (Delaware Department of Natural Resources and Environmental Control, 2005). According to World Health Organization (2011), maximum permissible consumption limit of chloride in water is 250 mg/L, beyond this affects the taste and corrodes the metals. With time due to the increased consumption pattern of fertilizers, variation in the upper limit of chloride content was observed. During 1970-71, 7,000 tonnes potassic nutrient was consumed in Punjab that increased to 29,000 in 1980-81. For 1990-91, 2000-01 and 2011-12, that figure reached to 15,000, 23,000 and 54,000 respectively. That accentuates the changes in spatio-temporal concentration of chloride content in groundwater of Punjab Satluj floodplain.

Chloride concentration was ranged between 8.9 to 96 mg/L for 1970, which was under the suitable consumption limit (figure 1 (a)). It exceeds the maximum permissible limit during 1980 and ranged between 6.7 to 309 mg/L for study area. Unsuitable groundwater ranged between 250 to 350 mg/L was experienced in four areas. One linear patch was found in the upper portion of the study area, which covered north western part of Balachaur Block and northern part of Nawanshahr Block of Shahid Bhagat Singh Nagar District. Circular patch was observed in the centre of the study area, it consist south western part of Nawanshahr Block, south eastern part of Aur Block of Shahid Bhagat Singh Nagar District and north eastern part of Ludhiana II Block of Ludhiana District.

This high range chloride concentrated groundwater was also covered the south central part of Ludhiana II Block and eastern portion of Ludhiana I Block of

4. CONCLUSION

Chloride concentration in groundwater of Punjab Satluj floodplain was changed with time. Variation in



Source: Interpreted from data provided by Central Groundwater Board, India

Fig. 1. Chloride Concentration in Groundwater of Punjab Satluj Floodplain: Pattern Analysis from 1970-2011: This natural entity includes part of Phillaur Block of Jalandhar District; Aur, Nawanshahr and Balachaur Blocks of Shahid Bhagat Singh Nagar District; Chamkaur Sahib Block of Rupnagar District and Machhiwara, Ludhiana I and Ludhiana II Blocks of District Ludhiana, Punjab (India).

Ludhiana District. A prominent circular patch was also considered under this unsuitable consumption zone consisting south western part of Phillaur Block of Jalandhar District and north western part of Ludhiana II Block of Ludhiana District (figure 1 (b)).

For 1990, upper limit of chloride concentration was reduced and ranged between 8.2 to 263 mg/L. During this period, as compare to earlier distributed beyond permissible limit areas, it was shifted towards north westward and incorporates North West part of Nawanshahr Block and central portion of Aur Block of Shahid Bhagat Singh Nagar District. This high range was also observed in north western part of Phillaur Block of Jalandhar District (figure 1 (c)).

During 2000 and 2011, whole study area was under the permissible consumption limit of chloride ions. That was 7.4 to 148 mg/L and 13 to 121 mg/L for 2000 and 2010 respectively (figure 1 (d) & (e)).

the distribution pattern of chloride concentration took place due to the movement of underground water that dilutes the ions presence. In this area Green Revolution was successfully executed as area under agricultural land was expanded by 151.01% from 1955 to 2011. With this utilization of groundwater for irrigation and fertilizers and pesticides consumption on land was also increased that caused the addition of chloride content in groundwater and exhibits flux in distribution pattern with time.

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