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Research Article

Assessment of Groundwater Suitability for Drinking Purpose from Narangal, (MS) India

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Abstract

Object of study is to show monthly variations of groundwater quality. Study of groundwater quality is major issue nowadays. Groundwater is source for drinking, domestic and commercial uses across globe. Narangal villagers use groundwater as direct source for drinking purpose. Duration of sampling is from August 2016 to July 2017. Water samples were collected on monthly basis and immediately it was transferred to laboratory for further physico-chemical analysis. Total 10 groundwater samples were collected form Narangal village from different sites. About 11 groundwater quality parameters were examined such as pH, EC, TDS, TH, Ca, Mg, Na, K, Cl, SO^4, and NO^3. Obtained results were compared with standards given by BIS. Study is carried out to show hydrogeochemical relationship of groundwater suitability for drinking purpose. Spatial distribution of groundwater quality is shown by using ArcGIS 10.2.1 software and Excel.

INTRODUCTION

Water is a natural resource present in nature absolutely essential for all living organisms present on Earth. Groundwater is available at purest form in nature which is colorless and tasteless. Safe potable water is not likely to be harm humans which keeps healthy lives throughout the world. Communities in developed countries are using good quality water for drinking purpose and in developing and undeveloped countries peoples are getting unsafe water for drinking purpose which is major issue. According to United Nations International Children's Fund (UNICF) 1.1 billion peoples get unsafe water for drinking purpose (Kanaujia *et al.*, 2015).

One of the most required natural resource for all living organisms on earth is water. It is most essential natural resource for life on surface and underground which is available in large quantity able to use (Patel *et al.*, 2016). Mostly in village's groundwater from bore, wells and dug wells are source for drinking purpose (Mahour *et al.*, 2016).

According to WHO 65% of rural and 35% of urban population consume unsafe water. Fresh water on earth is crucial for life surviving on earth to produce food, domestic and commercial use in daily life (WHO, 2008). From decades it observed that water is getting contaminated due to human activities which can cause water borne diseases and gets health hazards. It is found that human activities are responsible for polluting groundwater due to which it can cause health hazards. Fresh water plays an important role in all living things across globe as source for food production (Kalra *et al.*, 2012).

Due to pollution clean water is getting polluted which is essential compound for life (Shahida and Ummatul, 2015). Physico-chemical parameters present in water are essential to human health (Varughese and Devi, 2012).

Water is a renewable natural resource essential for life. Due to increase in water pollution it deserves special attention. Use of pesticides and fertilizers are causing chemical contamination in surface water. This leads to imbalance of water ecosystem (Togue *et al*., 2017).

Water is a natural resource and not restricted in any country. Industrialization and increase in urbanization lead water pollution. Humans require fresh water for drinking, agriculture etc. There is a big gap in supply of fresh water and there increasing demands. In some countries there is rapid population growth, water demand for consumption (Jamdade and Gawande, 2017)

Water is major support for life. Without water no life can survive on earth. In developing countries water pollution is considered as major issue. Ground water is the source for agricultural, industries and domestic use. Before some decades there was a major demand for pure drinking water in developing countries (Bansal and Dwivedi, 2018).

It is very necessary to analyse groundwater to maintain its quality. By analyzing physicochemical parameters it is determined whether it is suitable for drinking, agriculture and other uses. Water quality can be determined by physical, chemical and biological process (Ghosh, 2018)

MATERIALS AND METHODS

Study area lies between $77^0$39’0’’E to $77^0$41’0’’E longitude and $18^0$32’30’’ to $18^0$35’0’’ latitude as shown in (Fig.1). In Narangal village groundwater is used as direct source for drinking and many other uses. Narangal village is near to Telangana border. Narangal Bk. is located in Degloor tahsil of Nanded District, Maharashtra. It is 14 km away from Degloor tahsil and 88 km away from Nanded district headquarter. Total population of Narangal village is about 3,367 and having 674 houses in village. Total area of Narangal village is 2000 hectares. Peoples of village are depending on agriculture.

Total 10 samples were collected for one year on monthly basis from August 2016 to July 2017. Samples were collected in precleaned bottles and precaution was taken from other contaminations. Trivedi and Goal standard processes were used during analysis (Trivedi and Goel, 1998). pH was recorded at sampling site then samples were immediately transferred to laboratory for further analytical processes.. Electrical conductivity values were taken by using EC meter. For TDS evaporation method was used. TH, Ca and Mg were titrated against EDTA standard. Cl was titrated against $AgNO_3$. Standards of Na and K were of 10, 100 and 1000 ppm and analysed by using flame photometer. SO_4 and NO_3 were determined by using UV spectrophotometer. Except ph and EC all results are determined in mg/L. Obtained results are shown in average, minimum and maximum values as shown in (Table 1). Spatial Distribution of groundwater is shown by using ArcGIS 10.2.1 software.

Water is a medium of biochemical and chemical reaction. Selected parameter pH, TH, TDS, A, F, C and BOD were analysed. Obtained results were correlated with standards given by WHO and ICMR. Some parameters are above permissible limit not suitable for drinking purpose (Kolekar, 2017).

RESULTS AND DISCUSSION

The study of water quality provides information of its suitability for consumption. Obtained results help in future planning in specific polluted area. Total 6 groundwater samples were collected from different sites. Parameters pH, EC, TDS, TSS, TH, Ca, Mg, NO2, NO3, Fe and Mn were analysed by standard methods. Obtained results were complied with guidelines given by international drinking water. Groundwater samples were found slightly acidic and having highest concentration of TDS, EC, TH, Ca and Mg (Shigut *et al*., 2017)

Nowadays water pollution is a major issue. Humans require pure water for drinking purpose which keeps healthy. Present study is carried out to determined physico-chemical parameters of groundwater. Obtained results were compared with standards given by BIS (BIS, 2003).

Classification of Physico-Chemical Parameters.

pH, EC and TDS: The average pH value obtained is 7.8, maximum value is 8.4 and minimum value is 7.3 below permissible limit which are alkaline in nature. EC average values obtained is 1081.8, maximum value is 2697.7 and minimum value is 457.4 which are below permissible limit.

TDS average value obtained is 745.3, maximum value is 1519.0 and minimum value is 308.5 which are below permissible limit [Fig 2. (a, b and c)].

TH, Ca and Mg: Obtained average value of TH is 352.1, maximum value is 864.7 and minimum value is 151.8 it is above DL but below PL. Average value obtained of calcium is 81.0, maximum value is 240.2 and minimum value is 34.7 which is below PL. Mg average value found is 41.2, maximum value is 109.3 and minimum value is 14.4 which is below DL and PL [Fig 3(d, e and f)].

Na, K and Cl: Average Na concentration obtained is 54.4, maximum obtained value is 112.7 and minimum value is 26.5 shown below PL. K average value found is 4.4, maximum value is 27.1 and minimum value is 0.2 which is below PL. Cl average concentration obtained is 123.6, maximum value is 380.2 and minimum value is 46.0 which is below PL [Fig 3. (g)] and [Fig 4 (h and i)].

SO_4 and NO_3: Obtained average value of SO_4 is 64.1, maximum value was 145.6 and minimum value is 17.4 is below permissible limit. NO_3 average concentration is 36.3, maximum value is 77.2 and minimum value is 9.8 is below PL [Fig 4. (j and k)]

Correlation Matrix: Karl Pearson's correlation method is used for mathematical variations which calculate relation between variables. The coefficient correlation is denoted as "r" If (r = 0) then there is no correlation, if value (r) greater than (r < 0.7) indicates strongly correlated, value (r) between 0.5 and 0.7 are moderately correlated and value (r) (r < 0.3) are weak correlated (Table 2).

Table 1: Physico-chemical parameters of Narangal Village.

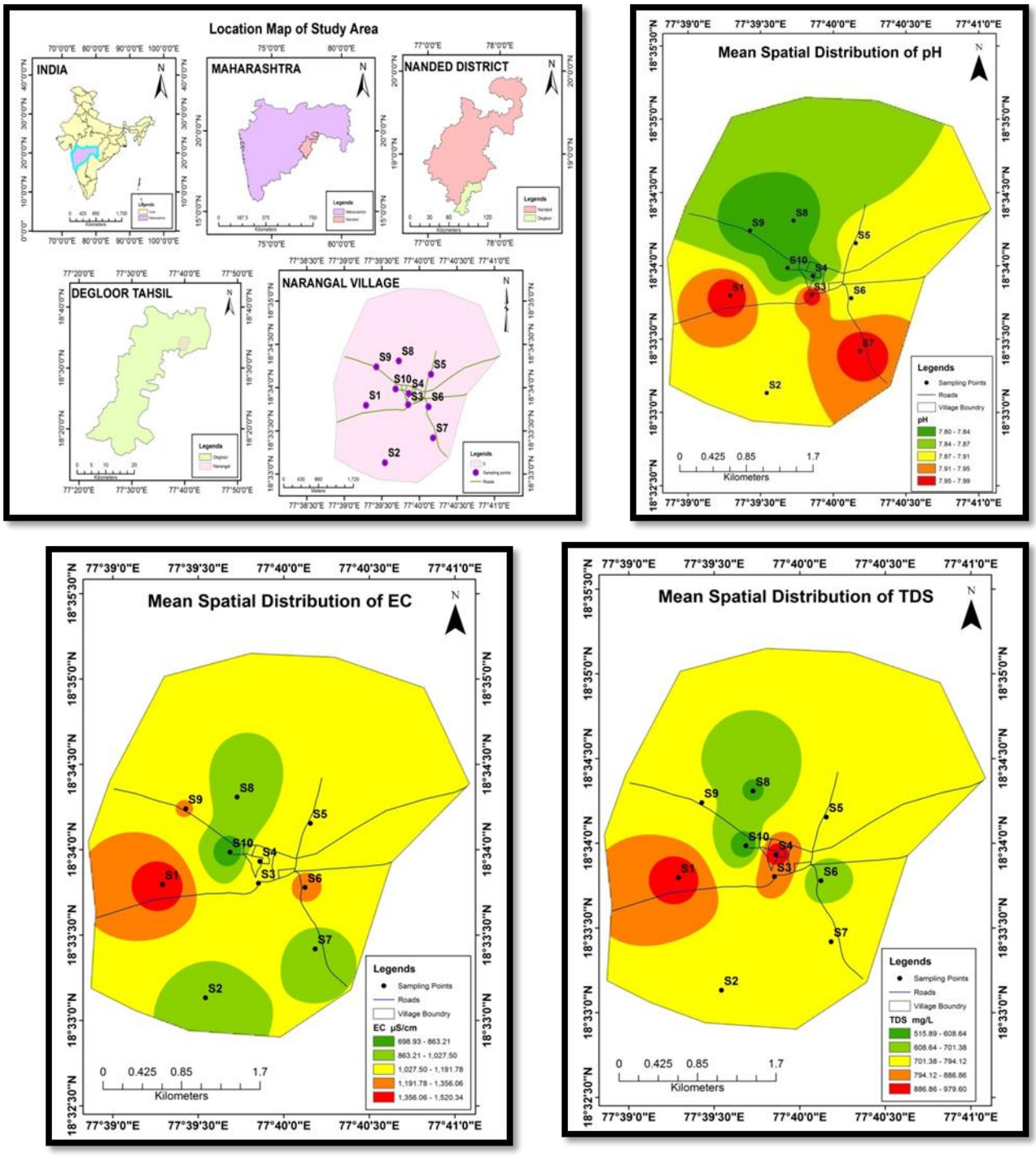
Parameters		Ave	Min	Max
PH		7.8	7.3	8.4
E.C	**µS/cm**	1081.8	457.4	2697.7
TDS	**mg/L**	745.3	308.5	1519
TH		352.1	151.8	864.7
Ca		81	34.7	240.2
Mg		41.2	14.4	109.3
Na		54.4	26.5	112.7
K		4.4	0.2	27.1
Cl		123.6	46	380.2
SO_4		64.1	17.4	145.6
NO_3		36.3	9.8	77.2

Table 2: Correlation matrix of physico-chemical parameters

	PH	EC	TDS	TH	Ca	Mg	Na	K	Cl	So4	No3
PH	1										
EC	0.36	1									
TDS	0.47	0.70	1								
TH	0.00	0.69	0.49	1							
Ca	0.19	0.87	0.55	0.78	1						
Mg	0.24	0.81	0.58	0.36	0.61	1					
Na	0.07	0.65	0.43	0.07	0.56	0.76	1				
K	0.12	-0.21	-0.33	-0.33	-0.43	-0.03	-0.11	1			
Cl	0.27	0.84	0.61	0.47	0.85	0.87	0.82	-0.28	1		
So4	0.55	0.79	0.50	0.36	0.41	0.70	0.40	0.15	0.50	1	
No3	0.03	0.51	0.47	0.24	0.51	0.54	0.76	0.13	0.69	0.17	1

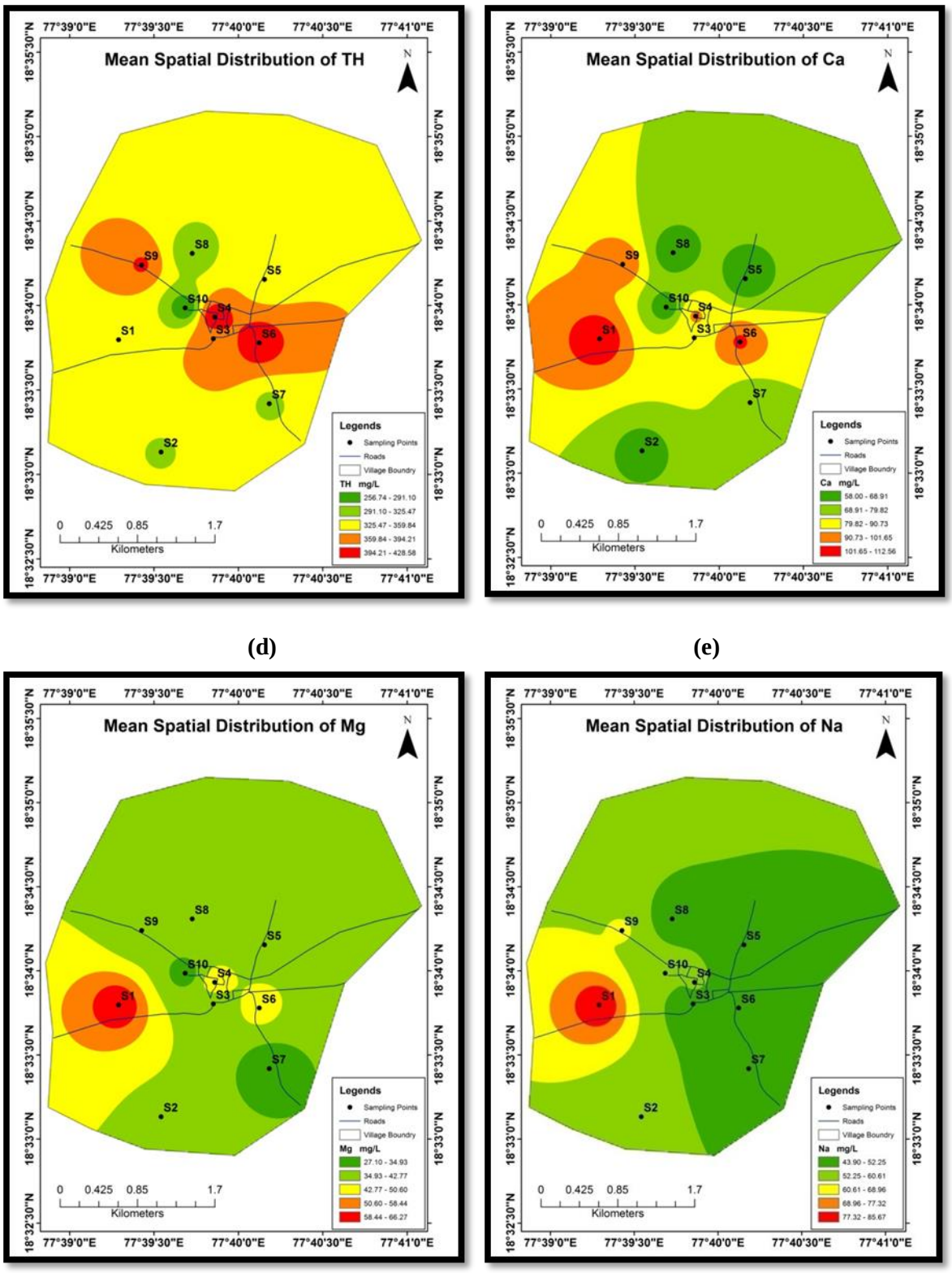
Mean Spatial Distribution of Physico-chemical parameters from Narangal

Fig 1: Location Map of study area with Sampling Locations



(a) **(b)** **(c)**

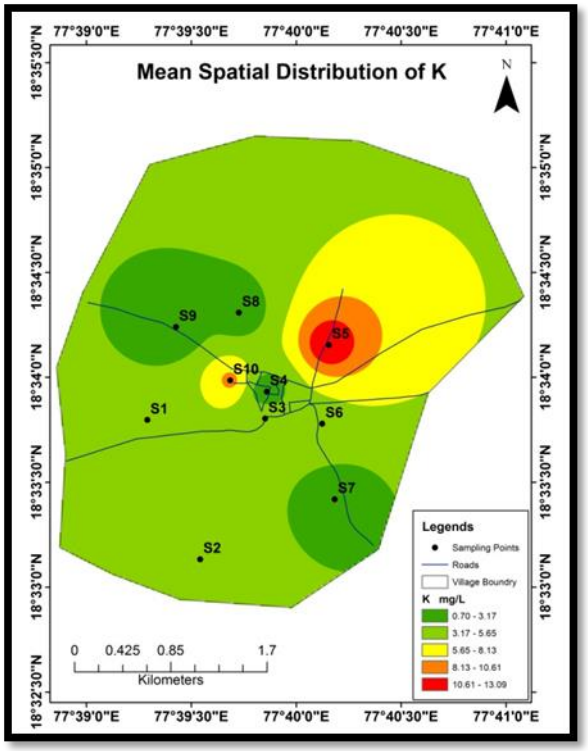
Fig 2: Mean Spatial Distribution of (a) pH, (b) EC and (c) TDS



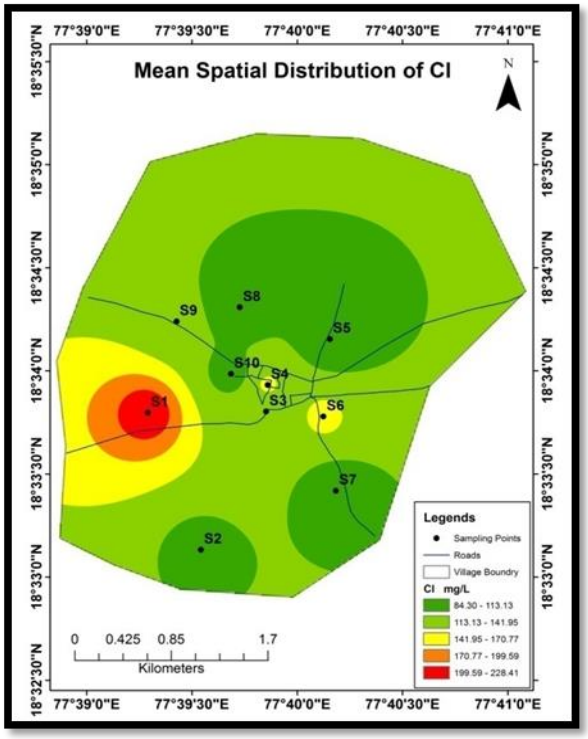
(d) **(e)**

(f) **(g)**

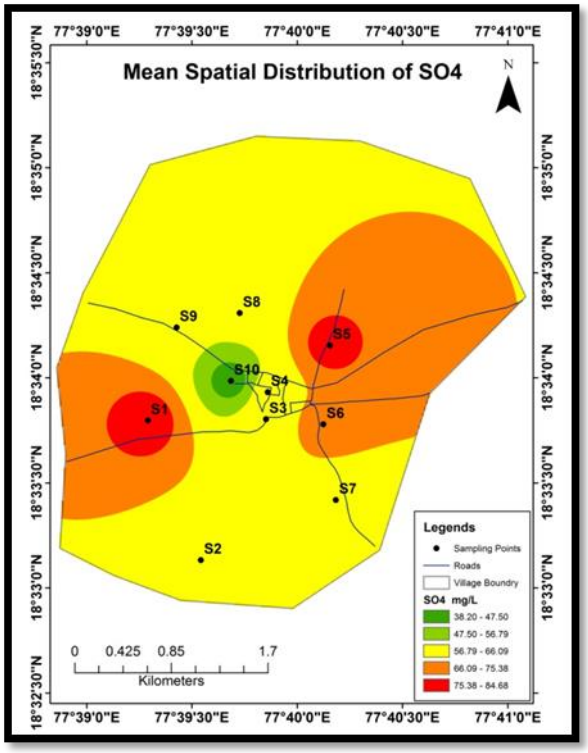
Fig 3: Mean Spatial Distribution of (d) TH, (e) Ca, (f) Mg and (g) Na



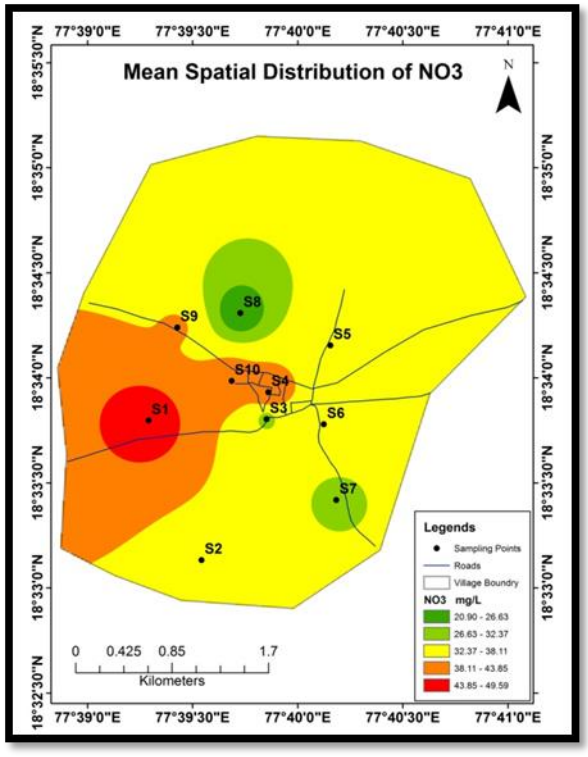
(h)



(i)



(j)



(k)

Fig 4: Mean Spatial Distribution of (h) K, (i) Cl, (j) SO^4 and (k) NO_3

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