Spatio-Temporal Groundwater Level Fluctuation Along Lower Reaches of the Ranganadi River, Assam

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Abstract

Precious groundwater is the backbone for modern human civilization. Availability or scarcity of groundwater has direct bearing upon environment. Groundwater level fluctuation is a natural phenomenon on seasonal basis influenced by multiple factors like amount and intensity of rainfall, temperature and rate of evapotranspiration throughout the year. Studies on different aspects of groundwater are gaining academic momentum day by day. The present study is conducted for Lower reaches of the Ranganadi river basin where focus is given to observe pattern of temporal (seasonal) fluctuations in groundwater level in different geomorphic units, i.e., upper piedmont, lower piedmont and alluvial plain covering 37 villages. In the upper piedmont zone the groundwater level at fell below the ground surface maximum of 7.35 m during 2020-2021 lean period. In Lower Piedmont Zone, groundwater level is observed at a depth of around 2.0 m during lean period while during peak period it is around less than 1.0 m. Similarly, in alluvial plain groundwater level during lean period is around at a depth of below 2.0 m during lean period, on the other hand it is at a depth of less than 1.0 m. The region can be identified as non-deficient in groundwater both in lean and peak periods. The only fact is that groundwater level moves down to a considerable extent during lean periods in all of the respective geomorphic units.

Keywords: Groundwater level fluctuation, Upper piedmont, Lower piedmont and Alluvial plain.

Introduction

Groundwater level fluctuation is a natural phenomenon on seasonal basis influenced by multiple factors like amount and intensity of rainfall, temperature and rate of evapotranspiration throughout the year. These temporal fluctuations in groundwater level are more prominent in shallow aquifers and reflect balance of water accumulating in aquifer (groundwater recharge) and water moving out from aquifer (groundwater discharge). In general, groundwater level rises during wet season due to increase of amount and intensity of rainfall. Subsequently, during dry spell groundwater level recedes. Seasonal variation in rainfall leads to recharge or subsequent discharge of groundwater. Geological structure is also determining factor for permeability and infiltration rate.

Porosity of soil is another important factor, which governs specific yield of groundwater level in a given period time in a locality. The size, shape and distribution of voids, interstices, pore spaces of the soil particles serve as conduits for water movement which are of fundamental importance.

Apart from porosity, the occurrence of groundwater is also determined and controlled to a great extent by physiography, land-use, lithology, precipitation and many other local factors. In fact, groundwater level fluctuation is highly variable in accordance with intensity and duration of rainfall.
Studies on different aspects of groundwater are gaining academic interest day by day. The present study tries to focus on temporal nature of change in groundwater level.

Literature Review

Innumerable studies are going on different aspects of groundwater at international, national and regional at macro, and micro level. A brief literature review has been outlined below.
Zoltan Grivoszki, Jozsef Szlagyi and Peter Kalicz (2010) analysed "Diurnal Fluctuations in Shallow Groundwater Levels and Stream flow Rates and their Interpretation – A Review" wherein the authors have emphasized nature of groundwater fluctuation and its relationship with stream flow pattern.
M Nygren et. al.(2020) studied about Changes in seasonality of Groundwater Level Fluctuation in a Temperate-Cold Climate Transition Zone".
Mishra N, Khare D, Gupta KK & Shukla R (2014) conducted a study on "Impact of Land-use Change on Groundwater – A Review".
Anantha Natarajan at el (2022) studied about "Analysis of Groundwater Level Fluctuations and its Association with Rainfall Using Statistical Methods".
"Precipitation disparity's Impact on Groundwater Fluctuation Using Geospatial Techniques in the Ranipet District of Southern India" was conducted by G Venkatesan at el (2024).
"Assessment of Groundwater Depletion at Guwahati, Largest Metropolis in North East India and its Consequences" were analysed by Ranu Sarmah, Sudipta Chakraborty and Arnab Sarma (2022).
Virendra R Nagarale (2017) in a UGC sponsored Major Research Project studied about "Groundwater Zonation by using Landform Characteristics in Karha River Basin, Pune District, M. S".

Methodology

In the present study, to observe the seasonal groundwater level fluctuation the study area has been divided into various geomorphic units based on satellite imagery (IRS-IC – LISS III FCC). The groundwater level at various locations within the geomorphic units has been monitored during lean period (covering the season between later parts of October to mid April) and peak period (mid April to mid October) through intensive field work by measuring water level in the dug wells.
In the present study 37 villages have been selected covering three different geomorphic units on both of the banks of the Ranganadi. Samples are taken from each of the villages selecting three sites thereof. Average value has been considered for respective villages. Data collected through measuring groundwater level at different locations have been compiled for further analysis.

Objectives

The study has been carried out with following objectives

1. To observe nature of groundwater level fluctuations in different locations in different geomorphic units.
2. To visualize net amount of rise and fall in groundwater level at different locations.

Study Area

The Ranganadi originating from the ranges of the Eastern Himalaya at an altitude of 3400 m flows through the Lesser Himalaya, Outer Himalaya and the Brahmaputra plain and joins the Khabali river, a branch of the Subansiri river which finally debouches to the river Brahmaputra. The Ranganadi basin is delineated following the watershed boundary using Survey of India topographical maps No. 83 E/6, 7,10, 11,14,15, 83 I/3 and 4 on 1: 50,000 scale. However, in the present study much emphasis is given on its lower course, i.e., from foothill to its confluence. The whole of the Ranganadi basin extends between 27^0 N to 27^0 40’ N latitudes and 93^0 15’ E to 94^0 5’ E longitudes covering a total area of 3077 sq.km. (Fig.1). The lower Ranganadi basin extends between 27^0 N to 27^0 15’N latitudes and 93^0 55’ E to $94^0$5’ E longitudes and covers an area of about 75 sq.km (Fig. 1).

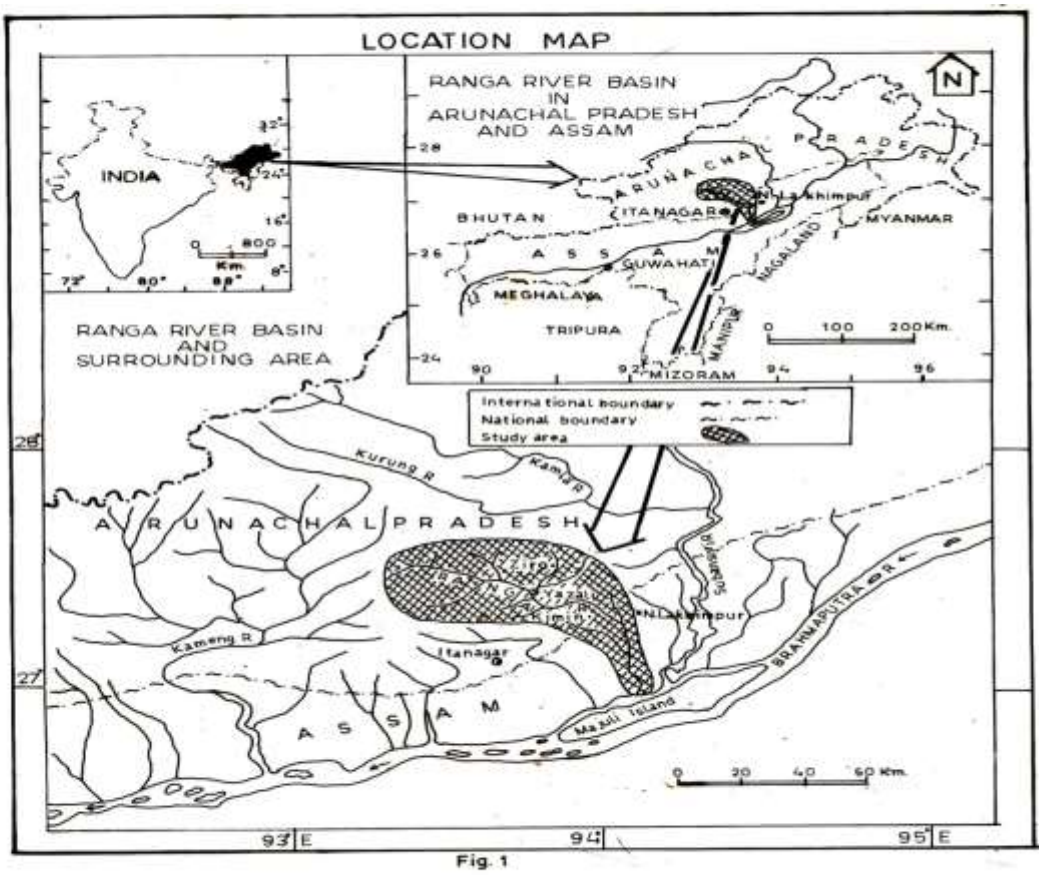

Fig. 1

Discussions and Results

Geomorphic Unit

The lower catchment of the Ranganadi basin has been delineated into following geomorphic units by superimposing satellite images pertaining to the area and corresponding topographical maps. The geomorphic units of the study area include structural hills, piedmont zone and alluvial plain.

Structural Hills

Structural hills are found to lie in the extreme northwestern part of the study area that extends northwards of Kimin locality on the right bank and Jaihing locality on the left bank of the main channel of the Ranganadi. These localities comprise mainly of loose sandstone and conglomerate.

Piedmont Zone

It is a transitional zone lying between structural hills and alluvial plain, extends along the foothills of Arunachal Pradesh. The piedmont zone is divided into upper piedmont and lower piedmont zone. The upper piedmont zone is built up by the coalescence of alluvial fans consisting of boulders, gravel, sand and silt of medium size. More finer materials of gravel, sand and silt are observed in the lower piedmont zone. It is having a gentle slope towards the Brahmaputra plain (Table -1).

Alluvial Plain

Alluvial plain extends from the lower Piedmont Zone to the confluence of the Ranganadi with the Khabali river. It mainly comprises of gravel, sand, silt and clay. Towards south floodplain, marshy land and traces of palaeo-channels are prevalent. Natural levees and channel bars are common feature along the channel (Fig 2).

Fig. 2

Land Use Pattern

Land-use pattern of the study area has been identified using the IRS – IC – LISS III FCC satellite imagery. The major land-use categories include forest, tea garden, agricultural land , bamboo groves with settlements and marshy lands. Jaihing Tea Estate and Koilamari Tea Estate on the left bank; and Diju Tea Estate and Dolohat Tea Estate on the right bank of the main channel are found in the lower piedmont zone. Other areas in general are put to agricultural land followed by settled area (Table – 1). The low lying areas towards south have patches of marshy land (Fig. 3).

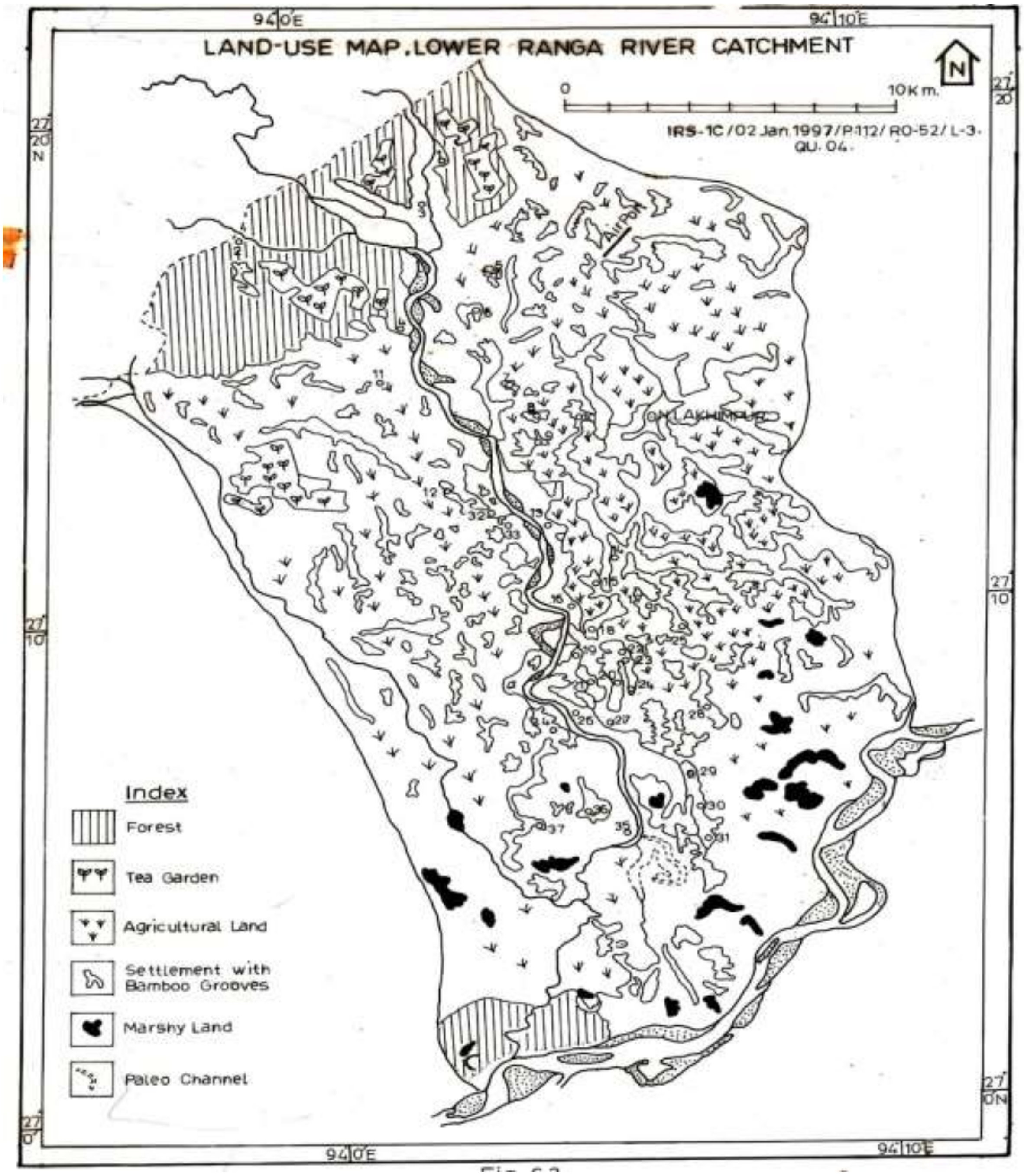

Fig. 3

Groundwater Fluctuation

The seasonal pattern of groundwater level fluctuation at various locations within the respective geomorphic units can be observed from the Table – 1. In the upper piedmont zone the groundwater level at Jaihing and Kimin fell below the ground surface maximum of 7.35 m and 5.69 m respectively during 2020-2021 lean period. Groundwater level has risen upto 4.05 m and 1.69 m at Jaihing and Kimin respectively, during the subsequent peak period of 2021. Similarly, it is observed that the groundwater level at these locations are 5.22 m and 5.14 m during lean period of 2022-2023 and has risen to 2.22 m and 2.16 m respectively during peak period of 2023.

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At Borbil in the lower piedmont zone the lean period (2020-2021) maximum groundwater level is at 1.90 m below the ground surface while peak period (2023) it is of 0.50 m. It is observed that at Bagalijan in the lower piedmont zone the groundwater level is at 2.18 m during the lean period of 2020-2021, which has risen to 0.72 m during the subsequent peak period (2021). It descended upto 1.56 m during the lean period of 2021-2022 and 1.89 m during next lean period (2022-2023). It rose to 0.80 m during the peak period of 2023. Similarly, at Kandura Pathar on the right bank in lower piedmont zone it fell upto 3.45 m during 2020-2021 lean period, which has risen upto 0.63 m during following peak period (2021). It is observed that it is 2.48 m below ground surface during lean period of 2022-2023 and during subsequent peak period it is of 0.68 m (Fig.4).

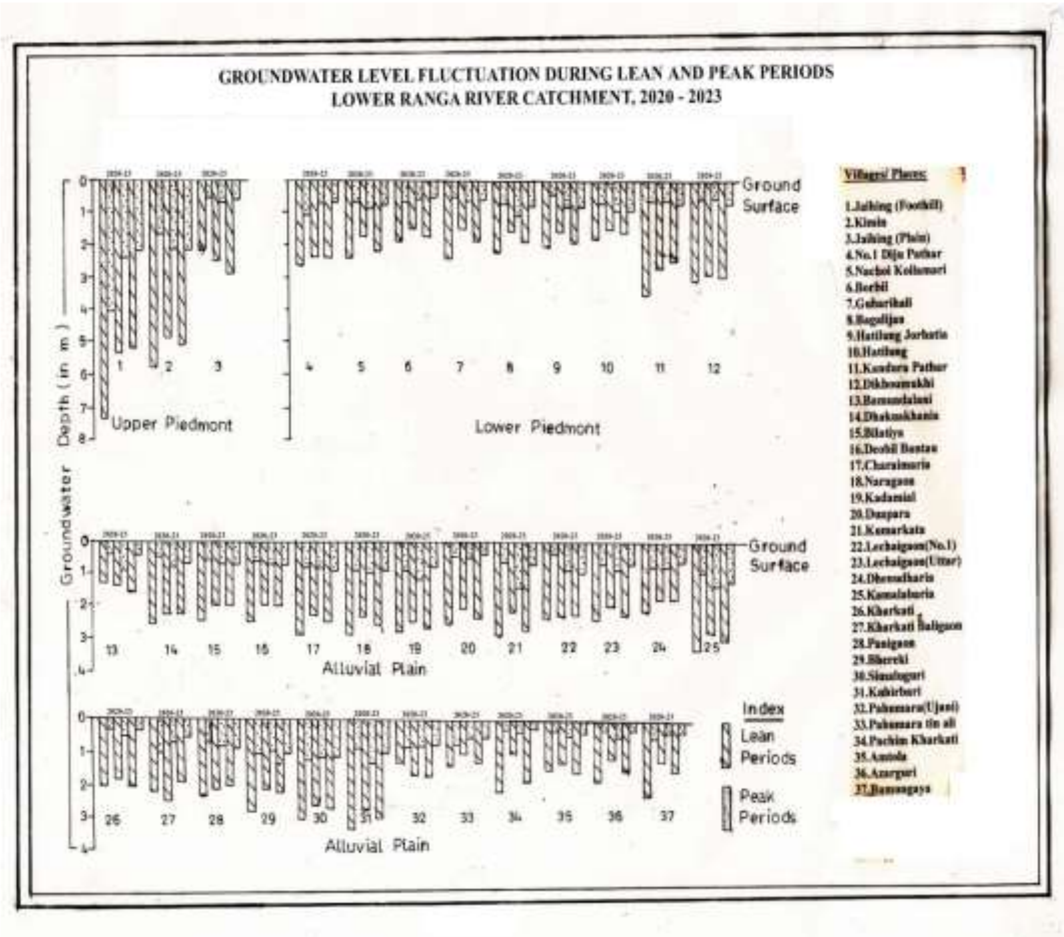

Fig. 4

In the alluvial plain, some of the locations / villages like Bamundalani, Pahumara (Ujani), Pahumara Tin Ali, Amtola etc are in low lying areas where lean period record of respective seasons is below 2.00 m. It is observed that at Bamundalani the groundwater level during 2020-2021 lean period is 1.26 m and during subsequent peak period (2021) it is 0.42 m. At Lechaigaon (Uttar), locating in middle part of the alluvial plain, groundwater level stands at 2.47 m during lean period of 2020-2021 and 0.70 m during peak period of 2021. During lean period of 2022-23 it is 2.27 m and during next peak period (2023) it is 0.67 m. The groundwater level at Kamalabaria in the alluvial plain is comparatively at lower depth. It stands at 3.32 m and 0.85 m during lean period of 2020-2021 and peak period of 1999 respectively. During lean period of 2022-2023 it is 3.03 m and 1.22 m during following peak period (2023). The pattern of seasonal variation of groundwater level at respective locations within specific geomorphic units can be observed from the Fig. 4.

Table –1: Geomorphic Unit wise Land-use and Groundwater Fluctuation, Lower Ranganadi Catchment.

Sl No.	Geomorphic Unit	Places / Villages	Land-use	Mean groundwater level in Metre					
				Lean Period 2020-2021	Peak Period 2021	Lean Period 2021-2022	Peak Period 2022	Lean Period 2022-2023	Peak Period 2023
1	Upper Piedmont	Jaihing (foothill)	Tea Garden & Agri	7.35	4.05	5.36	2.44	5.22	2.22
2	- do -	Kimin (foothill) *R	Forest & Jhum	5.69	1.69	4.86	2.15	5.14	2.16
3	- do -	Jaihing (plain)	Tea Garden &Agri	2.15	0.56	2.48	0.72	2.94	0.58
4	Lower Piedmont	No.1Diju Pathar *R	Tea Garden & Agri	2.64	1.13	2.40	0.74	2.40	0.72
5	- do -	Nachoi Koilamari	Agri	2.41	0.69	1.75	0.86	2.24	0.78
6	- do -	Borbil	Agri	1.90	0.65	1.55	0.57	1.75	0.50
7	- do -	Gubarihali	Agri	2.40	0.50	1.50	0.63	1.90	0.60
8	- do -	Bagalijan	Agri	2.18	0.72	1.56	1.08	1.89	0.80
9	- do -	Hatilung Jorhatia	Agri	1.98	0.38	1.63	0.83	1.90	0.77
10	- do -	Hatilung	Agri	1.78	0.73	1.48	0.93	1.57	0.88
11	- do -	Kandura Pathar *R	Agri	3.45	0.63	2.73	0.60	2.48	0.68
12	- do -	Dikhoumukhi *R	Agri	3.10	0.55	2.90	0.55	2.98	0.70
13	Alluvial Plain	Bamundalani	Agri	1.26	0.42	1.35	0.87	1.62	0.45
14	- do -	Dhakuakhania	Agri	2.61	0.54	2.30	0.76	2.29	0.69
15	- do -	Bilatiya	Agri	2.46	0.58	1.97	0.68	1.97	0.67
16	- do -	Deobil Bantau	Agri	2.36	0.63	1.76	0.82	2.37	0.73
17	- do -	Charaimaria	Agri	2.89	0.82	2.33	0.84	2.53	0.93
18	- do -	Naragaon	Agri	3.00	0.93	2.35	1.03	2.58	0.93

19	- do -	Kadamial	Agri	2.80	0.94	2.54	1.18	2.72	0.77
20	- do -	Duapara	Agri	2.55	0.45	2.13	0.52	2.37	0.40
21	- do -	Kumarkata	Agri	2.88	0.65	2.20	0.95	2.79	0.71
22	- do -	Lechaigaon (No1)	Agri	2.42	0.41	2.30	0.92	2.33	1.03
23	- do -	Lechaigaon (Uttar)	Agri	2.47	0.70	2.05	0.87	2.27	0.67
24	- do -	Dhenudharia	Agri	2.15	0.76	1.78	0.77	1.83	0.60
25	- do -	Kamalabaria	Agri	3.32	0.85	2.75	1.30	3.03	1.22
26	- do -	Kharkati	Agri	2.00	0.30	1.80	0.50	2.00	0.35
27	- do -	Kharkati Baligaon	Agri	2.15	1.00	2.45	0.70	1.90	0.55
28	- do -	Panigaon	Agri	2.32	0.73	2.10	0.80	2.03	0.85
29	- do -	Bhereki	Agri	2.80	1.00	2.08	0.93	2.23	1.00
30	- do -	Simaluguri	Agri	2.97	1.20	2.62	1.80	2.68	1.12
31	- do -	Kuhiarbari	Agri	3.32	0.85	2.75	1.30	3.05	1.00
32	- do -	Pahumara (Ujani) *R	Agri	1.38	0.90	1.76	0.85	1.85	0.83
33	- do -	Pahumara Tin Ali *R	Agri	1.53	0.80	1.08	0.57	1.41	0.59
34	- do -	Pachim Kharkati *R	Agri	2.30	0.35	1.10	0.40	2.00	0.30
35	- do -	Amtola *R	Agri	1.60	0.35	1.40	0.50	1.70	0.45
36	- do -	Azarguri *R	Agri	2.00	0.35	1.30	0.55	1.65	0.35
37	- do -	Bamungaya *R	Agri	2.45	0.60	1.35	0.43	1.65	0.40

Source : Satellite Imagery and Fieldwork ***R : Right bank places / villages**

Net Rise and Fall of Groundwater Level

The details of net rise and fall of groundwater in respective villages under different geomorphic units during lean periods and successive peak periods can be observed from the Table- 2.

There is net rise of 3.30 m and 4.00 m during peak period of 2021 over lean period of 2020-2021 respectively at Jaihing (foothill) and Kimin (foothill) of the upper piedmont zone (Fig.3). These two places, in comparison to other areas have much variation in terms of net rise and fall because of their location near the hilly terrain. In other areas in general the seasonal variation of net rise and fall of groundwater level is above 1 m and below 3 m. Of course, in some places like Bamundalani, Pahumara Tin Ali etc., it is observed that the net rise and fall of groundwater level is below 1 m, for example, at Bamundalani the rise of groundwater over 2020-2021 lean period is + 0.84 m where subsequent fall is - 0.93 m. Bamundalani, Pahumara Tin Ali etc are located in low lying areas of alluvial plain because of which the variation is below 1m. In this connection of rise and fall another characteristic feature is worth mentionable. During inter-personal interaction with some the villagers of Deobil Bantau, Kadamial, Kharkati etc which are located near the embankment of the Ranganadi, with the recession of water level in the river, groundwater level also recedes and with the increase of water level in the river the groundwater level also rises. It signifies that discharge and recharge of groundwater takes place as a consequence of rise and fall of stage

(water level) of the river. This phenomenon may also be observable during a flood period of the river, because groundwater levels are temporarily raised near the channel by inflow from the channel on one hand and on the other, with the recession of flood the groundwater level will also move down as a result of outflow (Fig.5).

Table 2: Net Rise & Fall of Groundwater Level (2020-2023) over Lean and Peak Periods, Lower Ranganadi Catchment

Sl No.	Places / Villages	Net Rise Over 2020- 2021 Lean Period	Net Fall Over 2021 Peak Period	Net Rise Over 2021-2022 Lean Period	Net Fall Over 2022 Peak Period	Net Rise Over 2022-2023 Lean Period
1	Jaihing (foothill)	+ 3.30 (44.90)	-1.31 (-32.35)	+ 2.92 (54.48)	- 2.78 (-113.93)	+ 3.00 (57.47)
2	Kimin (foothill) *R	+ 4.00 (70.30)	-3.17 (-187.57)	+ 2.71 (55.76)	-2.99 (- 139.07)	+ 2.98 (57.98)
3	Jaihing (plain)	+ 1.59 (73.95)	- 1.92 (- 342.86)	+ 1.76 (70.97)	- 2.22 (- 308.33)	+ 2.36 (80.27)
4	No.1Diju Pathar *R	+ 1.51 (57.20)	- 1.27 (- 112.39)	+ 1.66 (69.17)	- 1.66 (- 224.32)	+ 1.68 (70.00)
5	Nachoi Koilamari	+ 1.72 (71.37)	- 1.06 (- 153.62)	+ 0.89 (50.86)	- 1.38 (- 160.47)	+ 1.46 (65.18)
6	Borbil	+ 1.25 (65.79)	- 0.90 (- 138.46)	+ 0.98 (63.23)	- 1.18 (- 207.02)	+ 1.25 (71.43)
7	Gubarihali	+ 1.90 (79.17)	-1.00 (- 200.00)	+0.87 (58.00)	-1.27 (- 201.59)	+ 1.30 (68.42)
8	Bagalijan	+ 1.46 (66.97)	- 0.84 (-116.67)	+ 0.48 (30.77)	- 0.81 (- 75.00)	+ 1.09 (57.67)
9	Hatilung Jorhatia	+ 1.60 (80.81)	- 1.25 (- 328.95)	+ 0.80 (49.08)	- 1.07 (-128.92)	+ 1.13 (59.47)
10	Hatilung	+ 1.05 (58.99)	- 0.75 (- 102.74)	+ 0.55 (37.16)	- 0.64 (- 68.82)	+ 0.69 (43.95)
11	Kandura Pathar *R	+ 2.82 (81.74)	- 2.10 (-333.33)	+ 2.13 (78.02)	- 1.88 (-313.33)	+ 1.80 (72.58)
12	Dikhoumukhi *R	+ 2.55 (82.26)	- 2.35 (-427.27)	+ 2.35 (81.03)	-2.43 (-441.82)	+ 2.28 (76.51)
13	Bamundalani	+ 0.84 (66.67)	- 0.93 (-221.43)	0.48 (35.56)	- 0.75 (-86.21)	+ 1.17 (72.22)
14	Dhakuakhania	+ 2.07	- 1.76	+ 1.54	- 1.53	+ 1.60

		(79.31)	(- 325.93)	(66.96)	(-201.32)	(71.43)
15	Bilatiya	+ 1.88 (76.42)	- 1.39 (-239.66)	1.29 (65.48)	- 1.29 (-189.71)	+ 1.30 (65.99)
16	Deobil Bantau	+ 1.73 (73.31)	-1.13 (-179.37)	+ 0.94 (53.41)	- 1.55 (-189.02)	+ 1.64 (69.20)
17	Charaimaria	+ 2.07 (71.63)	- 1.51 (-184.15)	+ 1.49 (63.95)	- 1.69 (-201.19)	+ 1.64 (64.82)
18	Naragaon	+ 2.07 (69.00)	- 1.42 (-152.69)	+ 1.32 (56.17)	- 1.55 (-150.49)	+ 1.65 (63.95)
19	Kadamial	+ 1.86 (66.43)	- 1.60 (-170.21)	+ 1.36 (53.54)	- 1.54 (-130.51)	+ 1.95 (71.69)
20	Duapara	+ 2.10 (83.06)	- 1.68 (-373.33)	1.61 (75.59)	- 1.85 (-355.76)	+ 1.97 (83.12)
21	Kumarkata	+ 2.23 (77.43)	- 1.55 (-238.46)	+ 1.25 (56.82)	- 1.84 (-193.68)	+ 2.08 (74.55)
22	Lechaigaon (No1)	+ 2.01 (83.06)	- 1.98 (-460.98)	+ 1.38 (60.00)	-1.41 (-153.26)	+ 1.30 (55.79)
23	Lechaigaon (Uttar)	+ 1.77 (71.66)	-1.35 (-192.86)	+ 1.18 (57.56)	-1.40 (-160.92)	+ 1.60 (70.48)
24	Dhenudharia	+ 1.39 (64.65)	- 1.02 (-134.21)	+ 1.01 (56.74)	-1.06 (-137.66)	+ 1.23 (67.21)
25	Kamalabaria	+ 2.47 (74.40)	-1.90 (-223.53)	+ 1.45 (52.73)	-1.73 (-133.08)	+ 1.81 (59.74)
26	Kharkati	+ 1.70 (85.00)	-1.50 (-500.00)	+ 1.30 (72.22)	-1.50 (-300.00)	+ 1.65 (82.90)
27	Kharkati Baligaon	+ 1.15 (53.49)	-1.45 (-145.00)	+ 1.75 (71.43)	-1.20 (-171.43)	+ 1.35 (71.05)
28	Panigaon	+ 1.59 (68.53)	-1.37 (-187.67)	+ 1.30 (61.90)	-1.23 (-153.75)	1.18 (58.13)
29	Bhereki	+ 1.80 (64.29)	-1.08 (-108.00)	+ 1.15 (55.29)	-1.30 (-139.78)	+ 1.23 (55.16)
30	Simaluguri	+ 1.77 (59.60)	-1.42 (-118.33)	+ 1.08 (58.78)	-1.60 (-148.15)	+ 1.56 (58.21)
31	Kuhiarbari	+ 2.47 (74.40)	-1.90 (-223.53)	+ 1.45 (52.73)	-1.75 (-134.62)	+ 2.05 (67.21)
32	Pahumara (Ujani) *R	+ 0.48 (31.37)	-0.86 (-96.56)	+ 0.91 (51.70)	-1.00 (-117.65)	+ 1.02 (55.14)
33	Pahumara Tin Ali *R	+ 0.73 (47.71)	-0.28 (-35.00)	+ 0.51 (47.22)	-0.84 (-147.37)	+ 0.82 (44.32)
34	Pachim Kharkati *R	+ 1.95 (84.78)	-0.75 (-214.29)	+ 0.74 (63.64)	-1.60 (-400.00)	+ 1.70 (85.00)
35	Amtola *R	+ 1.25	-1.05	+ 0.90	-1.20	+ 1.25

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		(78.13)	(-300.00)	(64.29)	(-240.00)	(73.53)
36	Azarguri *R	+ 1.65 (82.50)	-0.95 (-271.43)	+ 0.75 (57.69)	-1.10 (-200.00)	+ 1.30 (78.79)
37	Bamungaya *R	+ 1.85 (75.51)	-0.75 (-125.00)	+ 0.92 (68.15)	-1.22 (-283.72)	+ 1.25 (75.76)

Source : Field Work

- **Figures within bracket indicate change in percent**

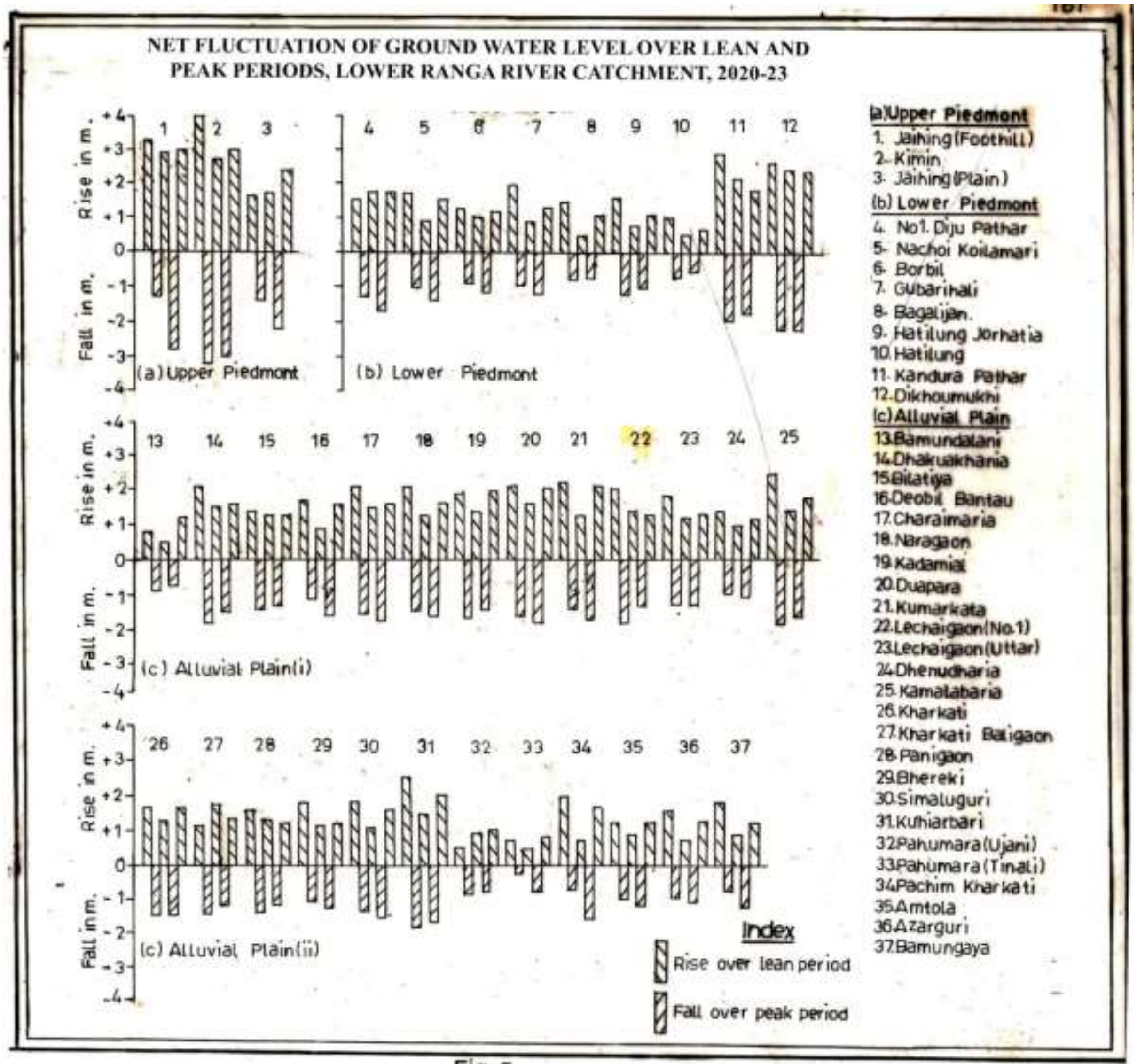

Fig. 5

Isobath

The isobath maps have been prepared based on mean of lean peak periods of groundwater level of the lower Ranganadi catchment (Table 3, Fig.6 &,7) . Isobaths are lines joining points of the groundwater table, which have equal depth. In other words, isobaths join the places of equal groundwater potentiality. The figures of two different seasons exhibit the probable potentials of groundwater level at various locations of the lower Ranganadi cathment .

Kelimentov P.P.(1983) observes that groundwater table is generally uneven and vary in a given hydro-geologic environment. It often follows the surface topography in a smooth manner, but various local factors may disturb such correlation between the surface topography and the groundwater table. A low-lying area, filled with earth may consequently raise the depth of water table.

Table 3: Mean of Lean Periods and Peak Periods of Groundwater Level, Lower Ranganadi Catchment

Sl No.	Places/ Villages	Mean of Lean Periods (in Metre)	Mean of Peak Periods (in Metre)
1	Jaihing (foothill)	5.98	2.90
2	Kimin (foothill) *R	5.23	2.00
3	Jaihing (plain)	2.52	0.62
4	No.1Diju Pathar *R	2.48	0.86
5	Nachoi Koilamari	2.13	0.78
6	Borbil	1.73	0.57
7	Gubarihali	1.93	0.58
8	Bagalijan	1.89	0.87
9	Hatilung Jorhatia	1.84	0.66
10	Hatilung	1.61	0.85
11	Kandura Pathar *R	2.89	0.64
12	Dikhoumukhi *R	2.99	0.60
13	Bamundalani	1.41	0.58
14	Dhakuakhania	2.40	0.66
15	Bilatiya	2.13	0.64
16	Deobil Bantau	2.16	0.73
17	Charaimaria	2.58	0.85
18	Naragaon	2.64	0.96
19	Kadamial	2.69	0.96
20	Duapara	2.35	0.46
21	Kumarkata	2.62	0.77
22	Lechaigaon (No1)	2.35	0.79
23	Lechaigaon (Uttar)	2.26	0.75
24	Dhenudharia	1.92	0.71
25	Kamalabaria	3.03	1.18
26	Kharkati	1.93	0.38
27	Kharkati Baligaon	2.17	0.75
28	Panigaon	2.15	0.79
29	Bhereki	2.37	0.98
30	Simaluguri	2.76	1.13
31	Kuhiarbari	3.04	1.05
32	Pahumara (Ujani) *R	1.66	0.86
33	Pahumara Tin Ali *R	1.34	0.65

34	Pachim Kharkati *R	1.80	0.35
35	Amtola *R	1.57	0.43
36	Azarguri *R	1.65	0.42
37	Bamungaya *R	1.82	0.48

Source : Field Work

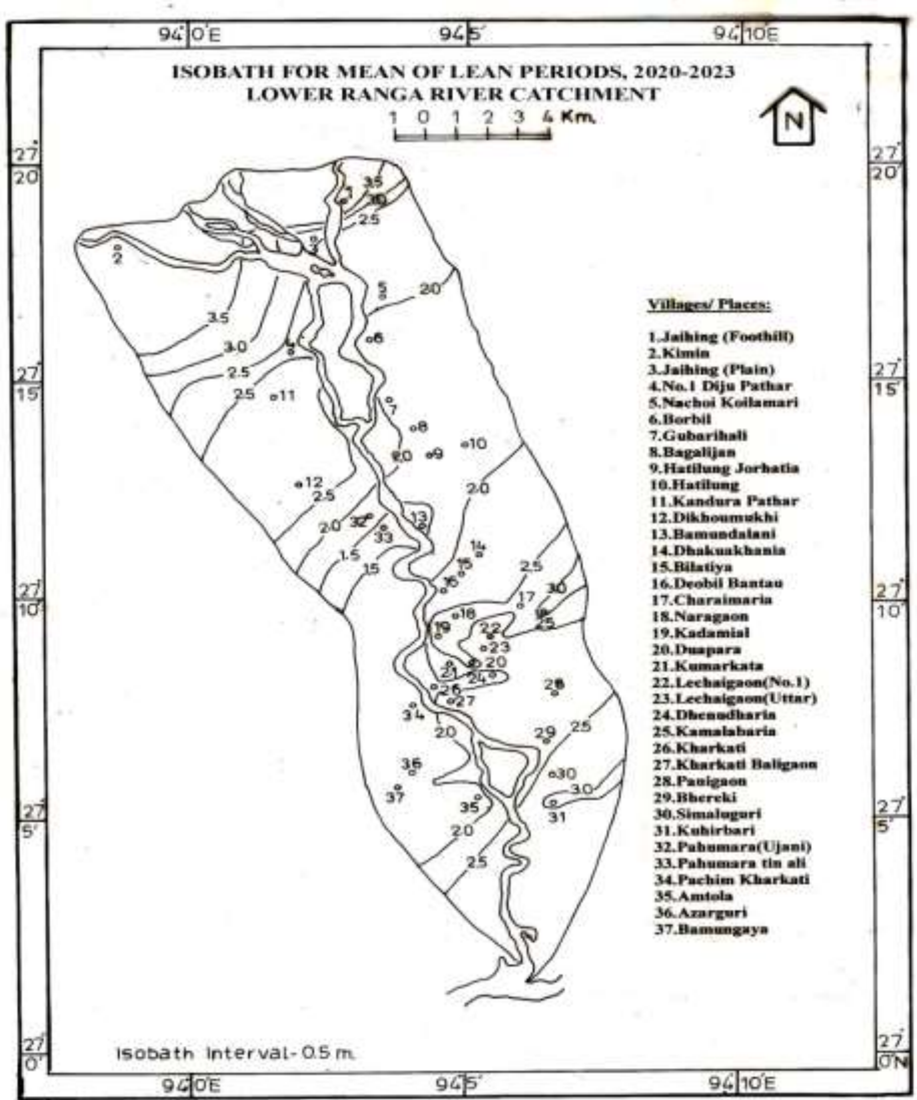

Fig.6

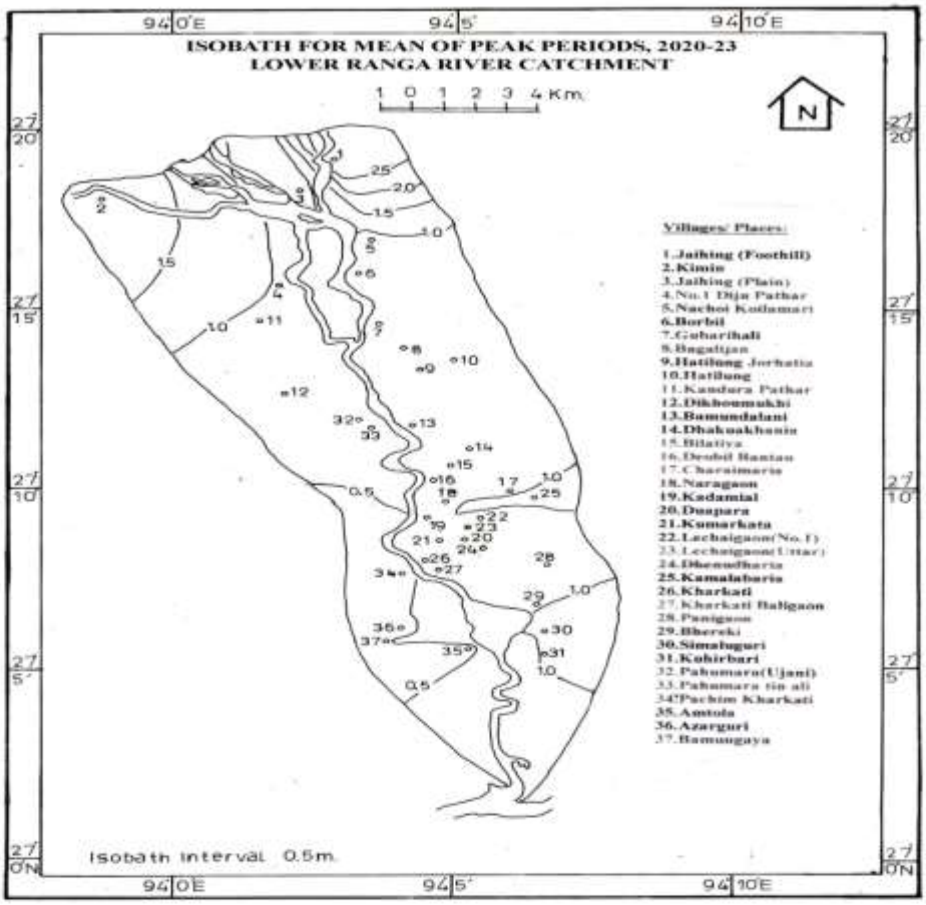

Fig.7

The mean of lean periods ranges in between 1.41 m to 5.98 m below the ground surface. On the other hand, the mean of peak periods ranges in between 0.35 m to 2.90 m below the ground surface (Table – 3).The isobath maps (Fig. 6 & 7) reflect the potentiality of water level at various localities in the lower Ranganadi catchment for lean and peak periods. However, in the upper piedmont zone the prospect of groundwater is lower during lean and peak periods. For instance, at Jaihing (foothill) locality has an average depth of groundwater of 5.98 m and 2.90 m during lean and peak periods respectively. On the other hand, Pachim Kharkati recorded on average 0.35 m below the ground surface during the peak periods.

Impact of Surface Topography

The land-use map prepared from satellite imagery (IRS – IC LISS III) shows that in northern part of the study area, there are tea gardens in the piedmont zone and rest of the areas are basically put to agricultural activities (Fig. 2). The land-use practices have significant impact upon groundwater level fluctuation. The surface and sub-surface soil is mainly composed of clay and sandy soil. Rainfall , its intensity and duration, plays a dominant and significant role in groundwater level fluctuation as well as recharge. Since porosity of clay and sandy soil is more, hence groundwater level increases gradually with on set of monsoonal rainfalls. Of course, the rate of evaporation is significant for depletion of groundwater level during the lean period when rainfall is too scanty. The dry spell after recession of monsoonal rainfall till its onset effects to a great extent on depletion of groundwater in different localities. In general, the prospect of groundwater is good to very good in the study area till now. But the construction of dam to generate hydroelectricity at Yazali of Arunachal Pradesh in the upstream will certainly effect in the long run in depletion of groundwater level in the downstream since the Ranganadi is presently flowing at a miserable level particularly, during the lean period.

Impact of Fluctuations in Groundwater

Temporal fluctuations in groundwater level have direct bearing upon amount of groundwater available for drinking water, irrigation and other purposes. Fluctuations in groundwater level may also influence in water quality as changes in water levels can alter movement of pollutants. Fluctuations in groundwater have potentiality of affecting amount of concentration dissolved substances in groundwater. Changes in groundwater levels can effect health and sustainability of ecosystems that rely on groundwater for their water supply for survival.

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