CRITICAL ECOSYSTEM PARTNERSHIP FUND

ATREE

Snehakunja Trust

LIFE

Soil survey and analysis report from tropical fresh water swamps

Linking fragmented fresh water swamps through restoration of micro-corridors, Central Western Ghats, India

Project # 55915 1 January 2010 to June 2015

SOIL ANALYSIS

Soils from watersheds of two swamp associated forests (they were and still have some sacred value to the local communities), namely Kathalekan and Torme. For comparison we also studied non-sacred non swamp forests Kodkani as comparison for Kathalekan and Kanalli as comparison for Torme. In the pictures and graphs given here the swampy forests used for soil studies are depicted as sacred groves (SG or *kan* which is traditional local name for such forests) and nearby non sacred groves (non SGs or non *kans*). Composite samples were collected from various locations under both kinds of forests. Kathalekan and Kodkani forests are shown in Figures 1 &2 and Torme location and Kanalli in Figure 3 & 4. Locations of soil sampling are shown in each figure. **Composite sampling** included collection of soil up to 15cm deep from at-least 3 points spaced 50m apart. Kathalekan being a network of swamps (including degraded portions) the sampling was done in 5 locations of swampy forests (5x3 samples).

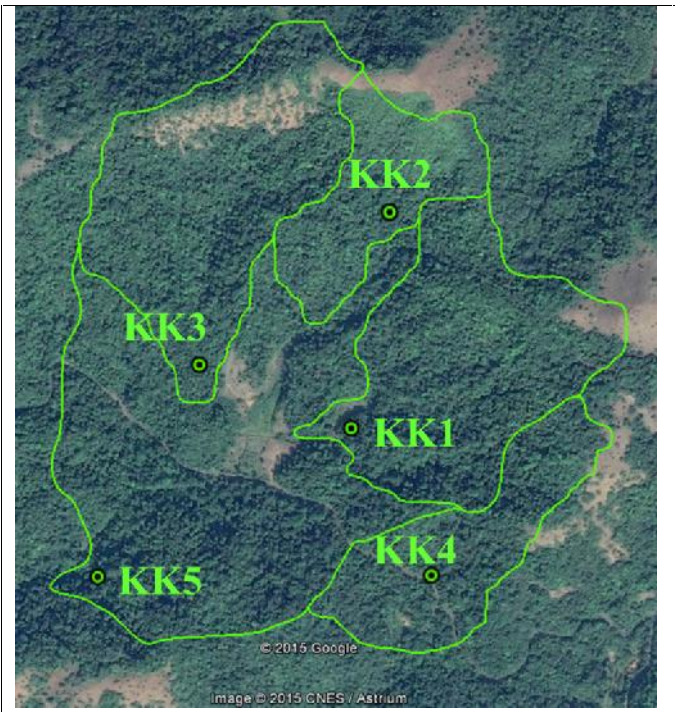

Figure 1. Kathalekan swampy forest (SG)

Figure 2 Kodkani non-swampy non sacred forest

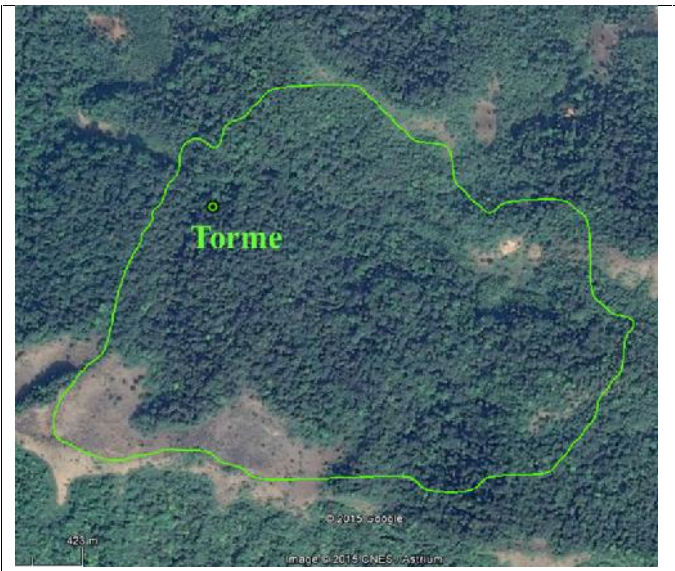

Figure 3. Torme swampy forest (SG)

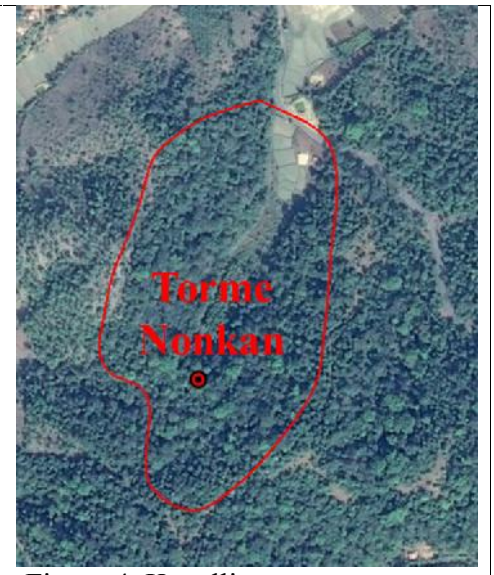

Figure 4. Kanalli non-swampy non sacred forest (non-kan)

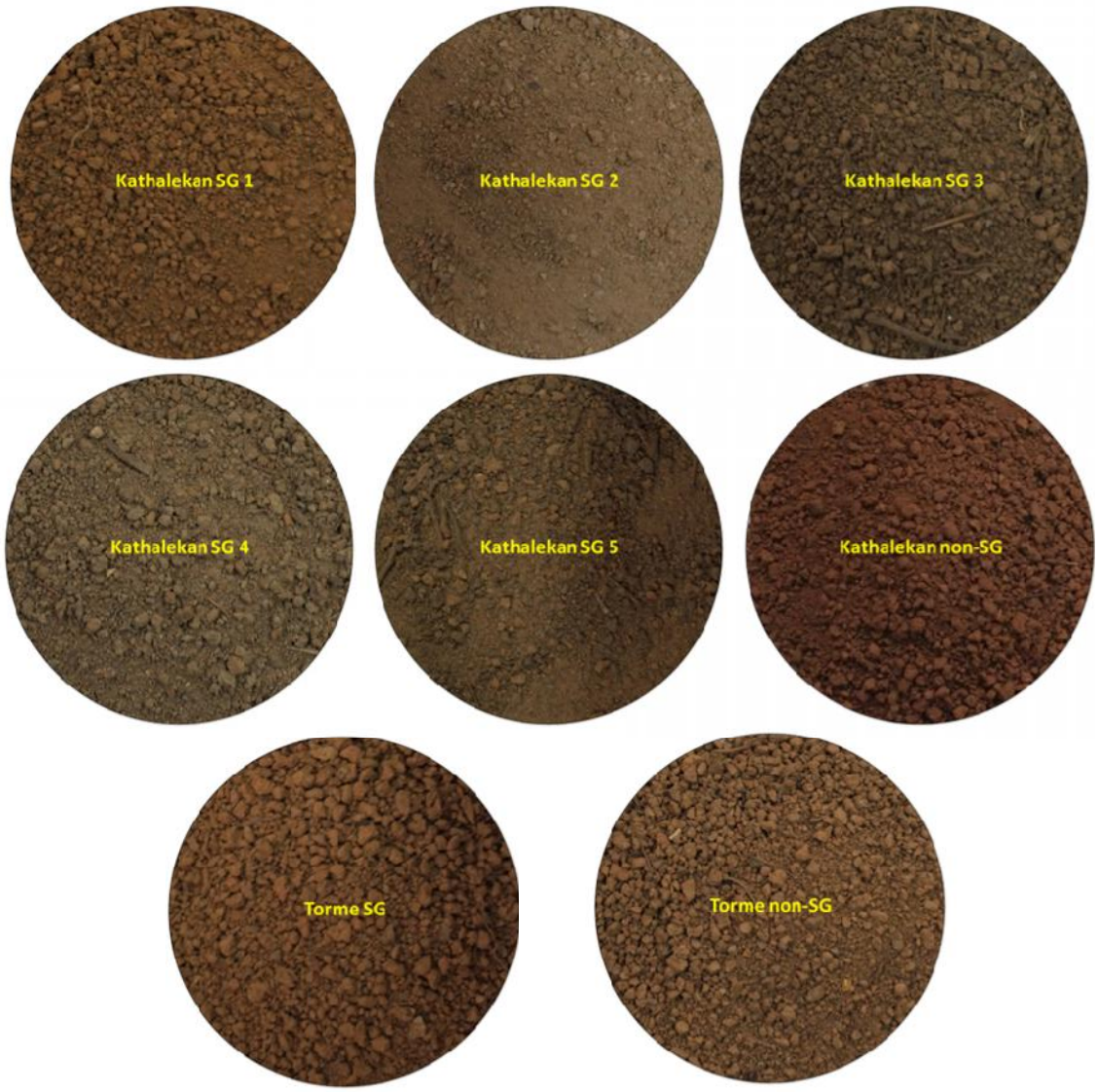

Figure 5: Soil Samples

Texture: Texture of the soils varies from clayey to sandy. Kathalekan has sandy clay to sandy clay loam soils. Sacred groves have sandy clay. Torme has sandy clay loam. The non-swampy forests Kodkani and Kanalli in comparison had loamy sand textures. Soils in Kathalekan were brownish to orangish brown, whereas Torme, Kanalli and Kodkani were towards reddish brown in shade.

Physico-chemical parameters:

Moisture and bulk density: Bulk density and moisture content are shown in Table-1. Normal composited soils in Kathalekan and Torme had higher moisture (about 30%) compared to the non-swampy forests (less than 25.5%). Soils from the swampy areas in the Kathalekan and

Torme had almost 35% to 40% of moisture content. Even though the textural analysis of soils showed near sandy nature, both the SG's and NSG's have reasonably lower bulk densities due to the presence of organics in the soil with the soil particles in the soil. It is clear from the Table that soil from good part of swamps such as Kathalekan-2 had higher moisture content of 34.43% and lowest bulk density of 1.21 and Torme 2 with 39.19% moisture had also lower bulk density of 1.24.

Table 1: Physical parameters (Pre Monsoon)

Location	Moisture Content (%)	Bulk Density g/cc
Kathlekan-1 (SG)	31.81	1.36
Kathlekan-2 (SG)	**34.43**	**1.21**
Kathlekan-3 (SG)	23.83	1.65
Kathlekan-4 (SG)	27.53	1.26
Kathlekan-5 (SG)	32.43	1.44
Kodkani (NSG)	25.30	1.41
Torme 1 (SG)	31.16	1.34
Torme 2 (SG)Torme	**39.19**	**1.24**
Kanalli (NSG)	21.80	1.54

Chemical analysis was carried out for monsoon, post monsoon and pre monsoon seasons, Figure 6 and Table 2 depicts the results of chemical analysis carried out for the composite samples.

Table 2: Physicochemical characters of swampy forests of Kathalekan and Torme and non-swamp non-sg forests of Kodkani and Kanalli.

Season	Sample	pH	EC (µS)	Na (mg/kg)	K (mg/kg)	AP (mg/kg)
Monsoon	Kathlekan-1 sg	6.10	65	659	345	21.17
	Kathlekan-2 sg	6.00	143	453	440	14.39
	Kathlekan-3 sg	6.60	109	489	353	23.88
	Kathlekan-4 sg	6.40	134	243	494	32.70
	Kathlekan-5 sg	7.10	115	188	344	12.35
	Kodkani non sg	6.40	126	204	336	29.98
	Torme sg	6.00	139	213	495	11.00
	Kanalli non sg	6.60	93	360	645	21.17
Post Monsoon	Kathlekan-1 sg	6.20	346	430	584	11.35
	Kathlekan-2 sg	6.90	395	500	624	5.09
	Kathlekan-3 sg	6.20	357	420	598	5.70
	Kathlekan-4 sg	5.90	315	484	424	7.30

	Kathlekan-5 sg	5.80	266	356	424	16.13
	Kodkani non sg	6.10	277	380	396	3.99
	Torme sg	6.30	322	442	642	11.59
	Torme sg	6.30	286	382	546	5.21
	Kanalli non sg	6.30	284	422	464	5.58
Pre Monsoon	Kathlekan-1 sg	6.04	96	228	150	7.79
	Kathlekan-2 sg	6.35	145	146	143	4.84
	Kathlekan-3 sg	6.25	153	300	185	12.37
	Kathlekan-4 sg	5.85	125	330	178	12.37
	Kathlekan-5 sg	5.85	110	205	140	24.23
	Kodkani non sg	6.09	86	60	130	14.58
	Torme sg	6.25	72	113	310	13.27
	Torme sg	6.20	71	153	109	25.13
	Kanalli non sg	6.21	107	298	210	10.24

Season	**Sample**	**Total C %**	**Total N %**	**C:N**	**meq Ca**	**meq Mg**
Monsoon	Kathlekan-1 sg	3.21	0.20	16.28	2.40	1.40
	Kathlekan-2 sg	1.08	0.16	6.90	3.35	1.25
	Kathlekan-3 sg	1.05	0.15	7.05	3.20	1.45
	Kathlekan-4 sg	2.66	0.17	15.54	2.90	1.30
	Kathlekan-5 sg	1.75	0.22	8.15	3.40	2.50
	Kodkani non sg	6.31	0.45	14.02	7.25	1.40
	Torme sg	4.70	0.63	7.52	4.85	2.25
	Kanalli non sg	4.33	0.19	22.39	4.80	0.70
Post Monsoon	Kathlekan-1 sg	3.33	0.20	16.26	8.00	2.85
	Kathlekan-2 sg	2.99	0.19	15.93	8.30	3.40
	Kathlekan-3 sg	5.72	0.29	19.69	8.55	2.35
	Kathlekan-4 sg	2.82	0.17	16.18	3.80	1.10
	Kathlekan-5 sg	2.92	0.18	16.50	0.85	0.85
	Kodkani non sg	3.07	0.21	14.74	2.10	1.20
	Torme sg	4.96	0.27	18.26	7.05	1.35
	Torme sg	3.99	0.20	20.04	2.80	1.20
	Kanalli non sg	2.96	0.17	17.85	4.80	2.15
Pre Monsoon	Kathlekan-1 sg	4.59	0.33	13.87	5.55	1.55
	Kathlekan-2 sg	5.69	0.28	20.27	6.30	3.80
	Kathlekan-3 sg	4.21			7.05	0.60

	Kathlekan-4 sg	4.68			5.30	0.80
	Kathlekan-5 sg	6.33	0.48	13.23	1.25	0.95
	Kodkani non sg	4.97	0.26	18.95	3.85	2.35
	Torme sg	4.67			5.75	0.70
	Torme sg	3.81	0.24	15.62	2.00	2.55
	Kanalli non sg	6.03	0.33	18.22	5.30	6.50

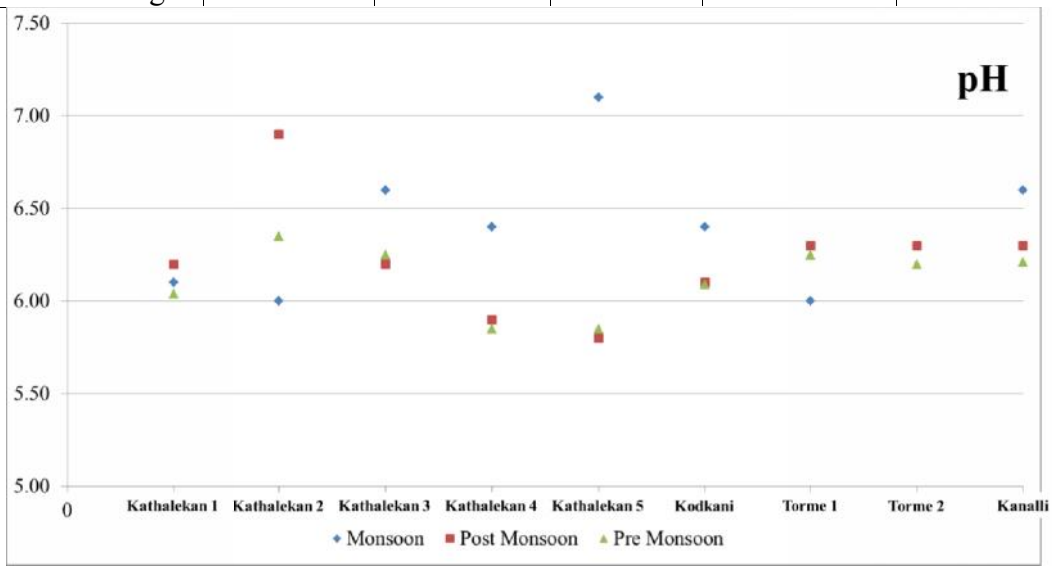

Figure 6: pH

pH of soils were found to be acidic in nature, in both sacred and non-sacred groves. Due to the monsoon, rain water seeps through soils, due to which soils tend to become neutral or near neutral in pH. Electrical conductivity in sacred grove as well as non-sacred groves were found to be high during the post monsoon seasons, this can be attributed to concentration of ions in the surface soils due runoff water during the monsoons.

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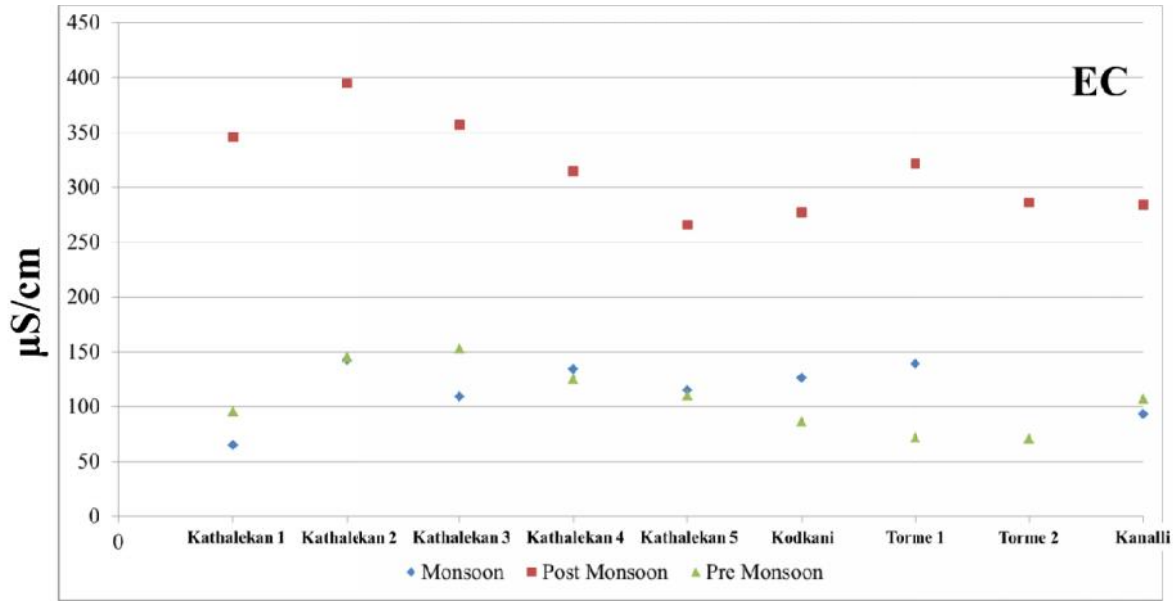

Figure 7: Electrical conductivity.

Sodium in the soils in SG's were found to be higher than the NSG's in most of the cases in all seasons. Across seasons it could be observed that during post monsoon, Sodium is observed in higher quantity, this can be attributed to the concentration of ions in the surface soils which happens to the lateral and vertical movement of precipitated water(leaching). Similar trends could be observed in potassium. Sacred groves were observed to have higher sodium and potassium concentrations compared to the non-sacred groves.

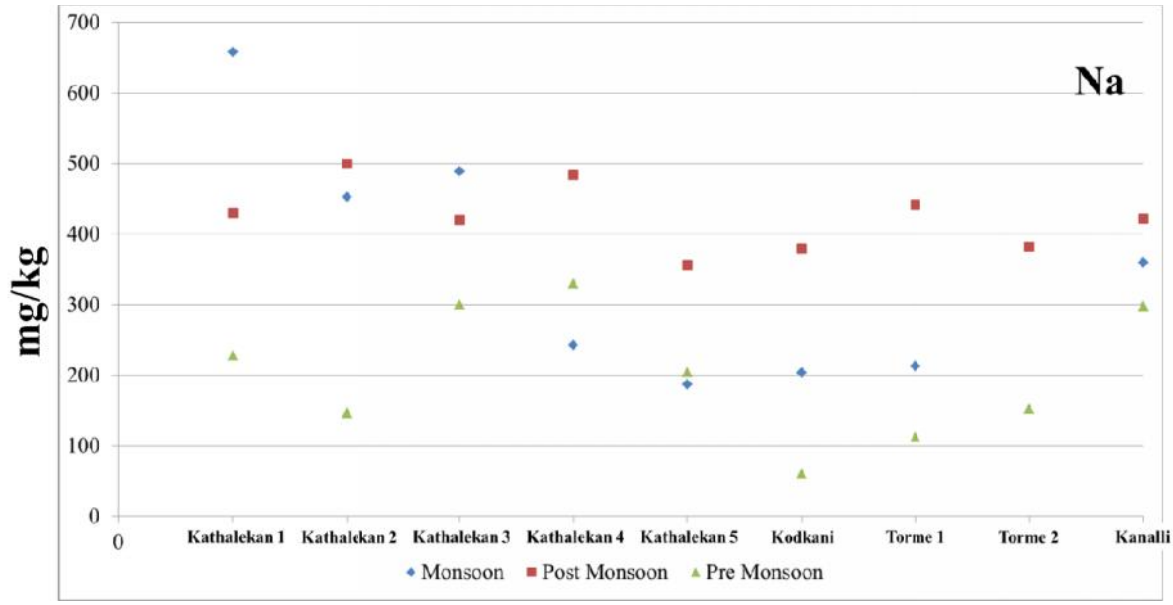

Figure 8: Sodium.

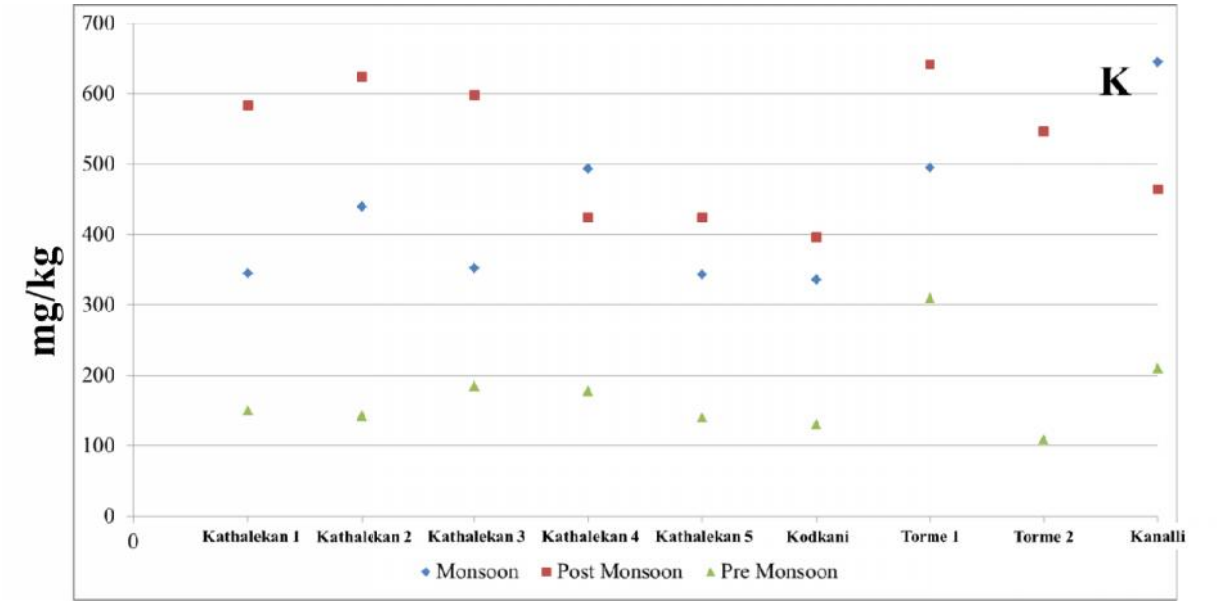

Figure 9: Potassium.

Phosphorous was observed to be higher in monsoon in most of the stations due to the weathering/scouring by precipitated rain water. SG's (swampy forests) showed lower variations across seasons, may be due to their climax nature and closed nutrient cycles, whereas the NSG's showed higher variations.

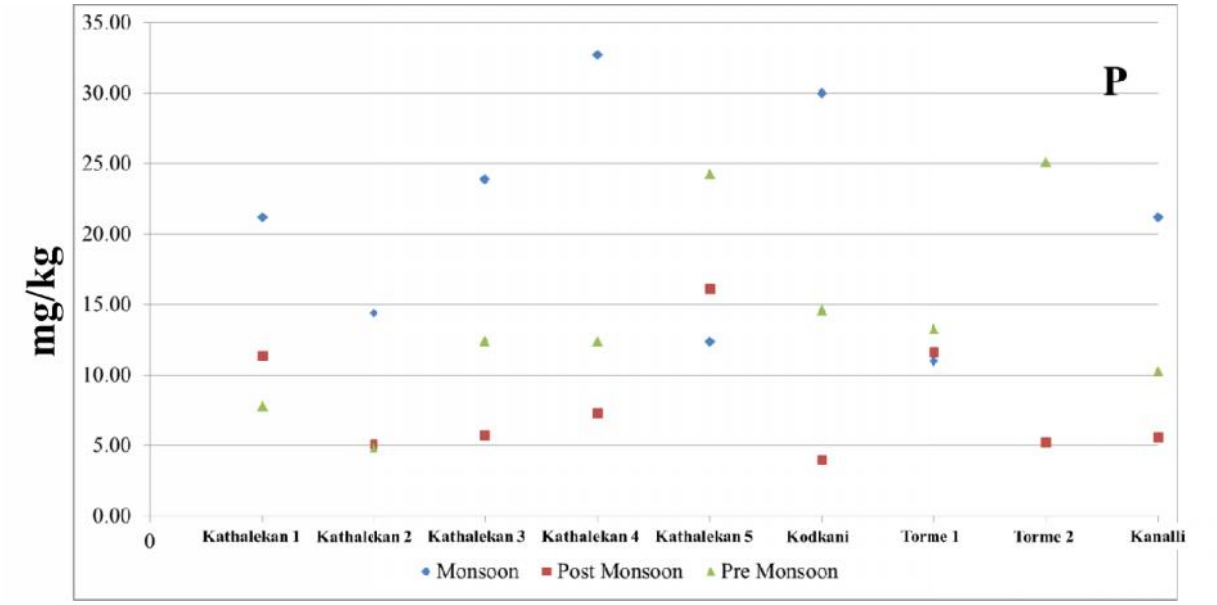

Figure 10: Available Phosphorous

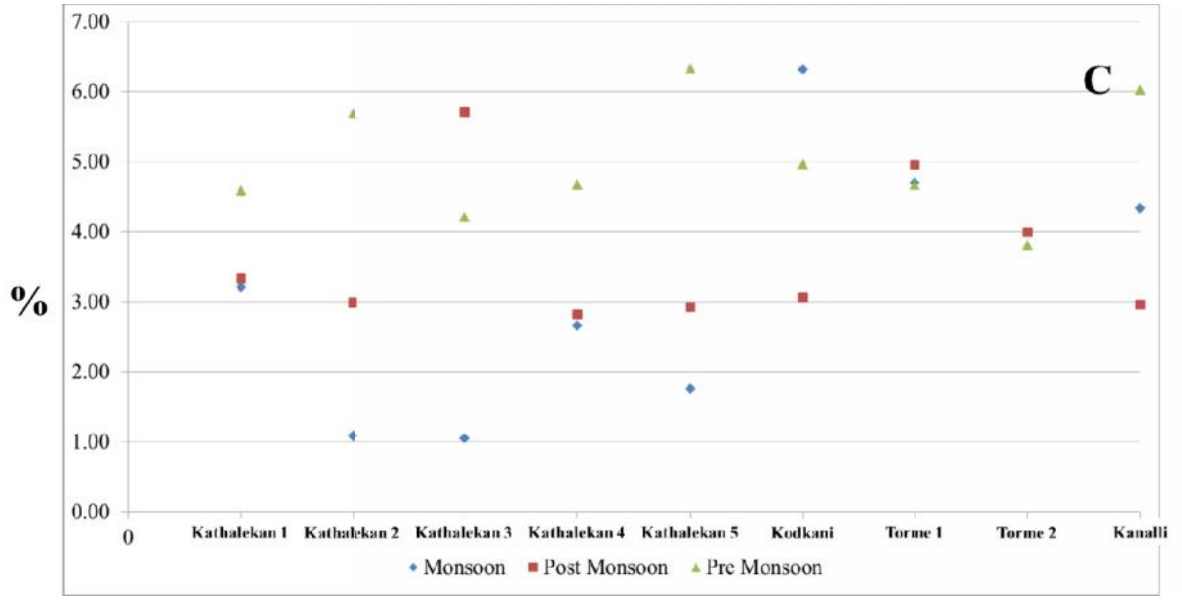

Figure 11: Carbon

Carbon and nitrogen: Soil accumulates carbon and nitrogen from the forest biomass. During the monsoons, flushing of the catchment due to intense rainfall leads to reduced carbon and nitrogen contents whereas post monsoon during the spring season accumulation of biomass tend to increase the carbon and nitrogen content in soil. The carbon to nitrogen ratio was observed to be higher in the post and pre monsoon in SG's in comparison with the non SG's, this can be attributed to higher extraction of biomass for the local agriculture and horticulture fields.

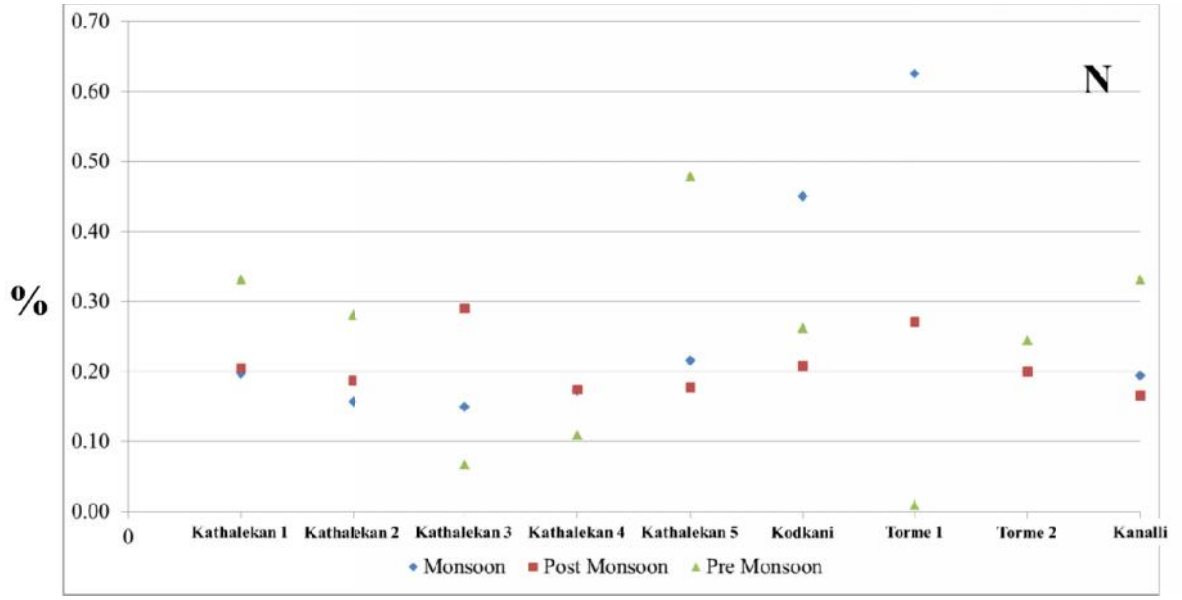

Figure 12: Nitrogen*

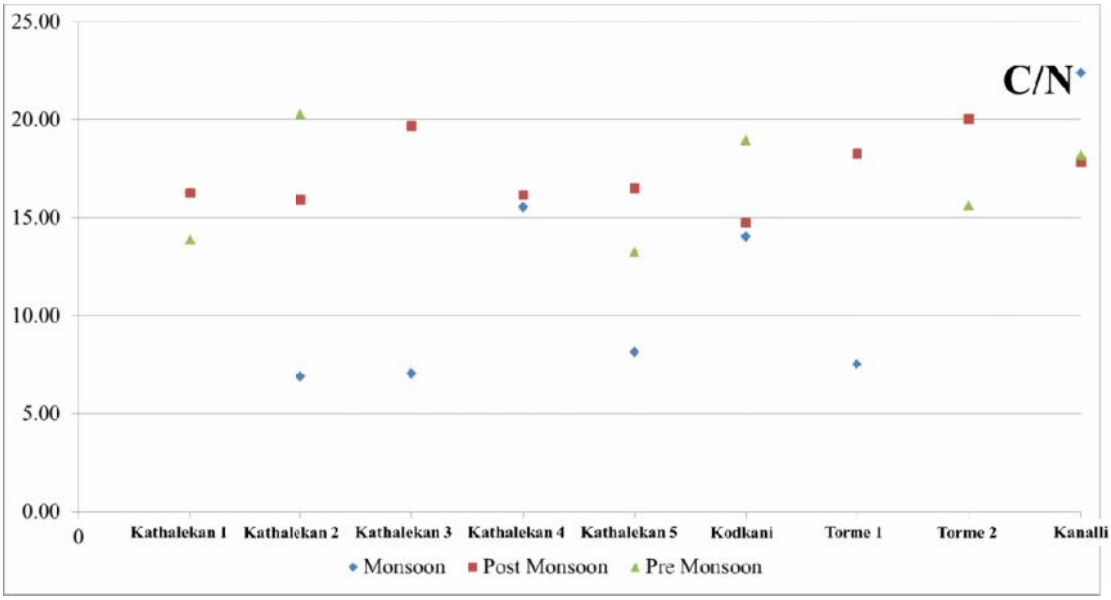

Figure 13: Carbon to Nitrogen Ratio*

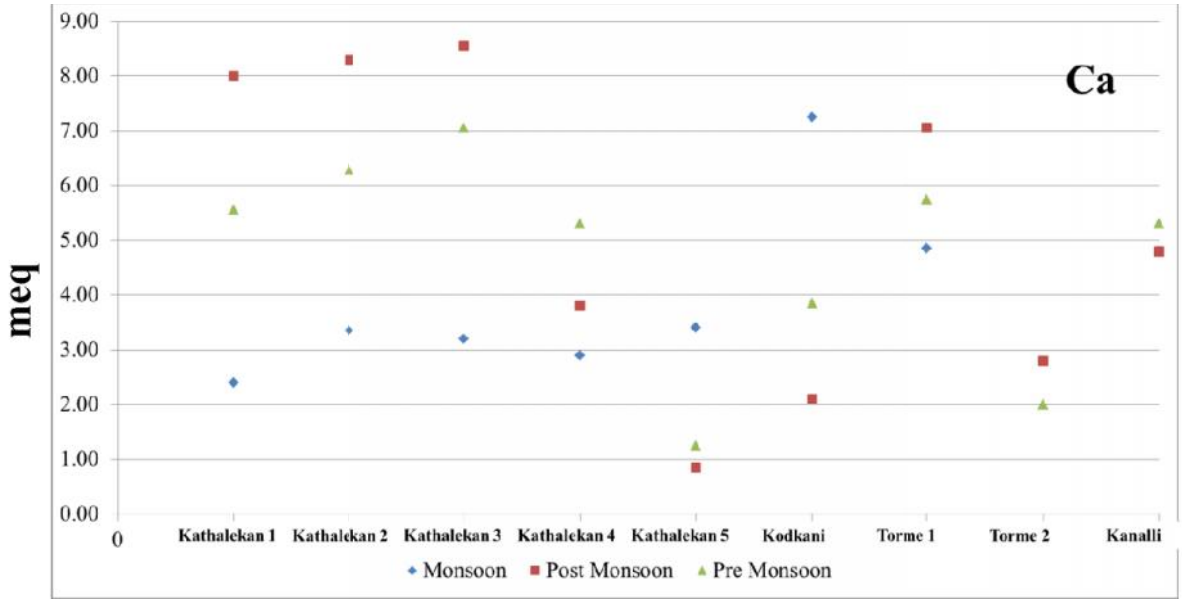

Figure 14: Calcium

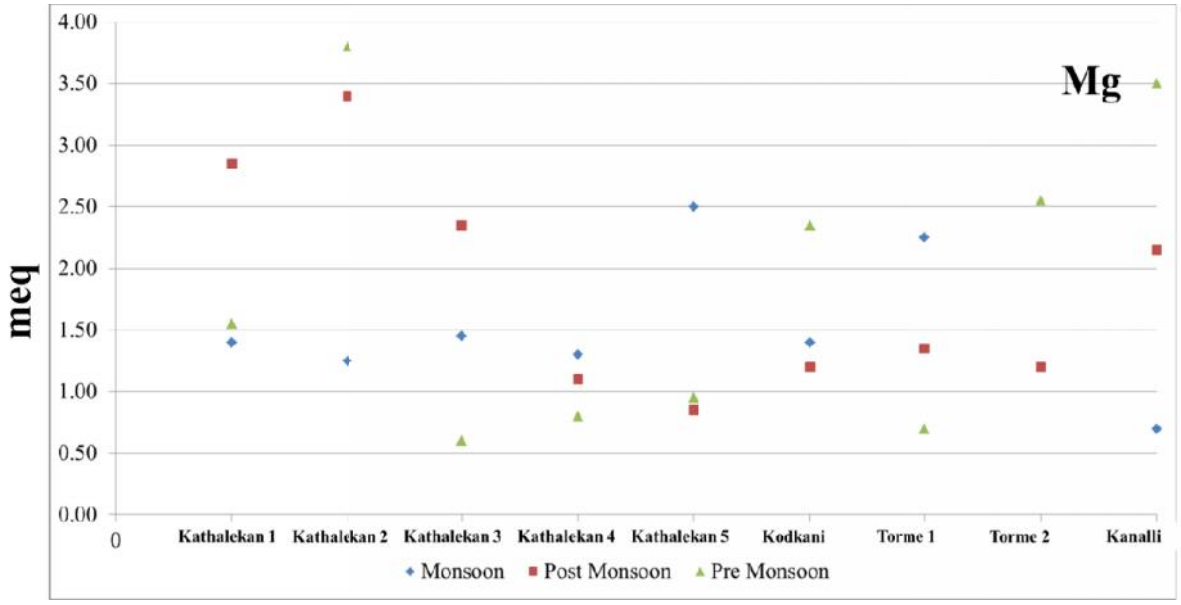

Figure 15: Magnesium

Calcium and Magnesium were found to be higher in SG's across all seasons. Kathalekan had comparatively higher amounts of Calcium and Magnesium content compared to Torme, followed by the NSG's.