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RESEARCH ARTICLE

LAND CAPABILITY EVALUATION BASED ON SOIL PARAMETERS IN PLATEAU FRINGE AREA OF WEST BENGAL, INDIA

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ABSTRACT

Land resource provides basic human needs. Soil is the most important component of land resource. Physio-chemical properties of soil are analysed to determine the land quality. Puruliya is the western most district of West Bengal falling plateau fringe area. The main objective of the study is to determine the quality of land on the basis of soil parameters for sustainable land uses. Soil samples are collected in each block of the districts and analysed in laboratory. Different maps are generated using chemical properties of soil and land capability evaluation maps are prepared applying Azzi's method in GIS environment. Four land classes are generated. Class-I & class-II land covers about 18% area and class-III & class- IV land covers nearly 82% area. Therefore 82% of the land fertility status is very low. So bio- fertiliser along with phosphorous and lime based fertiliser must be used for augmentation the soil fertility status.

INTRODUCTION

Land, a dynamic concept, carries ecosystem and also itself is a part of this ecosystem. Soils, one of its main components itself is a complex ecosystem containing animals and plants of different sizes and activities. Land capability classification is an exercise for interpretative grouping and grading of soils according to their potentialities and limitations. It helps to organize significant soil factors for conservation (Stallings 1957). This classification is made primarily on the basis of soil chemical properties for agricultural purposes and it enables the farmers to use the land according to its capabilities and to treat it according to its needs.

The Study Area

Physiographically, the region is the part of Chhotanagpur plateau. The western most district Puruliya falling in plateau fringe area of West Bengal lies between latitude 22^{0}42'35" N to 23^{0}42'0" N and Longitude 85°49' 25" E to 86°54'37" E covering 6259 sq.km. The district has three subdivisions such as Raghunathpur, Puruliya Sadar (West), Puruliya Sadar (East) and 20 Community Development Blocks. Puruliya municipal town is the headquarters of Puruliya district. The total population of the district is 29, 27,965 with a density of 468 persons per sq. km. The average literacy rate is 65.38% in 2011. The male literacy rate is 78.85% while female literacy is only 51.29%. The geology of the region is mainly characterised by granite-gneiss rocks of Achaean-Proterozoic periods except north eastern and southern part. The north-eastern part is covered by sedimentary rocks of Gondwana age while the volcanic rocks of Dalma group cover southern part. Topography is interesting because the area has a hilly upland tract in western and north-western part and extensive undulating land with river valley in the middle and eastern part while southern part have rugged topography with lateritic capping. Soils in the region is primarily lateritic with acidic in nature and low phosphorous content. Water resources are primarily enriched by surface water and lack of ground water resource due to hard crystalline basement. About 15% area is irrigated mainly through surface water irrigation. Climate of the region is characterized by hot summer and monsoon type climate with average annual rainfall is 1260 mm. for last 48 years average. Agriculture is the dominant land use (about 70% area) and rice is the dominant crop. The main objective of land capability evaluation is to understand potentiality and capability of land for optimum utilisation of land. The other objectives of the study

1. To analyse the chemical properties of soil such as soil pH, organic matter, available potassium& phosphorous etc.
2. To bring out the spatial variation of such chemical properties among the C.D. Blocks of the district
3. To prepare the land capability evaluation map on the basis of chemical properties of soil for different uses.

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MATERIALS AND METHODS

Soil is the basic natural resource for land capability evaluation and land function. Soil samples are collected from different physiographic units covering all C. D. Blocks of the district (Fig.1). Different physiographic units are identified from Survey of India topographical map and satellite imageries. Physical & chemical properties of these soil samples are analysed in laboratory and plotted in soil sample sites. Different soil chemical properties such as soil pH, organic matter, available soil phosphorous and potassium maps are generated using Map Info 7.5 and Adobe Illustrator 9.5. Land capability classification of the study area is also determined based on Azzi's Method (1959) which is expressed as IV= (100/H) x Y, where IV in is the index value and 100 is the constant, H is the highest value of each of the chemical properties of the soil, Y is the individual value of each of the chemical properties of the soil. From the index value (IV), Effective Index value (EIV) and Proportionate Index value (PIV) is calculated. The proportionate Index value is determined by taking the maximum value of Effective Index value as 100 by iterative process. The Proportionate Index values are plotted in sampling points for obtaining different spatial unit under GIS environment.

RESULTS AND DISCUSSION

Soil Function

Soil is the most important natural resource for land capability evaluation and land functions. The soil constitution may influence the land use pattern, water holding capacity, plant nutrients, and management option for sustainable crop growth. Soil function of the region is primarily controlled by parent materials mainly granite-gneiss rocks, undulating topography, climate and vegetation. The area is mostly covered by residual soil, which is formed due to disintegration and decomposition of rocks by weathering process. Geologically, these soils are older but immature. Most of the soil is lateritic, originated from granite-gneiss rocks. Based on parent materials, soils are classified into three broad categories: i) gneissic soils (laterite soils) ii) Gondwana soils on sedmientary rocks (sandy soils) and iii) transition soils of submetamorphic rocks (loamy soil). The different classes of land are the result of interaction of land forming factors. There are three main classes of land *baid* and *tard* (highland and ridge) *kanali* (medium land) and *bahal* (low land) in the study area. Soil functions are expressed in terms both physical and chemical parameters of the soil.

Soil Physical parameters

Physical parameters of the soil are very important for soil fertility as well as crop production. The important physical parameters of soil in different land classes are presented in Table 1. Reveals that sandy to sandy loam texture soil is observed in *Tard* and *Baid* (highland) region. The depth of soil is shallow. Water holding capacity in this category of soil is very low (25 to 35%) and moisture content is also low (3 to 5%). Sandy loam to loam texture soil is observed in *Kanali* land (medium land). Water holding capacity is moderate (35-45%) and moisture content is also moderate (5-8%) clay loam to clay soil is observed in *Bahal land* (low land). The depth of soil cover is relatively good. Water holding capacity is also relatively good (50-63%) and soil moisture content is also good (8-12%).

Soil Chemical parameters

Soil chemical parameters are important for land capability evaluation. Soil chemical parameters are expressed in terms soil pH, organic matter, available phosphorous and potassium.

Soil pH

The soil of the study region is mainly acidic in nature. The data on soil pH is presented in tabular form (Table 2). Form Table 2 and Fig 2, it is observed that about 27% of the total geographical areas have very strong acidic soil with pH value < 5.5. This type of soil is mostly concentrated in the central part of the region and is a major constraint for plants growth as it affects the soil microbiological activities. Slightly alkaline soil (pH >7) is observed in the hilly region with small patchy occurrences in the eastern part of the region and covers 6.1% of the total geographical area Table 3 and c.f. Fig 2 represents the micro-level pH value of the region. A detailed analysis of the table indicates that most of the blocks have soil below pH value 6. However Hura blocks represents strong acidic soil with total geographical ≈72%, followed by Puruliya-I (50.63%) and Raghunathpur-I (46.84%).The soils are derived from laterization process of the parent rock granite-gneiss. Pedogenesis process is still going on. The soil is immature and rich in iron and aluminium content and thus it is acidic in nature.

Soil organic matter

Soil organic matter derived from plants and animals that grew and lived on it (Daji, 1996). The dead vegetables and animals remain and dead microbial tissues form the main source of organic matter. Table 4 represents the % of soil organic matter in the study region. Table 4 reveals that most of the area (56.01 %) of the study region is falling the category of medium organic content in the soil (0.85 – 1.35 %). It is also observed that low organic matter content in the soil (< 0.85 %) covers more than 30% of the total geographical area while high organic content in the soil covers 14% of the total geographical area. Fig 3 shows the spatial variability of the soil organic matter content. It is apparent from the map that the most of the area represents a lack of soil organic matter content. Table 5 and c.f. Fig 3 also reveal the detailed aerial characteristics of the distribution of the soil organic matter content. It appears that more than 85% of the Santuri block falls very low organic matter content (< 0.85%), followed by (74.67%), Hura (63.90%), Para (49.35%), and Barabazar (45.47%).high organic matter content in the soils are found at Puncha (39.20%), followed by Manbazar – ii, Nituria, Manbazar – i, Banduan and Raghunathpur - i (Table 5). Most of the area of the study region having low to moderately low organic content which is a major constraint for agricultural development in the region. Besides leaching and associated processes with lack of vegetation cover is responsible for poor organic matter content in the soil.

Soil phosphorus

The availability of phosphorus in the soil determines the nutrient availability to the plant growth. The lack of phosphorus in the soil leads to poor plant growth and subsequently poor yield. Determination of available phosphorus in the soil allows the farmers to take necessary measures for application of inorganic fertilizer to make agriculture sustainable in the region. Unscientific and random application of inorganic fertilizer on the other hand creates environmental problems and necessitates proper management of land resources. The results of the chemical analysis of the available phosphorus (p_2o_5) in the soil represent a very gloomy picture. Table 6 reveals that ≈ 79% of the total geographical area have low available phosphorus content (<45 kg/ha) in the soil which indicates the fertility level is low. According to Daji (1996) the availability of phosphorus is highest in the neutral soil. However, the availability is reduced both in acidic

Table 1: Some important physical parameters of soil in study area

Soil texture	Type of land	Depth of soil	Water holding capacity	Soil moisture content	Leaching	Remarks
Sandy to sandy loam	Soil at or near the high land	Shallow	25-35%	3-5%	Excessive	Quartz, feldspar and iron contents hindrance to cultivation
Sandy loam to loam	Soil below the high land and above the valley fill zone	Moderately deep	35-45%	5-8%	Moderate	Moderately suitable for cultivation
Clay loam to clay	Valley fill zone	Deep soil	50-63%	8-12%	Low	Suitable for paddy cultivation

Source: Compilation of laboratory analyzed soil data

Table 2: Soil pH of the study region

Soil pH	Area in sq. km	% of area to total area	Soil category
<5.5	1739.23	27.28	Strongly acidic
5.5-6	1701.62	27.19	Moderately acidic
6-6.5	1760.97	28.14	Slightly acidic
6.5-7	675.45	10.79	Neutral
>7	381.73	6.1	Slightly alkaline
Total	6259	100	

Source: Data generated from digitized soil pH map in GIS environment

Table 3: Categories of soil pH at micro level

C. D Block	<5.5	5.5-6	6-6.5	6.5-7	>7	Total
1. Arsa	62.49 (17.27)	83.17 (23.00)	84.08 (23.24)	74.78 (20.67)	57.23 (15.82)	361.75 (100)
2. Baghmundi	80.47 (18.90)	55.12 (12.98)	128.12 (30.20)	78.07 (18.36)	83.02 (19.54)	424.80 (100)
3. Balarampur	118.56 (40.70)	56.35 (19.35)	49.2 (16.88)	29.66 (10.18)	37.58 (12.89)	291.35 (100)
4. Banduan	1.14 (0.32)	26.53 (7.54)	120.05 (34.10)	160 (45.44)	44.35 (12.6)	352.07 (100)
5. Barabazar	93.13 (23.05)	147.99 (36.65)	121.52 (30.10)	35.86 (8.88)	5.32 (1.32)	403.82 (100)
6. Hura	293.48 (71.82)	44.53 (10.90)	28.43 (6.96)	9.03 (2.21)	33.17 (8.11)	408.64 (100)
7. Jaipur	70.97 (29.23)	72.11 (29.70)	82.46 (33.96)	17.27 (7.11)	0	242.81 (100)
8. Jhalida-I	31.66 (10.30)	46.44 (15.30)	73.04 (23.90)	103.71 (33.90)	50.8 (16.60)	305.65 (100)
9. Jhalida-II	122.75 (42.62)	60.5 (21.00)	96.61 (33.55)	8.17 (2.83)	0	288.03 (100)
10. Kashipur	110.33 (25.20)	95.44 (21.80)	199.13 (45.48)	13.74 (3.14)	19.15 (4.38)	437.79 (100)
11. Manbazar I	80.49 (21.54)	205.19 (54.88)	76.21 (20.38)	7.09 (1.89)	4.9 (1.31)	373.88 (100)
12. Manbazar II	78.96 (26.60)	130.95 (44.14)	51.85 (17.50)	20.97 (7.06)	13.92 (4.70)	296.65 (100)
13. Nituria	21.03 (10.20)	129.84 (63.30)	54.36 (26.50)	0	0	205.23 (100)
14. Para	34.66 (11.20)	181.08 (58.70)	95.21 (30.00)	0.22 (0.10)	0	308.47 (100)
15. Puncha	146.88 (44.60)	76.56 (44.23)	29.91 (9.10)	50.81 (7.64)	25.17 (15.43)	329.33 (100)
16. Puruliya I	141.17 (50.63)	64.53 (23.14)	69.92 (25.07)	3.23 (1.16)	0	278.85 (100)
17. Puruliya II	100.81 (27.80)	105.23 (29.00)	154.82 (42.70)	1.79 (0.50)	0	362.65 (100)
18. Raghunathpur I	61.88 (46.84)	40.58 (30.72)	21.2 (16.04)	8.45 (6.40)	0	132.11 (100)
19. Raghunathpur II	30.38 (11.25)	34.16 (12.70)	145.35 (53.90)	52.6 (19.51)	7.12 (2.64)	269.61 (100)
20. Santuri	57.99 (31.26)	45.32 (24.43)	82.2 (44.31)	0	0	185.51 (100)
District	1739.23 (57.28)	1701.97 (27.19)	1760.97 (28.14)	675.45 (10.79)	381.73 (6.10)	6259 (100)

Figures indicate sq. km and percentages in parentheses; Source: Data generated from digitized soil pH map in GIS environment

and alkaline soil. Very low to low fertility level of the soil is mainly due to acidic nature of the soil. The detailed analysis of the spatial variability of the phosphorus content in the soil is presented in table 7 and fig 4. From the table 7 and fig 4 it is apparent that very low phosphorus content (<20 kg/ha) in the soil covers more than 68% area of Barabazar block followed by Jhalida - ii (55.87) and Baghmundi (36.63%). The phosphorus content of the soil (20 – 45kg/ha) covers about

Table 4: Soil organic matter content

Organic Matter (%)	Area in sq. km	Percentage of area to total area	Grade
<0.85	1879.65	30.03	Low
0.85-1.1	2054.20	32.83	Medium
1.1-1.35	1450.95	23.18	
>1.35	874.20	13.96	High
Total	6259	100.00	

Source: Data generated from digitized map in GIS environment

Table 5: Categories of soil organic matter content at micro level

C. D Block	<0.85%	0.85-1.1%	1.1%-1.35%	>1.35%	Total area in sq. km
1. Arsa	88.17 (24.37)	153.28 (42.37)	81.9 (22.64)	38.4 (10.62)	361.75 (100)
2. Baghmundi	94.99 (22.36)	94.23 (22.18)	173.93 (41.00)	61.65 (14.51)	424.8 (100)
3. Balarampur	217.56 (74.67)	73.79 (25.33)	0	0	291.35 (100)
4. Banduan	20.82 (5.91)	161.41 (45.85)	74.99 (21.30)	94.85 (26.94)	352.07 (100)
5. Barabazar	183.62 (45.47)	108.87 (26.96)	36.79 (9.11)	74.54 (18.46)	403.82 (100)
6. Hura	261.13 (63.90)	125.2 (30.64)	21.98 (5.38)	0.33 (0.08)	408.64 (100)
7. Jaipur	75 (30.89)	93.66 (38.57)	52.93 (21.80)	21.22 (8.74)	242.81 (100)
8. Jhalida-I	46.34 (15.16)	150.32 (49.18)	91.6 (29.97)	17.39 (5.69)	305.65 (100)
9. Jhalida-II	96.46 (33.49)	109.3 (37.95)	74.99 (26.03)	7.28 (2.53)	288.03 (100)
10. Kashipur	154.32 (35.25)	116.56 (26.62)	147.94 (33.80)	18.97 (4.33)	437.79 (100)
11. Manbazar I	73.57 (19.68)	91.8 (24.55)	96.01 (25.68)	112.5 (30.09)	373.88 (100)
12. Manbazar II	19.53 (6.58)	88.75 (29.92)	88.4 (29.80)	99.97 (33.70)	296.65 (100)
13. Nituria	23.1 (11.25)	48.33 (23.55)	69.92 (34.07)	63.88 (31.13)	205.53 (100)
14. Para	152.23 (49.35)	118.61 (38.45)	24.39 (7.91)	13.24 (4.29)	308.47 (100)
15. Puncha	3.59 (1.09)	140.36 (42.62)	56.25 (17.08)	129.13 (39.21)	329.33 (100)
16. Puruliya I	105.44 (37.81)	76.77 (27.53)	85.73 (30.74)	10.91 (3.90)	278.85 (100)
17. Puruliya II	66.49 (18.33)	114.51 (31.58)	143.4 (39.54)	38.25 (10.55)	362.65 (100)
18. Raghunathpur I	26.67 (20.19)	19.01 (14.39)	52.50 (38.24)	35.91 (27.18)	132.11 (100)
19. Raghunathpur II	12.18 (4.52)	155.21 (27.57)	72.77 (26.99)	29.45 (10.92)	269.61 (100)
20. Santuri	158.44 (85.41)	14.23 (7.67)	6.51 (3.51)	6.33 (3.41)	185.51 (100)
District	1879.65 (30.03)	2054.2 (32.83)	1450.95 (23.18)	874.2 (13.96)	6259 (100)

Figures indicate sq. km and percentages in parentheses; Source: Data generated from digitized map in GIS environment

Table 6: Categories of available phosphorus (P_2O_5)

Available phosphorus kg/ha	Area in sq. km	Percentage of area to total area	Grade
<20	1301.25	20.79	Very low
20-45	3620.42	57.84	Low
45-70	1173.76	18.75	Moderate
>70	163.57	2.62	High
Total	6259	100.00	

Source: Data generated from digitized map in GIS environment

Table 7: Categories of available phosphorus (P_2O_5) at micro level

C. D Block	<20 kg/ha	20-45 kg/ha	45-70 kg/ha	>70 kg/ha	Total
1. Arsa	111.19 (30.74)	216.71 (59.90)	33.85 (9.36)	0	361.75 (100)
2. Baghmundi	155.6 (36.63)	191.11 (44.99)	73.04 (17.19)	5.05 (1.19)	424.8 (100)
3. Balarampur	99.55 (34.17)	183.58 (63.01)	7.89 (2.71)	0.33 (0.11)	291.35 (100)
4. Banduan	22.91 (6.51)	215.08 (61.09)	97.86 (27.80)	16.22 (4.60)	352.07 (100)
5. Barabazar	275.42 (68.20)	95.49 (23.65)	20.16 (4.99)	12.75 (3.16)	403.82 (100)
6. Hura	30.14 (7.38)	279.88 (68.49)	97.6 (23.88)	1.02 (0.25)	408.64 (100)
7. Jaipur	20.91 (8.61)	174.45 (71.84)	36.22 (14.92)	11.23 (4.63)	242.81 (100)
8. Jhalida-I	43.94 (14.38)	168.29 (55.06)	93.42 (33.56)	0	305.65 (100)
9. Jhalida-II	160.93 (55.87)	83.76 (29.08)	43.34 (15.05)	0	288.03 (100)
10. Kashipur	58.96 (13.47)	169.68 (38.76)	209.15 (47.77)	0	437.79 (100)
11. Manbazar I	57.48 (15.37)	219.2 (58.63)	56.46 (15.10)	40.74 (10.90)	373.88 (100)
12. Manbazar II	1.69 (0.57)	252.98 (85.28)	41.98 (42.15)	0	296.65 (100)
13. Nituria	15.32 (7.46)	113.34 (55.23)	64.76 (31.55)	11.81 (5.76)	205.23 (100)
14. Para	0	298.56 (96.79)	9.91 (3.21)	0	308.47 (100)
15. Puncha	46.63 (14.16)	192.98 (58.60)	84.41 (25.63)	5.31 (1.61)	329.33 (100)
16. Puruliya I	65.39 (23.45)	197.98 (71.00)	15.48 (55.55)	0	278.85 (100)
17. Puruliya II	46.75 (4.89)	185.57 (51.17)	81 (22.34)	49.33 (13.60)	362.65 (100)
18. Raghunathpur I	8.58 (6.50)	40.3 (30.50)	78.34 (59.30)	4.89 (3.70)	132.11 (100)
19. Raghunathpur II	65.99 (24.48)	174.81 (64.84)	23.92 (8.87)	4.89 (1.81)	269.61 (100)
20. Santuri	13.87 (7.48)	166.67 (89.84)	4.97 (2.68)	0	185.51 ((100)
District	1301.25 (20.79)	3620.42 (57.84)	1173.76 (18.75)	163.57 (2.62)	6259 (100)

Figures indicate sq. km and percentages in parentheses; Source: Data generated from digitized map in GIS environment

Table 8: Categories of available potassium

Available soil potassium kg/ha	Area in sq. km	Percentage of area to total area	Grade
<150	575.31	9.19	Low
150-250	2896.12	46.27	Moderate
250-350	1733.44	27.7	
>350	1054.12	16.84	High
Total	6259	100.00	

Source: Data generated from digitized map in GIS environment

Table 9: Categories of available soil potassium at micro level

C. D Block	<150 kg/ha	150-250 kg/ha	250-350 kg/ha	>350 kg/ha	Total
1. Arsa	0	153.28 (42.37)	123.16 (34.05)	85.31 (23.58)	361.75 (100)
2. Baghmundi	0	110.15 (25.93)	224.71 (52.93)	89.94 (21.17)	424.8 (100)
3. Balarampur	58.99 (20.25)	156.85 (53.84)	70.23 (24.11)	5.28 (1.81)	291.35 (100)
4. Banduan	10.03 (2.85)	117.82 (33.46)	137.43 (39.03)	86.79 (24.65)	352.07 (100)
5. Barabazar	12.18 (3.01)	265.48 (65.74)	92.25 (22.84)	33.91(8.40)	403.82 (100)
6. Hura	31.3 (7.66)	294.21 (72.00)	78.42 (19.19)	4.71 (1.15)	408.64 (100)
7. Jaipur	7.03 (2.90)	74.28 (30.60)	73.21 (30.40)	87.79 (36.20)	242.81 (100)
8. Jhalida-I	16.2 (5.30)	77.67 (25.41)	141.91 (46.43)	69.87 (22.90)	305.65 (100)
9. Jhalida-II	0.88 (0.31)	144.26 (50.08)	121.41 (42.15)	21.48 (7.50)	288.03 (100)
10. Kashipur	74.65 (17.10)	256.87 (58.70)	106.27 (24.30)	0	437.03 (100)
11. Manbazar I	53.61 (14.33)	194.65 (52.10)	70 (18.72)	55.62 (14.90)	373.88 (100)
12. Manbazar II	98.54 (33.21)	126.43 (44.61)	45.56 (15.40)	26.12 (8.80)	296.65 (100)
13. Nituria	0.53 (0.26)	73.7 (35.91)	29.93 (14.58)	101.07 (49.25)	205.23 (100)
14. Para	36.19 (11.73)	194.73 (63.13)	42.24 (13.70)	35.31 (11.44)	308.47 (100)
15. Puncha	63.93 (19.40)	171.59 (52.10)	80.45 (24.42)	13.36 (4.10)	329.33 (100)
16. Puruliya I	0	161.97 (58.10)	68.27 (24.48)	48.6 (17.42)	278.85 (100)
17. Puruliya II	0	106.94 (29.49)	112.56 (31.04)	143.15 (39.47)	362.65 (100)
18. Raghunathpur I	8.76 (6.63)	73.35 (55.52)	29.75 (22.52)	20.25 (15.33)	132.11 (100)
19. Raghunathpur II	30.05 (11.15)	60.01 (22.26)	73.44 (27.24)	106.11 (39.35)	269.61 (100)
20. Santuri	72.44 (39.05)	81.88 (44.13)	11.74 (6.32)	19.45 (10.50)	185.51 (100)
District	575.31 (9.19)	2896.12 (46.27)	1733.44 (27.70)	1054.12 (16.84)	6259 (100)

Figures indicate sq. km and percentages in parentheses; Source: Data generated from digitized map in GIS environment

97% of the total area of para block, followed by Santuri (89.84%), Manbazar – ii (85.25%), Jaipur (71.84%),

Table 10: Soil fertility index

Land category	Index limit	Land type	Area in sq. km	% of area to total area
Class – I	100-80	Good	159.03	2.54
Class – II	80-60	Moderately good	968.96	15.48
Class – III	60-40	Fair	3244.32	51.83
Class – IV	40-20	Poor	1886.77	30.15

Source: Data generated from digitized map in GIS environment

Fig 1: Administrative and Soil Sample Sites Map

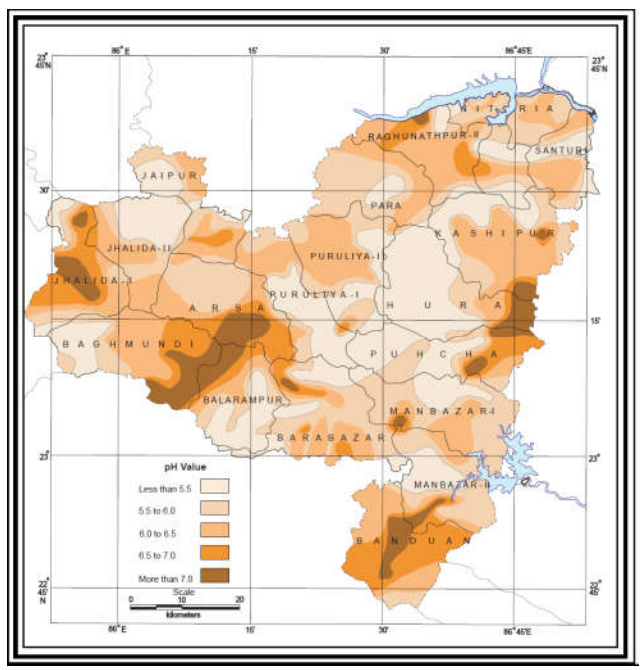

Fig 2: Spatial Variation of Soil pH in the Study Region

Puruliya– i (71%) and Hura (68.49%). In fact all the blocks of Puruliya Districts have low phosphorus content. High phosphorus content in the soil (>70 kg/ha) covers 13.60% of the total area of Puruliya – ii Block, followed by Manbazar – i (10.90%). At least eight blocks of the study region do not have any area within the category of the high phosphorus content.

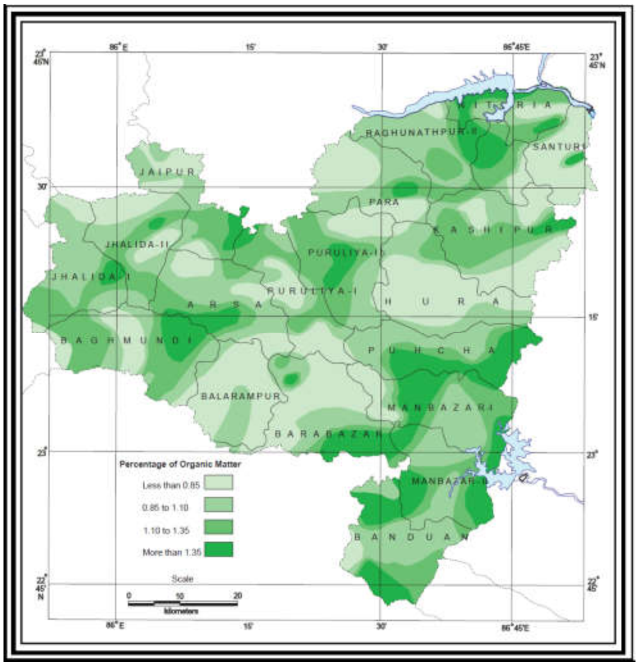

Fig 3: Spatial Variation of Organic Matter

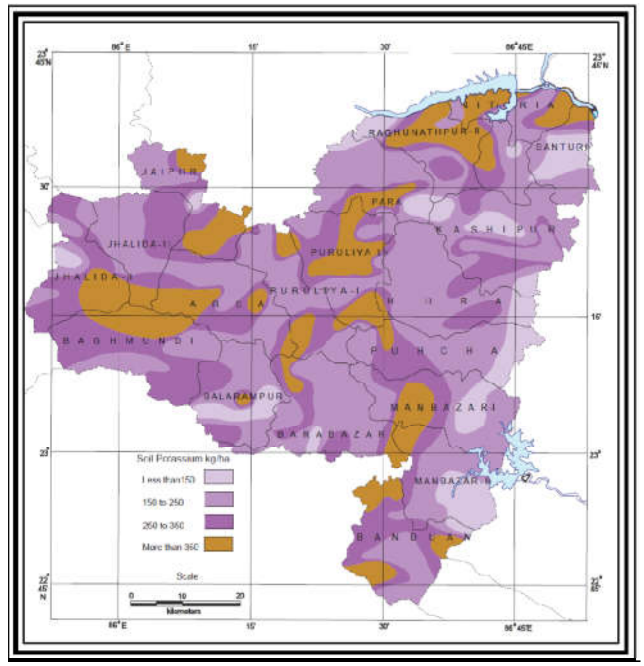

Fig 5: Spatial Variation of Soil Potassium

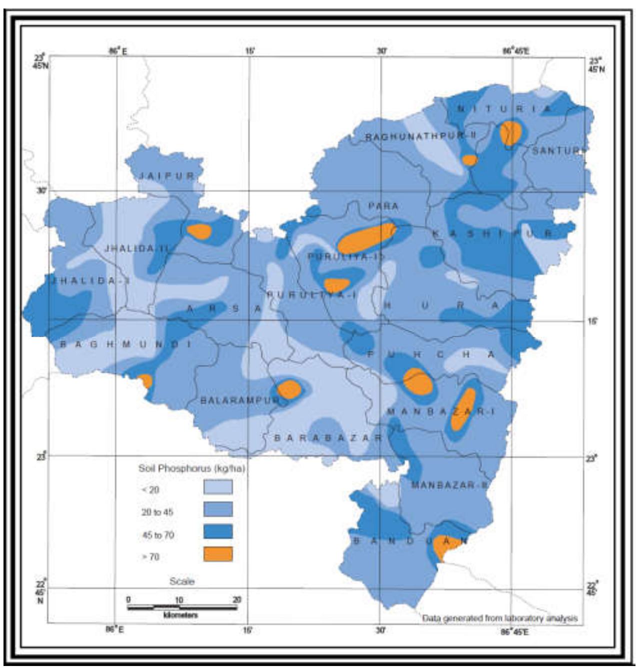

Fig 4: Spatial Variation of Available Soil Phosphorous

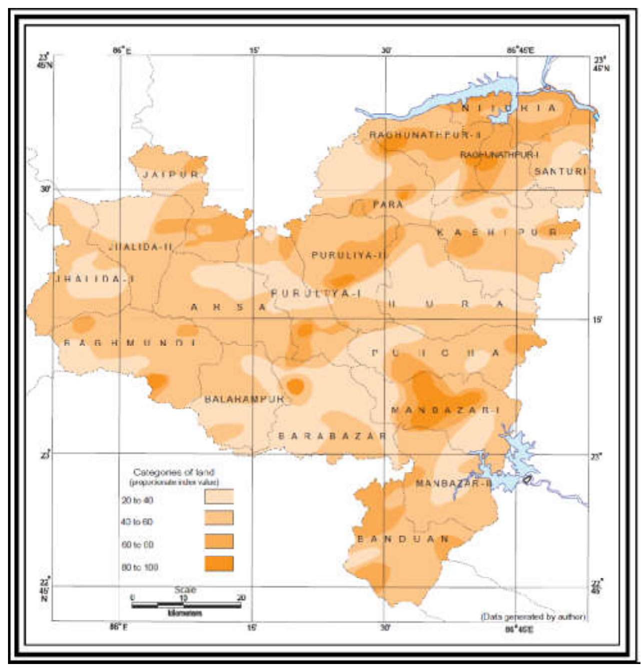

Fig 6: Land Capability Evaluation of the Study Region

The plausible explanation for low phosphorus content in the soil is due to the low ph content in the soil.

Soil potassium

Soil potassium is an important chemical property for determining the soil fertility. Table 8 represents the analytical results of the available potassium of the soil sample collected in the study region. The spatial variability of the available potassium is shown in fig 5. In the study region, available potassium in the soil is classified in the four categories. From the table 8, it is revealed that ≈ 74% of the total geographical area of the region falls the moderate category potassium content in the soil (150 – 350 kg/ha) while 16.84% of the total geographical area is under the category of high potassium content (>350 kg/ha). It is apparent from the table 9 and c.f. Fig 5 that most of the area of the blocks is under the category of 150 – 250 kg/ha potassium content in the soil. In fact 46.27% of the total geographical area of the study region belongs the category of potassium availability of 150 – 250 kg/ha. Land capability classification of the study area is done on the basis of chemical analysis data on soil samples, i.e. Organic matter, available phosphorus and available potassium. These data is utilized to generate soil fertility index data. Based on azzi`s method proportionate index value (piv) is calculated. This proportionate index value is plotted against the soil sampling sites (c.f. Fig 1). Isopleths are drawn to obtain the spatial distribution of soil fertility class and land evaluation is made based on soil fertility class. The map is digitized to obtain the statistical data on aerial coverage of the soil fertility class and presented in table 10.

It is observed from the table10 that good quality land with index value 80 - 100 covers only 2.54% of the total geographical area while poor quality land with index value of 20-40 cover 30.15% of the total geographical area. Based on piv, the study area is under the category of fair quality with fertility class – iii covering more than 51% of the total geographical area. Good and moderately good quality land has patchy occurrences in the north eastern, south central and central part (fig 6). It also indicates that class – iii and class – iv types of land are the dominant category of land (82%) in the area. So the fertility status of soil is very poor. Soil erosion is observed in the district 31.8% area of the district suffers from one or the other kind of land degradation. Water induced soil erosion is the major problem which accounts for 31.3% of the district. Land degradation due to water logging is limited to only 0.3% area whereas 0.2% area is degraded due to rock quarries, brick kiln and industrial effluents. The open scrubland are most vulnerable to soil erosion with 15.45% area affected followed by agriculture lands with 12.35% area degraded. Forestlands are least affected with 4% area under degradation (Saini *et al* 1999).

Conclusion

It may be concluded that 18% area of the district have good to moderately good quality land which is suitable for agriculture mainly paddy and related activities in terms of soil fertility index. Fair to poor quality land covers 82% area is not suitable for crop production unless bio-fertilizer and chemical fertilizer are used. After augmenting the soil fertility, this land may be used for oil seeds, vegetables, short growing paddy, forestry and others as there is increasing trend in oil seeds production. Forestry will be grown in high land and wasteland in poor and fair quality land.

About 32% area of the district suffers due to land degradation. Among these, about 15% areas are open scrubland and 12% agricultural land. Open scrub land will be rejuvenated through afforestation. Degraded agricultural land will be protected from erosion through terracing, criss-cross ploughing etc, though many agricultural lands have terracing pattern. The district is agriculturally drought and about 15% areas are irrigated mainly surface water irrigation. Surface water irrigation must be increased through digging new tanks, small reservoirs, jhore bandhs at suitable places mainly waste land for better agriculture purposes. Acidic soil (ph < 6.5) in the district covers about 80% areas while 78% areas have low phosphorous content (< 45 kg/ha). These two chemical properties are deficit in the district. Therefore, phosphorous content fertilizer and lime must be use to augment the fertility in the soil for agricultural activities.

Acknowledgement

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