Plant Archives Vol. 25, No. 2, 2025 pp. 618-622 e-ISSN:2581-6063 (online), ISSN:0972-5210

Plant Archives

Journal homepage: http://www.plantarchives.org

DOI Url : https://doi.org/10.51470/PLANTARCHIVES.2025.v25.no.2.083

LAND IRRIGABILITY CLASSIFICATION OF SOILS OF CHAR AREAS UNDER DIBRUGARH DISTRICT OF ASSAM, INDIA

Aditya Bezbaruah[1], Bipul Deka[2]*, Marami Dutta[1], D. K. Patgiri[1], Kalyan Pathak[3], Kaushik Das[4], Bipasha Borkotoky[1] and Rajneesh Khargharia[1]

[1]Department of Soil Science, Assam Agricultural University, Jorhat - 785 013, Assam, India.
[2]AICRP on Irrigation Water Management, Assam Agricultural University, Jorhat - 785 013, Assam, India.
[3]Department of Agronomy, Assam Agricultural University, Jorhat - 785 013, Assam, India.
[4]Department of Crop Physiology, Assam Agricultural University, Jorhat - 785 013, Assam, India.
*Corresponding author E-mail : drbipuldeka@gmail.com
(Date of Receiving-01-06-2025; Date of Acceptance-11-08-2025)

ABSTRACT

Land irrigability refers to a method of land evaluation which primarily deals with degree of suitability of the land for irrigation based on soil characteristics related to irrigation. The current study was carried out in the Char areas (riverine areas) of Brahmaputra River under Dibrugarh district to assess the suitability of the land for irrigation. The entire district was divided into 18 different char areas encompassing an area of 145.66 sq.km. The land irrigability assessment was done based on soil physico-chemical characteristics, soil erosion and certain topographical features. The study revealed that, out of the total geographical area, 98.77% of the area was moderately suitable for irrigation (S2) and 1.23% of the area was highly suitable for irrigation (S1). Soil erosion was the limiting factor for irrigation.

Key words : Land irrigability, Char areas, Brahmaputra river.

Introduction

The state of Assam occupies an area of 78,438 sq. km out of which 3,608 sq. km area is occupied by Char areas or riverine areas. These Char areas have a huge potentiality for agriculture especially for horticultural crops. Out of the several factors that determine the production of crop, irrigation is one of the most vital inputs. Apart from providing additional water to the crops during the dry season, it also ensures that the risk of crop failure is reduced. In the current era of climate change, with water resources getting depleted, the risk of crop failure is increasing. Hence to prevent such instances' adopting irrigation is utmost necessity. At the same time, proper management of irrigation is also important to prevent the problems of waterlogging and soil salinization. The assessment of soil irrigability mainly deals with the suitability of the soils to irrigation mainly on the basis of soil characteristics related to irrigation. The process of determining whether the soil is suitable for irrigation based on soil properties related to irrigation is known as soil irrigation suitability assessment (Bhusan and Roy, 2018). Danbara and Zewdie (2022) used spatial information such as NDVI, proximity, soil, slope, rainfall deficit and land use for assessment of land suitable for surface irrigation in Bilate river basin of Ethiopia. Results indicated that 93% of the land was suitable for small scale irrigation, while only 7% can be used for medium or minor irrigation. Deka *et al*. (2024) assessed the land irrigability of Simen river basin of North Bank Plain Zone in Dhemaji district using the method outlined by Palaskar and Varade (1985) and Sehgal *et al*. (1996). They found that flood plains had higher land irrigability index values followed by alluvial plain and piedmont plain. Bijerniya *et al* (2025) assessed the land irrigability of riverine areas of lower Brahmaputra valley and found that majority of the areas was moderately suitable for irrigation.

There is a dearth of investigation on estimating irrigation potential based on land and water resources in the Upper Brahmaputra Valley of Assam. As such the current study was carried out with an objective to assess

the land irrigability of Char areas under Dibrugarh district of Upper Assam.

Materials and Methods

The study was was carried out in the char areas of Dibrugarh district located in the Lower Brahmaputra Valley Zone of Assam, India (Fig. 1). The study area lies at a latitude ranging from 27.17^0 N to 27.70^0 N and longitude varying from 94.60^0 E to 95.30^0 E. Based on geocoded FCC of Resources at satellite data, coupled with survey of India toposheet, the entire district of Dibrugarh was divided into 18 different chars encompassing an area of 145.66 sq.km. The elevation of the study area ranged from 90 m to 230 m above mean sea level. The land use and land cover of the study area mostly included agricultural crops, seasonal horticultural crops, grazing land, wasteland and fallow land. Altogether, 133 nos. of geo-referenced surface soil samples and core samples were collected from these 18 chars (Fig. 2). The collected samples were air dried, grinded and passed through 2 mm sieve and packed in polyethene bags for physico-chemical property analysis using the standard procedures. The soil depth was estimated through profile

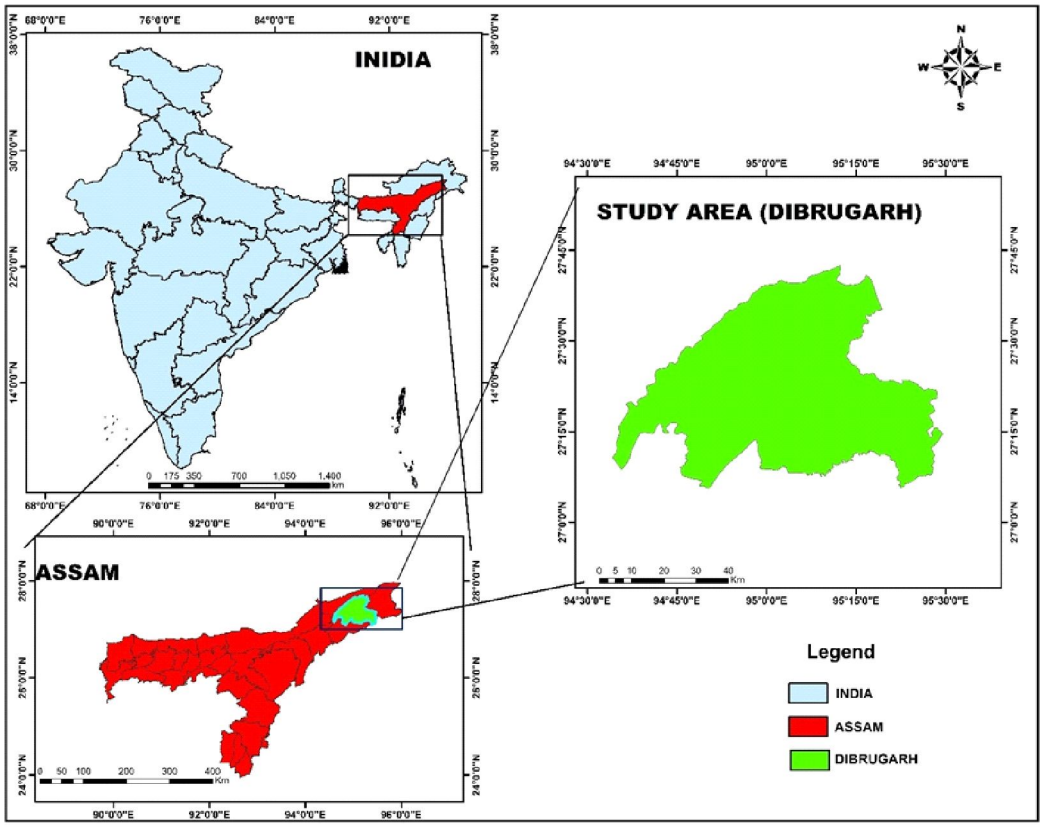

Fig. 1 : Location map of Char areas of Dibrugarh district.

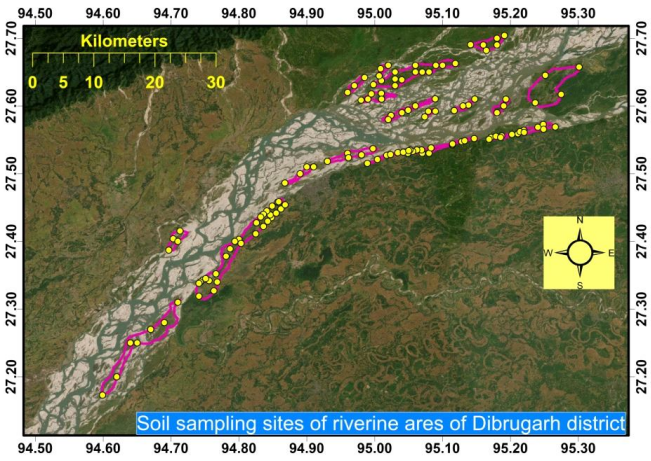

Fig. 2 : Soil sampling sites of char areas under Dibrugarh district along river Brahmaputra.

study. The slope of the study area ranged from 1.7% to 7.3%. The land irrigation classes were assessed based on the method given by Palaskar and varade (1985) and Sehgal (1996), which were subsequently modified by A total of 12 parameters were taken and weightage was given ranging from 1 to 5. Scores were allotted to values of each soil samples based on the results of soil physico-chemical analysis (Table 1). The weightage of each parameter and scores of each soil samples were multiplied. The land irrigability index was calculated by dividing the aggregated score by maximum weightage score and based on the obtained value the irrigability classes for each soil samples were assigned. The land irrigability classes were determined using a rating system (Table 2)

based on the computed Land Irrigability Index (Deka *et al.*, 2024). The GIS based land irrigability map was prepared under Arc GIS environment using the calculated land irrigability index values. Interpolation for the unsampled location was carried out using Inverse Distance Weighted (IDW) function and the interpolated maps were reclassified to get the map units and legends.

Results and Discussion

The analyzed values for various physico-chemical properties and topographic features are given are given in Table 3.

Physical properties

The texture of the soils in the studied area ranged from sandy loam to silty clay loam with sandy loam being the dominant soil order. Based on the soil texture, the score was assigned in the range of 15-25. The structure of the soils varied from single grain to sub-angular blocky and accordingly, the score was assigned in the range of 3-15.

Chemical properties

The pH of the soils ranged from 5.2 to 7.9 with a mean value of 7.03 making the soils acidic to mildly alkaline in nature. The electrical conductivity of the soils varied from 0.01 dS/m to 0.16 dS/m with a mean value of 0.06 dS/m while the maximum value of exchangeable sodium percentage was found to be0.29% and the minimum value was 12.38% with a mean value of 2.09%.

Table 1 : Weightage of different soil parameters and soil classes for land irrigation suitability (Deka *et al.*, 2024).

Soil characteristics	Weightage	Soil classes				
		A (5)	B (4)	C (3)	D (2)	E (1)
Effective soil depth (cm)	**5**	>100 Deep	75-100 Moderately deep	50-75 Slightly Deep	25-50 Shallow	25 Very shallow
Surface texture	**5**	Sil, CL, L	C, SiC, SC	SL	LS	S, Si
Soil structure	**3**	Crumb, granular	Angular, sub-angular blocky	Platy	Columnar, prismatic	Massive, single grained
Available water capacity in effective profile depth (cm)	**5**	>21	21-14	14-7	7-2	<2
Saturated hydraulic conductivity (cm/hr)	**4**	6-2	2-0.5	12.5-6	25-12.5 or 0.5-0.25	>25 or < 0.25
Drainage	**2**	Well	Moderately well	Imperfect	Poor	Very poor
pH	**2**	6.6 -7.3	5.6-6.5	4.6-5.5	4-4.5	<4
EC (dS/m)	**1**	<1	1-1.5	1.51-2.50	2.51-3	>3
ESP (%)	**1**	<15	15-35	20-30	30-40	>40
Gravels (% by volume)	**2**	<15	15-35	35-55	55-70	>70
Slope (%)	**3**	0-2 Level	3-5 Nearly level	5-8 Very gentle	8-15 Gentle	>15 Strong
Erosion	**3**	Slight	Moderate	Severe	Very severe	Extremely severe
Total	**36**					

Table 2 : Land irrigation suitability classes and index.

Land Irrigability Classes	Land Irrigability Index	Interpretation
A (Highly suitable)	5-4	None to slight soil limitation for sustain use under irrigation
B (Moderately suitable)	4-3	Moderate soil limitation for sustain use under irrigation
C (Moderately suitable)	3-2	Severe soil limitation for sustain use under irrigation
D (Currently not suitable)	2-1	Very severe soil limitation for sustain use under irrigation
E Currently not suitable)	<1	Unsuitable for irrigation

Table 3 : Range values of different soil parameters for assessing irrigation suitability.

S. no.	Parameter	Value (Range)
1	Soil depth (cm)	75- 95
2	Soil texture	Sandy loam to Silty clay loam
3	Soil structure	Single grain to Sub-angular blocky
4	Available water capacity in effective profile depth (%)	2.83-28.59
5	Saturated hydraulic conductivity (cm/hr)	8.65-43.24
6	Drainage	Moderately well to Well
7	pH	5.2-7.9
8	EC (dS/m)	0.01-0.16
9	ESP (%)	12.4-0.30
10	Stoniness	Nil
11	Slope (%)	1.7-7.3
12	Soil Erosion	Slight to Extremely severe

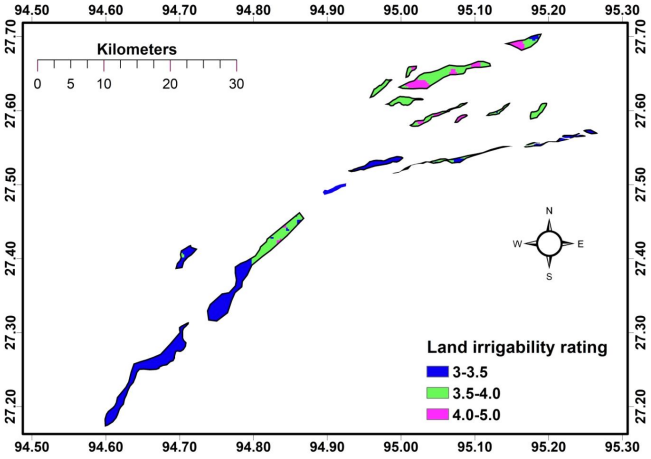

Fig. 3 : Land irrigability index map of Char areas of Dibrugarh district.

Hydraulic properties

The hydraulic conductivity of the study area varied between 0.85 cm/hr to 10.21 cm/hr with a mean value of 6.12 cm/hr. Based on the values the scores were assigned ranging from 12-20. The available water content (AWC) ranged from 1.62% to 28.59% with an average value of 7.60% and based on the available water content of the soils of the study area, the maximum score assigned was 25, while the minimum score was 5. The soils of the study area were found to be moderately well to well drained hence the score was assigned in the range of 8-10.

Slope

The slope of the study area varied from 1.7% to 7.3% with an average value of 4.37% and based on the slope per cent the score was assigned in the range of 9-15.

Soil erosion

The soil erosion or soil loss in the char areas of Dibrugarh district was calculated using the Revised Universal Soil Loss Equation (RUSLE). The maximum value of soil loss was 101.88 t/ha/yr (extremely severe) and the minimum value of soil loss was 3.45 t/ha/yr (slight) with a mean value of 35.16 t/ha/yr (severe). Based on the severity of soil loss, the scores were assigned in the range of 3-15.

Soil depth and presence of gravels

A profile study was carried out to measure the soil depth of the study area. The soil depth varied from 75 cm to 95 cm. Based on the soil depth a score of 20 was assigned to all the soils in the area. The presence of gravels or stoniness in the studied char areas of the district was negligible and hence a score of 10 was assigned to all the soils.

Evaluation of Land irrigability

The soils of the study area were classified into different irrigability classes varying from class A (Highly suitable for irrigation) to class E (Not suitable for irrigation) based on the calculated values of soil irrigability indices. Soil erosion was the limiting factor for land irrigability in the study area. A land irrigability map was prepared using the calculated values of irrigability index. It was observed that, out of the total geographical study area, 98.77% (143.81 sq. km) was moderately suitable for irrigation belonging to irrigability class B while 1.23% (1.85 sq. km) of the area was highly suitable for irrigation belonging to class A (Fig. 3.).

Conclusion

The study carried out in Char areas of Dibrugarh district near the Brahmaputra River revealed that out of 145.66 sq. km, 143.81 sq.km. of char areas (98.77%) was moderately suitable for irrigation, while only 1.23% of the total area was highly suitable for irrigation. Soil erosion was the most prominent factor which caused hindrance to irrigation in the study area. Use of soil erosion control measures can help in making the entire area highly suitable for irrigation.

Acknowledgements

Authors are grateful to Govt. of Assam for providing the financial support to carry out this research work at

Assam Agricultural University, Jorhat, Assam through the project “GIS mapping of Char areas of Assam using geospatial techniques for planning strategies of crop management and improving livelihood security”.

References

Bhushan, M. and Roy B. (2018). Soil and Land Irrigability Classification for Soils of Bhagwanpur Distributary of Gandak Irrigation Scheme in Bihar, India-A case study. *J. Adv. Res. Dynamical and Control Systems,* **10(6)**, 864-873.

Bijarniya, M., Deka B., Dutta M., Sarma C.K., Patgiri D.K. and Karmakar S. (2025). Land irrigability classification of riverine soils in lower Brahmaputra valley zone of Assam India. *Plant Archives*, **25(1)**, 1078-1082.

Danbara, T.T. and Zewdie M. (2022). Assessment of suitable land for surface irrigation using spatial information systems: Case of Bilate River Basin in the Rift Valley Lakes Basin, Ethiopia. *Comput. Elect. Agricult.*, **202**, 1-12.

Deka, B., Sarma B., Dutta M. and Patgiri D. K. (2024). Land irrigability classification of soils in Simen river basin under north bank plain zone of Assam, India. *Plant Archives*, **24(2)**, 1293-1298.

Jackson, M.L. (1973). *Soil Chemical Analysis*. Prentice Hall of India Pvt. Ltd., New Delhi.

Palaskar, M.S. and Varade S.B. (1985). Suggested modification in soil Irrigability Classification. *J. Maharashtra Agricult. Univ., India.*

Sehgal, J.L. (1996). *Pedology – Concepts and Application*. Kalyani Publishers, New Delhi, pp. 1-488.