Land capability classification of Langate block, Kupwara district, Kashmir

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Abstract: A study was undertaken to characterize, classify and map the soil resources of Langate block of Kupwara district during 2017 using standard method of soil survey in order to assess their land capability. The entire area was surveyed and nine pedons were exposed on the basis of soil heterogeneity, vegetation, physiography, elevation, slope and soil colour. Site features and morphological characteristics were recorded on-spot and physico-chemical properties were determined in the laboratory. The soils were classified on taxonomical and land capability grounds. The soils were classified under Mollisol and Alfisol orders and finally up to subgroup level as per Keys to the Soil Taxonomy of USDA (2010). As per the Land Capability Classification, soils were classified into II, III and IV capability classes with limitations of slope, erosion, wetness etc. The results revealed that soils were good to moderately cultivable lands.

1.Introduction

Soil survey constitutes a valuable resource inventory linked with the survival of life on the earth. It provides an accurate and scientific inventory of different soils, their kind and nature, and extent of distribution so that one can make prediction about their characters and potentialities. It also provides adequate information in terms of landform, slope, land use as well as characteristics of soils (*viz.,* texture, depth, structure, stoniness, drainage, acidity, salinity etc.) which can be utilized for the planning and development. The use of land is not only determined by the user but also by the land capability. For optimal utilization of available land resources on a sustainable basis, timely and reliable information on soils regarding their nature and extent along with their potentials and

limitations is important. General evaluation based on limitations of land characteristics, is best illustrated in the USDA Capability Classification (Kilngebiel and Montgomery, 1961). The classification points out automatically the possibilities and limitations of the climate and soil for each crop and type of agriculture. Crop cultivation without proper consideration of soil and site characteristics results in lower yield and deterioration of soil health. They need to be use according to their capacity to satisfy the need of its inhabitants. This can be achieved through proper investigations of land resources and their scientific evaluation. Land suitability evaluation is the process of estimating the potential of land for land use planning. The land capability is governed by the different land attributes such as the types of soil, its

depth and texture, underlying geology, topography, hydrology, etc. (Panhalkar,2011). The capability classification is one of a number of interpretive groupings made primarily for agricultural purposes Eight classes of land designated with Roman number I to VIII. First four classes are suitable for agriculture and necessity of soil conservation measures and management practices have been used in the class I to IV. Class V to VIII, are not suitable for agriculture, but can be used for pasture, range, woodland, grazing and wildlife purposes. The criteria for placing a given area in a particular class involves the landscape location, slope of the field, depth, texture and land use /land cover (Tideman, 2000).

2. Material and Methods

The region selected for present study Langate Block belongs to Kupwara district of Kashmir valley which has an area of 2,379 sq km. The study area Langate Block is located between 34.15^0 N to 34.28

^{0} N latitude and 74.09^0 E to 74.27^0 E longitude at 1583 metres above msl) of district Kupwara, Jammu and Kashmir. The study area was by actual traversing across the various land forms before the selection of representative sites. Keeping in view surface features like, physiographic changes, altitude and present land use, nine representative soil profiles at different locations were selected for studying the soil properties in detail. Nine sites were selected which represented the whole Block (map) of the valley. Thirty-six samples were taken from different horizons brought to the laboratory. The classification is based on the inherent soil characteristics, external land features and environmental factors that limit the use of land. Based on the susceptibility of soils to erosion (e), soil limitations (s), topography (t) and drainage (d) limitations the study area was classified into different land capability classes as suggested by Klingebiel and Montgomery (1961).Criteria for land capability classification of the study area is given in Table1.
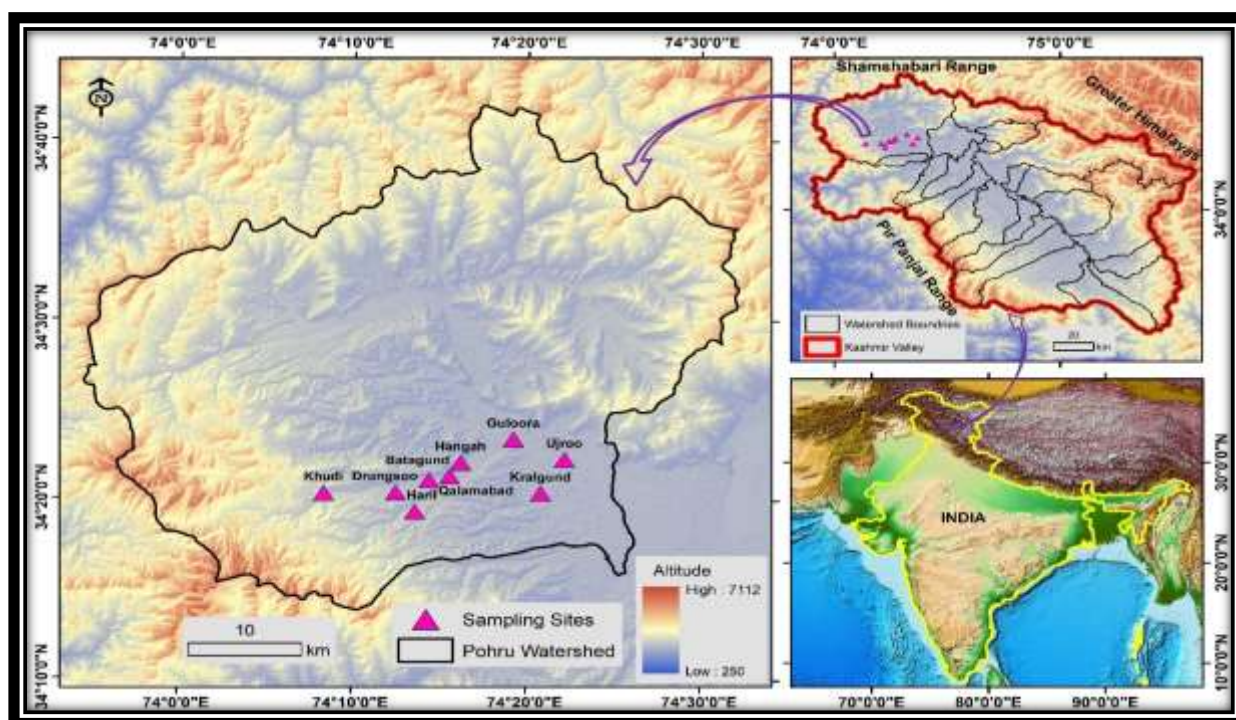
Map of the Study Area

Table1: Land capability criteria for Classification

Characteristics	I Class	II Class	III Class	IV Class	V Class	VI Class	VII Class	VIII Class
Topography (t)								
Slope (%)	0-1	1-3	3-8	8-15	upto 30	15-35	35-50	>50
Erosion	Nil	Slight	Moderate	Severe	Nil	Severe	Severe	
Wetness (w)								
Flooding	nil	nil	nil to slight	Slight to mod.	mod.to severe	nil to severe	nil to very severe	
Drainage (l)	Well	Mod. well	Imperfect	Poor	V. poor	Excessive	Excessive	Excessive
Permeability	Moderate	Mod. rapid	Rapid slow	V. rapid	V slow			
Physiological soil conditions								
Surface texture	Loam	sil & cl	sl & c	scl	s, c(m)	ls cl	ls, s, c)	ls, s, c(m
Surface coarse fragments (%)	1-3	3-15	15-40	40 -75	15-75	75+		
Surface stoniness (%)	<1	1-3	3-5	5-8	8-15	15-40	40-75	>75
Soil depth (cm)	>150	150-100	100-50	50-25	-	25-10	25-10	<10
Fertility (f)								
CEC (cmol (p+) kg^{-1})	40-16	16 -12	16-12					
Base saturation (%)	80+	80+	80-50	50-35	50-35	35-15	<15	
OC (0-15 cm) (%)	>10	0.75-1.0	0.5 -0.75	>0.5	>0.5			
EC (dS m-1)	<10	1-2	2-4	4-8	8-15	15-35	35-50	>50

3. Results and Discussion

According to site features studied in the field, morphological and physico-chemical characteristics, three capability classes II, III and IV were found to be prevalent in the cultivated soils of the study area with some limitations of slope, erosion and root restriction problems (Table 2 and 3). Pedons 1 and 3 were placed under capability sub-class II which were good cultivable lands for sustainable agriculture with no major restriction limitation. The management practices suggested for these pedons Proper drainage and fertility management. Pedon 2 was placed under capability sub-class IIs which was a good cultivable land for sustainable agriculture with limitations of slight erosion,gentle slope and soils were slightly acidic in nature. The management practices suggested for this pedon were proper fertility management, crop rotation, green manuring, suitable land for paddy and other cereals.Pedon 6 was placed under capability sub-class IIe which was a good cultivable land for sustainable agriculture with limitations of slight erosion. The management practices suggested for this pedon were proper irrigation and fertility management, cultivation of cereal crops. Pedon 4 was placed under capability sub-class IIIe which was a moderately good cultivable land for sustainable agriculture with limitations of slight erosion, undulating topography,low base saturation and CEC. The management practices suggested for this pedon were terracing, moisture conservation, green manuring, fertility management, floricultural nursery establishment, and plantation of apricot are well. Pedons 5 and 7 were placed under capability sub-class IIIes which were moderately good cultivable lands for sustainable agriculture with limitations of slight erosion, moderately shallow depth and sandy texture in surface. Pedons 8 and 9 were placed under capability sub-class IVes which were moderately good cultivable lands for sustainable agriculture with limitations of severe erosion, moderately steep sloping, moderate runoff, low base saturation and CEC. The management practices suggested for this pedon were terracing, moisture conservation, green manuring, fertility management, floricultural and medicinal plantation, forest nursery, conservation of crop residues and animal manures and green manuring. In general the land capability sub-classes indicate that the soils are moderately well to fairly good cultivable with limitations of slope, physical conditions and erosion. The results are in conformity with the studies of Gangopadhyay et al. (2011); Khanday et al. (2013); Abdelrahman et al. (2016) and Rehman et al. (2017).

Table 2: Land capability classification of Langate Block of District Kupwara

Pedon	Slope (%)	Erosion	Flooding	Drainage	Permeability	Surface texture	Stoniness	Coarse Fragments (%)	Depth (cm)	CEC	BS (%)	O.C (%)	dsm^{-1}	Capability Class
P$_1$ (Kralgund)	I	I	I	II	I	II	I	I	II	III	III	I	I	II
P$_2$ (Guloora)	I	II	I	II	I	II	I	I	II	III	III	I	I	II
P$_3$ (Ujroo)	I	I	I	II	I	II	I	I	II	II	IV	I	I	II
P$_4$ (Hangah)	III	II	I	I	I	I	II	II	III	III	IV	I	I	IIIe
P$_5$ (Batagund)	I	II	III	I	I	I	III	III	II	III	III	I	I	IIIe
P$_6$ (Qalamabad)	I	II	I	I	I	II	I	II	II	III	IV	I	I	II
P$_7$ (Haril)	IV	IV	I	III	I	I	I	I	III	III	III	I	I	IIIes
P$_8$ (Drungsoo)	IV	IV	I	III	I	I	II	II	II	III	III	I	I	IVes
P$_9$ (Khudi)	IV	IV	I	IV	I	II	II	II	II	III	III	I	I	IVes

Table 3: Land capability classification of arable soils of Langate Block of district Kupwara

Pedon	Capability class	Land suitability	Remedial measures and suggested Land use
P_1 (Kralgund)	II	Land suitable for cultivation with no major limitation	Proper drainage and fertility management, apple cultivation with pulses inter cropping may be more remunerative. The site area is also suitable for paddy, maize and other vegetable crops.
P_2 (Guloora)	II	Land suitable for cultivation with no major limitation	Proper drainage and fertility management, apple cultivation with pulses inter cropping may be more remunerative. The site area is also suitable for paddy, maize and other vegetable crops.
P_3 (Ujroo)	II	Land suitable for cultivation with no major limitation	Proper drainage and fertility management, apple cultivation with pulses inter cropping may be more remunerative. The site area is also suitable for paddy, maize and other vegetable crops.
P_4 (Hangah)	IIIe	Cultivable land with moderate limitation of erosion.	Terracing, moisture conservation, green manuring, fertility management, floricultural nursery establishment, and Plantation of apricot shall be good for the area.
P_5 (Batagund)	IIIe	Cultivable land with moderate limitation of erosion.	Terracing, moisture conservation, green manuring, fertility management, floricultural nursery establishment, and Plantation of apricot shall be good for the area.
P_6 (Qalamabad)	II	Land suitable for cultivation with no major limitation	Proper drainage and fertility management, apple cultivation with pulses inter cropping may be more remunerative. The site area is also suitable for paddy, maize and other vegetable crops.
P_7 (Haril)	IIIes	Land suitable for cultivation with severe limitations of erosion and slope	Bench terracing, moisture conservation, green manuring, fertility management, floricultural nursery establishment, and plantation of apricot are suitable. moisture conservation, Fertility management
P_8 (Drungsoo)	IVes	Land suitable for cultivation with severe restrictions	Bench terracing, moisture conservation, green manuring, fertility management, plantations of floricultural and medicinal plants, forest nursery, conservation of crop residues and animal manures and green manuring
P_9 (Khudi)	IVes	Land suitable for cultivation with erosion limitations	Terracing, moisture conservation, Green manuring, Fertility management, floricultural and medicinal plantation, forest nursery, conservation of crop residues and animal manures and Green manuring.

5. Conclusion

The pedons were taxonomically categorized into orders Alfisols and Mollisols and were finally classified up to sub-group level. The land capability classes *viz*: II, III and IV in the study area reveals that the soils are cultivable with limitations of topography, wetness and physical conditions which could be rectified by following the suggested land use in order to maximize the productivity and profitability out of the soils to enhance better economy of the area. It is necessary to implement appropriate land use practices such as plantation and successful introduction and adoption of agricultural technologies on a sustained basis

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