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ANALYSING THE SOIL TYPES OF KASHMIR VALLEY AND TO ASERTAIN THE AREAS AFFECTED BY SOIL EROSION IN KASHMIR

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Abstract: Soil is the naturally occurring fragmented, porous, and relatively loose assemblage of mineral particles and organic matter that covers the surfaces of our planet's terrestrial domains. The valley of Kashmir is endowed with different soil types with unique characteristics. The present study has shown that soils of Kashmir exhibit differences in their physical and chemical characteristics, as well as in their capability for different crops. It was found that the soils found in rest of India are also found in the valley but there are few soils which are different from the rest of India.

Key Words: Soil type, Soil erosion, Kashmir valley

1. Introduction

The name of Kashmir implies "land desiccated from water". The term has been derived from Sanskrit *Ka*water, *Shimira*to desiccate. In Sanskrit Puranas, Kashmir is called Gerek (hill) nestled as it is in hills. In chapter VIII of *Avanadikosha,* themeaning of the word Kashmir is given as 'land, ruling in which is difficult'. The ancient Greeks called it Kashpeiria, and in the classical literature Herodotus mentionsit as Kaspatyros and Hekataios calls it by the name Kaspalyros or Kaspapyros. It is called 'Shie-mi'in the narrative of To Yeng and Sung Yan (578 AD). Huien Tsiang, a Chinese traveller, who visited Kashmir in 631 AD, calls it Kia-shi-mi-lo. Kashmir has further been shortened into Kashir by the Kashmiris in their own tongue. It was also called as *Kismire, Cassimere, Chishmeere, Kachemire, Cashmere, Kashmire, Cashmeer* (Foster, 1921; Bernier, 1891). The Tibetans call it Khachal (snowy mountain), and the Dards (the inhabitants of Gures, etc.) Kashrat (Koul, 1925). Ptolemy called this territory as Kaspeiria, In the poem of Dionysios 'Kaspeiroi' is mentioned as a tribe (Stein, 1899). Kashmir region is a political division of the Jammu & Kashmir state which mainly consists of the Valley, and the surroundings hills and mountains along with numerous side valleys. The region lies between Zanskar and Dhauladhar ranges. It is 135kilometres long and 40 kilometers broad in its middle – the broadest part (Wadia,1919). Valley of Kashmir is restled in the north-western folds of the Himalayas and is surrounded on almost all sides by mountain ranges. It is an oval shaped valley filled with thick deposits of alluvium. The valley is drained by the vitatsa (Jhelum) and its tributaries viz., Lidder, Indus, Pohru, Sandran, Bring, Vishav & Sukhnag.

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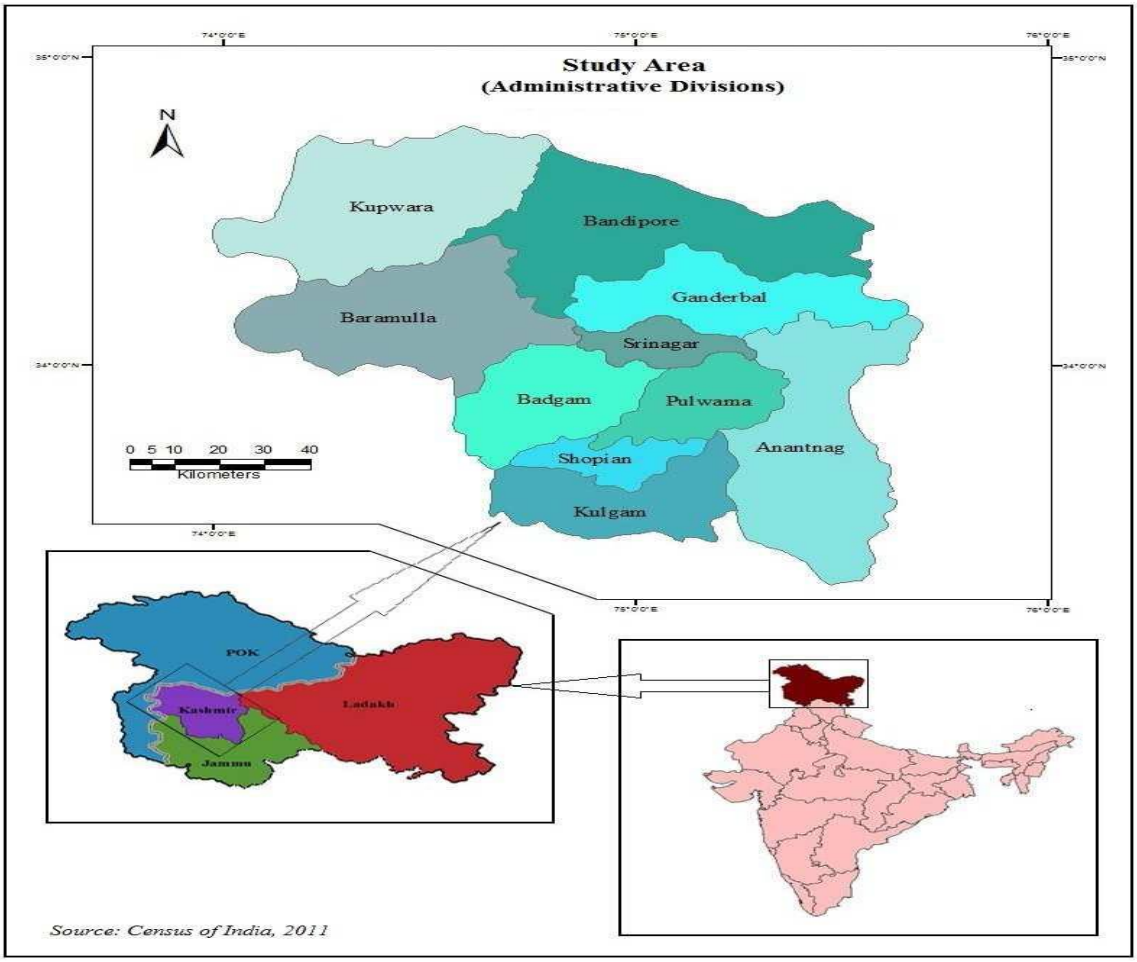

Fig. 1 Location map of the study area.

2. Geographical Setting:

The region of Kashmir lies between the Pir Panjal and the main Himalaya (Fig. 1). It is a great basin of about 135 by 40 kilometers, with its floor lying 1585 metres above sea level. The floor is the floodplain of the Jhelum River. The most striking feature of the region is the flat-topped terraces known as Karewas. These Karewas are the deposits of clays, sands and silts of the lacustrine origin (Spate and Learmonth, 1967).

Kashmir today is a cool, temperate place, full of poplars, willow, chinar, apple and walnut trees. The vegetation and the environment that we see today have been continuously modified in the past by climatic changes, geological uplifts, as well asby anthropogenic activities. If we scan the last two million years, we find that the valley has gone through subtropical and glacial (cold) climates. In fact, it has experienced several Ice Ages (Agarwal, 1988). The valley was a huge lake, called *Satisar*, which was desiccated later. The Wular lake through which Jhelum flows and the Dal Lake are remnants of this lake (Krishnan, 1949). Irfan Habib (2010) testifies that it was a Chinese pilgrim, Xuan Zhaung (AD 640) who for the first time recorded that Kashmir Valley was a lake. The rise of Pir Panjal range on the southwest and the Himalayan foothills on the north-east had created a vast lake, or perhaps a number of lakes in the present Kashmir valley. Further rise of the Pir Panjals lifted up even the lake sediments, shifting the basin towards the Himalayan flank. In recent geological times, the basin drained out through the Jhelum and large areas of land emerged. In the last few hundred thousand years, the wind transported glacial silts provided a mantle of silt-like dust (loess) all over the valley. Glaciers, in the wake of their retreat, left a large number of

ponds which in course of time changed into bogs and preserved excellent pollen records of the vegetation changes of the last 20-30thousand years (De Terra and Paterson, 1939).

Kashmir has been described as "the province or country" consisting of "an extensive plain, surrounded on all sides by lofty mountains". It is also considered as "the valley of the river veth, or Jehlam, which is separated from that of the Chenab on the south, by rugged and often snowy ranges, and from the basin of the Indus on the north, by the main axis of the Western Himalaya, which, originating in the peaks of Kailash, separates the basins of the Sutlej and the Chenab from that of the Indus. The mountains which surround the plain of Kashmir are very lofty. Those on the north are for the most part bare and rugged on their southern face, while those which lie to the south appear from the plain to be magnificently wooded with forests of pines and deciduous-leaved trees, descending almost to their base. On both sides of the valley the mountains rise above the level of perpetual snow, but those on the north side are considerably loftier than the others. Numerous transverse valleys penetrate into these mountains, which are well cultivated in their lower parts, and, higher up, present superb mountain scenery (Thomson, 1852).

3. Objectives:

1. To study the various types of soils in Kashmir valley.
2. To ascertain the areas affected by soil erosion in Kashmir valley.

4. Database and Methodology:

The study is based on both primary and secondary data. The primary data is collected from Sher- I- Kashmir university of Agricultural Sciences and Technology (SKUAST) and secondary data is collected from different books and research papers. The primary data is analyzed through tables and different maps. The maps have been digitized by Arc view and GIS.

5. Results and Discussion:

The naturally occurring thin layer of unconsolidated material on the earth's surface that has been influenced by the parent material, climate, relief, and physical, chemical, and biological agents is known as soil'. Soils exhibit differences in their physical and chemical characteristic (soil structure, soil temperature, soil texture, soil humus, soil water), as well as in their capability for growing crops soil may be classified into:

i. Zonal, in broad latitudinal zones or belts.
ii. Inter-zonal, resulting from special parent rocks, (i.e., limestone, sandstone).
iii. Azonal or immature soil, new material on which soil forming processes have not had sufficient time to work.

In brief, differences in soils arise from the mineral composition of the parent materials and from differing climatic conditions, which together influence the organic and inorganic processes of soil development. A comprehensive soil map of Kashmir valley, based on scientific data, has not been prepared so far. The available soil maps of the valley give a parochial picture of the soils. The land revenue records and settlement reports have classified soils on the basis of texture, structure and colour, while the rural folk and cultivators recognize their soils by different nomenclatures which differ from slope to slope and in many cases from village to village. Under the existing geo-climatic conditions, a wide range of soils, both of residual and alluvial origin is found in the valley. The Kashmir Valley is essentially hilly and mountainous. The hilly and mountainous areas are generally covered by the residual soils, while the upper reaches of the Jhelum and their tributaries are covered with alluvial and morainic soils. On the basis of rock strata and pedogenic characters, the following major categories of soils (see Fig.2) may be identified in the Valley.

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5.1 Hilly and Mountainous Soils:

The hilly and mountainous soils are found in the entire Kashmir valley excepting the valley floor of Kashmir. The undulating topography and steep slopes affect the run-off and drainage system. Other things being equal, the run-off is large on steep slopes. As a rule, more the water run-off, lesser is its absorption in the soil on steep slopes. The run-off also washes away more of the weathered rocks on steeper slopes. The depth of soil and soil profiles on steeper slopes are consequently shallower than that on gentle slopes. Many soils in the mountainous areas are shallow, immature and highly susceptible to soil erosion.

These soils are generally, acidic in character, deficient in potash, phosphoric and lime and therefore, need regular manuring and fertilization for good yields. The humus content in these soils varies from slope to slope and altitude to altitude. Depending on the availability of sunshine and rains, these soils are generally devoted to the cultivation of maize, pulses, orchards (almonds, apples, peach, and pears), oilseeds, barley, wheat, oats and fodder.

The higher altitudes, between 2500 m to 4000 m are reserved as alpine pastures. These pastures develop nutritious grasses during the summer season which are grazed and utilized by the Gujjars and Bakarwals for their flocks of goats, sheep and horses. Scarcity of water, leaching, erosion and avalanches are the main problems of these soils. These problems are getting accentuated owing to the indiscriminate felling of trees and depletion of ecosystems.

5.2 Alluvial Soils:

The alluvial soils are deposited by the action of rivers. They are found in the river channels, floodplains, estuaries, lakes and fans at the foot of mountains. The alluvial soil includes all consolidated fragmented material from the coarsest gravels and sands down to the finest clay and silt-sized particles. In other words, sand, silt and mud brought down by rivers in floods and deposited on the temporarily submerged land are known as the alluvial soils. These are the most productive soils of the state, found mainly in the Jammu- plain, the valley floor of Kashmir and at narrow river terraces along the tributaries of the Chenab, Jhelum and their tributaries.

The alluvial soils may be classified into following two types:

i. The old alluviums, and
ii. The new alluviums.

The old alluviums lie above the banks of rivers and are generally free from floods, while the newer alluviums are frequently inundated as they lie in the flood plains of the Jhelum, and their tributaries. New alluviums (Khadar) soils are relatively coarse in texture and contain more sand than that of old alluviums (Bhangar) soils. The alluvial soils, wherever, irrigated grow two to three crops in a year.

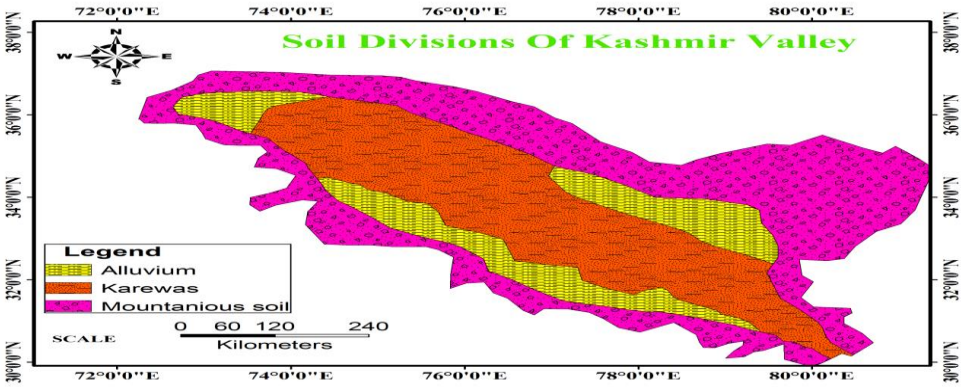

Fig. 2 Major soil divisions of Kashmir valley

Source: Generated from ICAR, 1992.

In the Valley of Kashmir, these are largely devoted to paddy, maize and orchards. Being highly productive, these soils are giving good returns of the High Yielding Varieties of wheat and rice in the areas of controlled and assured irrigation.

5.3 Karewa Soils:

Karewas are fresh-water (fluviatile and lacustrine) deposits found as low flat mounds or elevated plateaus in the Valley of Kashmir. The important Karewas are found in Kulgam, Shopiyan, Badgam, Qazigund, Tanmarg, Gulmarg, Baramulla, Laithpora, Chandhara, Pampore, Bijbehara, Awantipora, Islamabad (Anantnag), Mattan, Tral and Ganderbal. The Karewa soils are composed of fine, silty clays with sand bouldry gravel, the coarse detritus being as a rule, restricted to the peripheral parts of the valley, while the finer variety prevails towards the central parts. The Karewa soils of Kashmir have enormous agricultural potential. Commercial and cash crops like saffron, almond, apples, walnut, peaches, pears, cherry, plum, etc., with orchards and saffron beds. Moreover, some leguminous and fodder crops are also grown in Karewa. The pampore Karewa is famous all over the world for saffron cultivation. Soil erosion and depleting soil fertility are the major problems of the karewa soils. It has been reported by the farmers of the Chandhara and Dusu villages (Pampore-Karewa) that with the passage of time the karewa soils are losing their resilience characteristics.As a matter of fact, the per unit production of saffron and almond has gone down substantially during the last three decades. The soil conservation practices need to be adopted to maintain the health of the karewa soils, making them economically more productive and ecologically more sustainable.

5.4 Soils types of Kashmir Valley:

Fig. 3 gives the distribution of different soil classes in Kashmir valley. The various soil types predominantly include the following:

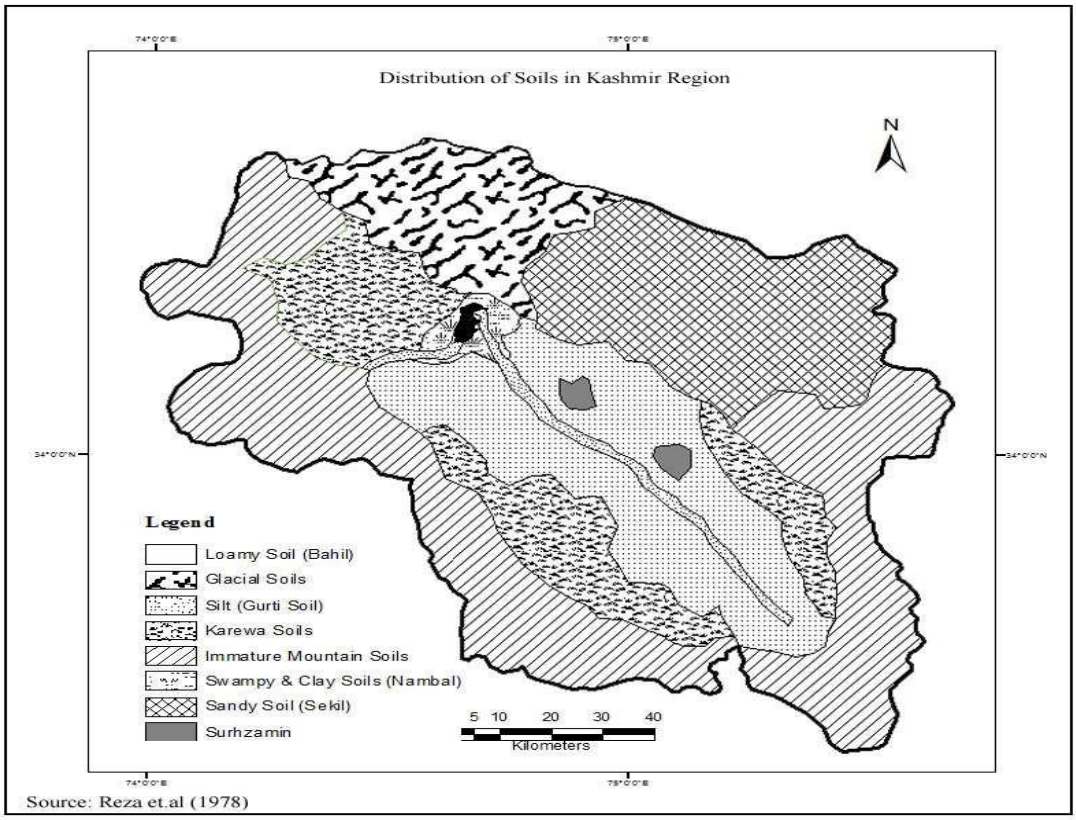

Fig 3. Distribution of soils in Kashmir valley

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i. Gruti (Clayey Soil):

Gruti soils contain a large proportion of clay. Texturally, it resembles to the clayey loam. Its water retaining capacity is high. In years of scanty rainfall, it is considered to be the safest for the cultivation of rice. Contrary to this, if rams are heavy, the gruti soil gets compacted and achieves the shape of hard cakes; the ploughing of which becomes difficult and pulverization of soil is an arduous task. In the years of scanty rainfall, these soils give poor yields. The gruti soils are found in the low-lying areas of the Kashmir Valley.

ii. Behil (Loamy Soil):

Behil is a rich loam of great natural fertility. The humus content is high which enriches the soil fertility. Consequently, it does not require heavy manuring. Moreover, there is always a danger that by over-manuring the soil will be too strong, in which the rice crop will show more vegetative growth and will be more susceptible to lodging. It is ideally suited for paddy cultivation.

iii. Sekil (Sandy Loam):

Sekil is a light loam with sandy subsoil. In the sekil soil field if artificial irrigation is available, good crops of rice are harvested in the summer season. Sekil soil is generally confined to the lower edges of karewas in the Valley of Kashmir.

iv. Dazanlad (Sandy Silt):

Dazanlad soil is chiefly found in the low-lying ground near the swamps, but it sometimes occurs in the higher villages also. The soil has an admixture of sand and clay and becomes more warm in the summer season. A peculiar characteristic of dazanlad is that the irrigation water when stands in the fields turns red in colour. If controlled irrigation is provided, high yielding varieties of rice can be grown successfully in dazanlad soils.

v. Nambal (Peaty Soils):

Near the banks of the Jhelum River and in the vicinity of the Wular, Manasbal and Anchar lakes is found the rich peaty soil, locally known as Nambal. In the years of normal rainfall and moderate snowfall, nambal soils give good yields of rape-seed, mustard, maize, oats, pulses and fodder.

vi. Karewa soils:

The Karewa soil is generally Gruti. The most productive Karewa land has blackish soil known as Surzameen. The red Gruti is the next best while the yellow buff soil is known as the worst of all. It is found in the Karewas of Pampore, Kulgam, Qazigund, Budgam, Tral, Baramulla, Mattan and Ganderbal

vii. Tand (Mountainous Soils):

The land on the slopes of mountains, reclaimed from the forests is called Tand soil. After reclamation the tand gives good yields of maize, pulses and fodder for two or three years, but under the impact of accelerated soil erosion the land loses its natural strength. Consequently, the productivity declines and after a period of about six to ten years the land acquires the shape of a pasture and culturable waste.

viii. Zabelzamin (Alkaline Soils):

Patches of irrigated land if excessively irrigated lose their fertility and develop alkaline formations. Such adversely affected patches of saline and alkaline formations are known as zabelzamin. These soils are unproductive from the agricultural point of view unless especially treated with gypsum, water and manures.

ix. Glacial soils:

The glacial soils have found in entire Madhumati basin and eastern Pohru basin.

x. Surhzamin:

It is especially cured and highly manured soil for vegetable culture. It has a darkish ash colour and a thick layer of manure. Surhzamin is rated as the best soil in fertility. It is found in the vicinity of Srinagar and Tral.

xi. Kharzamin:

It is a saline soil and is unfit for cultivation.

xii. Rad: It is a term used for soils of the floating gardens.

5.5 Soil Erosion in Kashmir Valley:

The Kashmir Valley is highly vulnerable to soil erosion and landslides because of its mountainous nature and faulty land use. There are vast barren hills and erosion in lower foot hills in quite rampant, particularly Karewas. No data is available in respect of the magnitude of soil erosion problem in the state. On the basis of sample survey of some representative catchments, it is estimated that 60% of the land area is estimated affected by erosion in one form or the other; and 30% of the area is under severe erosion.

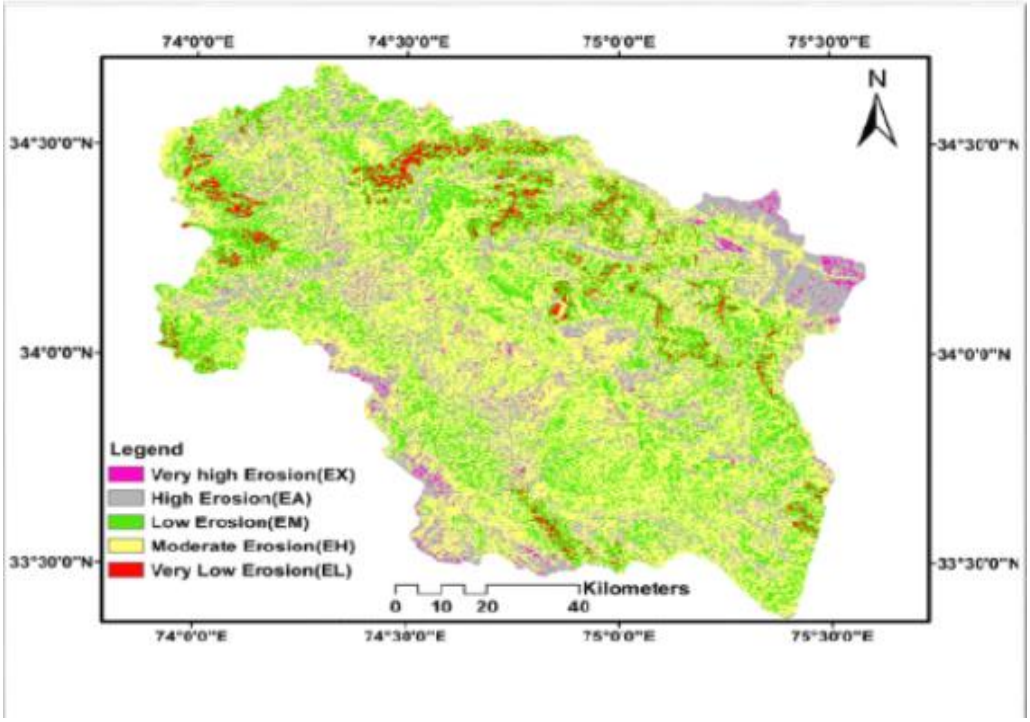

Fig.4 Soil erosion affected areas in Kashmir valley

Comprehensive estimation of the extent of land affected by erosion in Kashmir region is, however, available as no systematic work has been done in this respect so far.An estimate of magnitude of erosion is possible within the framework of following six regions: The valley bottom adjoining paddy growing zone with gentle slope, Karewa slopes and uplands, the forest zone, the alpine pasture land and the rocky slopes and glacier zone. The first and last have no erosion problems as such. The valley bottom is almost flat, while the high-altitude rocky exposures have no soil cover to be eroded away. Similarly, erodibility is of no order in the paddy belt of Jhelum flood plain. It is only the dry forming lands of Karewas where erosion is a real hazard. Sheet and gully erosion, the most dangerous one (in terms of the amount of soil removed), are common in these Karewas. The absence of any irrigation in the Karewas, leaves it an extensive devastation. Fig. 4 shows areas with different risks of soil erosion.

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6. Conclusions and Suggestions:

Since soil takes so long to form but is so easily lost, it is important that steps should be taken to halt soil erosion immediately; there are incipient signs of its action. Once erosion has occurred and the topsoil has been lost, little, of course, can be done, but where it is in process, action can be taken to check it. As a result of devastation, the government initiated wide-spread soil conservation methods which have very largely tried to bring the problem under control, without much success. The soil erosion is still rampant, and good soil, which the farmers can ill afford to lose, is being lost. Soil conservation, however, is as much a matter of education as of capital. Regarding the intensity of soil erosion, the soil conservation becomes very essential. The Govt. in past has been making generous allotments of funds for soil conservation operation. But the results have not been impressive partly because different departments and agencies has been executed these works in isolation, without any integrated approach to problem.

The first really serious and large-scale attempts to tackle the grave problem of soil erosion was started in the year 1976 when, the soil conservation board was set up on the basis of recommendations from the board of directorate of soil conservation, with the following functions:

i. Research
ii. Demonstration
iii. Formation of soil conservation scheme
iv. Monitoring
v. Evaluation and coordinate of soil conservation activities of various departments

The soil conservation departments gave some measures to protect soil erosion viz;

- By adopting suitable crop rotations which will prevent the exhaustion of the soil.
- By paying due attention to drainage, to ensure that the soil is adequately aerated and does not become water-logged.
- The terracing of sloping land to prevent the soil being washed down slope and swept away.
- The plugging of gullies with the construction of bunds (barriers) to catch the soil that is being removed.
- The use of strip-cropping which helps to check both run off and wind erosion.
- The afforestation of steep slopes, where there is rapid run-off, for the forests protect the ground and roots help to hold the soil in place.

Prevention is better than cure, but it is clear that if soil erosion is to be prevented on a global scale, then improved agricultural practices, the diversification of forming and scientific agricultural education must be introduced. Only when man is made to realize that the soil is a basic natural resource which is irreplaceable and must not be squandered, but must be seriously cared for and natured, then will the problem of soil erosion be solved.