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Agro-Climatic Zones of the Jammu Siwalik

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Abstract

An attempt has been made here to divide the Jammu Siwalik into agroclimatic zones in order to have an understanding of the cropping system that may he suitably adopted in such a region. For delineation of the Siwalik into agroclimatic zones broad pedogeomorphological divisions (soil), moisture adequacy index and agricultural productivity have been taken into consideration. The agricultural productiivity of the region has been worked out according to Bhatia's (1967), productivity method and moisture adequacy index has been estimated on the basis of Subrammanyam's (1963) model. To test the weightage of these two components, the residuals from regression matrix have been applied to evaluate the results. On the basis of these estimated values, a macro agroclimatic map of the area has been prepared. It was later superimposed on pedogeomorphological map of the area. Thereby three macro and seven micro agroclimatic zones have been obtained. The region is dominated by Alfisols, Ultisols, Entisols and Inceptisols with sand loam, clay loans, loam and silt loam texture which support the cultivation of wheat, maize, rice, bajra, oilseeds and pulses. The moisture adequacy index ranges between 0.70 and 0.97, with udic, ustic and xcric soil moisture regime.

Introduction

The agricultural potential of a country or a region depends mainly on the efficient use of natural resources for food production. The instability in agricultural production is caused primarily due to unpredictable monsoon rainfall. An appraisal of the agro-climatic potential should thus be considered as the framework on which the food production can be increased (Subramaniam and Rao, 1989).

The agro-climatic study is based on the combination of two words: agriculture and climate. Weather has an over-riding influenc on agricultural environment because climatological factors play a predominant role in the growth and development of plants. Of the various climatic factors, precipitation is one of the important parameters in the agricultural sector, which minimises the physiological drought and thereby increases the growth rate of plants. On the otherside, the climatic water balance study provides an information about the water requirements of the crops. Thus, an understanding of the interaction of the climatological conditions with biological processes of the plant is necessary for scientific farming which is based on planned cropping pattern and improved soil and water management practices (Subramaniam, 1990). The Hetero-geneity in the macro-climatic resources of India, necessitate studies on micro-regional

characterization of agro-climate, which could be an essential pre-requisite to exploit the natural resources to meet the demands of staggering increases in popuplation (Subramaniam, 1989).

Agricultural geographers have paid little attention to delineate the boundry of agro-climatic zonation of India. Only a few studies of preliminary nature have been carried out. Agro-climatic studies were primarily carried out by climatologists particularly Subramaniam and his team. Agro-ecological and agro-climatic studies in India were made by Murthy and Pandey (1978) Panabokke (1979) Subramaniam and Rao (1989) Chowdhary and Mandal (1989), and Basu and Chanda (I989). Murthy and Pandey, demarcated eight agro-ecological regions of India on the basis of analysis of the individual attributes viz., physiography, climate, soil, crop and agricultural regions. Panabokke classified the agro-ecological zones of south and southeast Asia, taking rainfall and soil as criteria. Subramaniam classified agro-ecological zones of India on the basis of Index of moisture adequacy. Subramaniam and Rao, delineated the agro-ecological zonation of Prakasam and Nellore districts of Andhra Pradesh, India, on the basis of moisture adequacy values and soil, in which the moisture regimes were superimposed on a soil map. Choudhary and Mandal divided West Bengal into eight agroclimatic zones on the basis of soil, annual and seasonal monthly moisture index, average temperature, growing periods and cropping patterns. Basu and Chanda divided-West Bengal into 11 agro-climatic zones on the basis of broad soil divisions and spatial variations in seasonal rainfall. The soil map was superimposed on the map of composite rainfall zones of West Bengal.

In Jammu and Kashmir, no such study has been carried out, despite its diverse physiographic and climatological characteristics. The present study attempts to describe agro-climatic aspects of the Jammu Siwalik (fig.1). The study region has humid to dry subhumid type of climate. It receives nearly 1307 mm of rainfall annually of which about 60 percent is received during the summer monsoon. Nearly 80 percent of the region falls under the dry farming tract of the Jammu and Kashmir State. The region supports the cultivation of wheat, maize, rice, pulses, oilseeds, jowar and bajra crops. The yield per hectare of these crops is not satisfactory due to limited irrigation facilities, undulating topography and a host of many socio-economic factors. Economically, Jammu Siwalik is far below the national as well state level in per capita income due to lack of agricultural development.

Land utilisation pattern indicates that 20 percent of the cropped area is under irrigation. As such scientific management of prevailing climate pedogeomorphology (soil) and water resources are essential for improving the economic status of the common farmer. Hence, detailed investigation will provide a comprehensive description of the existing natural resources of the region for optimum utilisation, to increase the productivity and minimize the instability.

Study Area

The Siwaliks have experienced a combination of climatic, tectonic and an anthropogenetic affect during the recent past, resulting in the development of certain morphogenetic characteristics, particularly

devastating gully erosion, associated with human and biotic interferences. The study area occupies the southern part of the Jammu and Kashmir State. It lies between the Ravi river in the east, and the Chenab river in the west, the Jammu plains in the south, and the Lesser Himalaya in the north. Geomorphologically, the area comprises of hogback ridges, consequent, subsequent and obsequent valleys, gullies, extended gullies, gorges, pediments, ephemeral and seasonal streams, earth pillars, alluvial fans, scree cones and terraces. The. study region is crossed by three important rivers: The Tawi, Ujh and Basantar. The Tawi and Ujh originate from the base of two main snowfields in Bhadarwah hills, at an altitude of 4200 metres a.m.s.l.

Physiographically, the Jammu Siwalik is a region of great inequality having Duns, hills, Kandi belt, Piedmont and Rolling plains. Large portions of Siwalik at Udhampur, Ramnagar, Ramkot and Billawar are separated from the Lesser Himalaya by a flat bottom valley termed 'Dun' and covered by thick gravel and alluvium. These 'Duns' are buttressed by a crust of hills, which ascend to an altitude of 1800 meters. Adjacent to these duns are located the Siwalik hills, Piedmont and the Rolling Kandi plain. 'The rate of erosion varies with the relief, being highest in the Siwalik hills and the Piedmont region, moderate in Kandi belt and quite low in the Dun region (fig.2). The Siwaliks are girdled on three sides by the lesser Himalayan ranges. The height of these ranges extends upto 2000 to 2500 meters. The study region has a sub-tropical type of climate, with a marked temperature variation in summer and winter months.

Method and Results

For demarcating the agro-climatic zones of the Jammu Siwalik, a systematic study of soils, agricultural productivity and moisture index has been carried out. The agricultural productivity has been worked out by Bhatia's (1967), method and moisture index by Thornthwaite's (1948) as well as Subrahmanyam's (1963), model of index of moisture adequacy. The soils have been studied with respect to their soil texture physiochemical characteristics and moisture regime. On the basis of the above variables soils have been classified into eight groups (fig. 3).

Agricultural Productivity

Agricultural productivity reflects the interaction between weather and soil, and also instigates the agricultural planners and scientists to introduce scientific management and package programmes for higher agricultural returns. The yield per hectare may he considered to represent the agricultural productivity in a particular region and that other factors of production be considered as possible causes for the variation, while comparing it with other regions (Shafi, 1984). The productivity of a region depends on the fertility and water holding capacity of the soil, depth of water table, intensity of rainfall, assured irrigation facilities and the method of cultivation. Of all the factors, precipitation, both its amount and its regularity, seems to be the most decisive factor in agriculture, since irrigation facilities are not well developed. The agricultural productivity of the region has been evaluated on the basis of the above attributes with respect to different physiographic (geomorphic) regions. In the present

study, 220 households spread over 11 sample villages distributed in four geomorphic regions have been surveyed to collect field data, pertaining to agricultural productivity measurements for difrerent crops. From each village, 20 households have been selected, on the basis of stratified random sampling. In the present study, Bhatia's (1967), method has been adopted, which is more scientific and is also an improved version of Deshpande and Sapre's (1964), model.

Table1, indicates the productivity index of the area, which ranges hctwecn 60.26 to 185.8. The index has been highest in the plain area (145.32-185.8), moderate in Dun region (108.15-120.45), and the lowest in Kandi belt and in the Siwalik hills (60.26--87.5). The high productivity is mainly due to assured water supply, fertile soils, plain topography and economical land holding. On the other side, the low productivity is largely due to lack of assured water supply, undulating topography, soil erosion, unsciencitific method of cultivation and scattered land holding. Moderate productivity in the region is mainly due to limited irrigation facilities, small size of holding and high moisture regime which is less suitable for the cultivation of - wheat, pulses, jowar and bajra crops.

Soil

The rocks of the area have been a source of material for soil formation. The cyclic sequence of the Upper, Middle and the Lower Siwalik of the study region begins with sandstone, mudstone, siltstone, massive clear grey and soft sandstone. Alternations of the Siwalik group occur throughout the region. These show varying characters and properties, both in space and time. Pebbles, cobbles, clay, shale, sandstone, sand, grit, conglomerate and boulders are generally overlain by horizontal beds of terrace material at places. The bulk of the rock being sandstone, does not allow degradation and clay formation and therefore, most of the soil comprises of residual sands.

In addition, the Siwalik consists of nearly unconsolidated, sandy gravelly sediments of tertiary age. Quartz, feldspar and mica are the main minerals of light-sand fractions, where as the heavy sand fractions contain epidote, homblende and ferruginous minerals. Mica is the dominant clay mineral followed by chlorite, Kaolinite and mixed layer minerals (Gupta, Anand and Sharma, 1988). The minerology of clay fraction mostly consist of mica or illite, chlorite, smectite, venniculite and Kaolinite. Soils of the study region are suffering from the problem of soil erosion, soil exhausion and deficiencies of nitrogen, phosphorus and potassium content. In the Siwalik hills and foot hills of the region, soils are generally calcareous in nature and varied in colour, texture and structure. But in Dun physiographic region the soils have lowest amount of clay in contrast to others, where coarse and fine sands are maximum, thus contributing to rapid to moderate rapid permeability. The soil in this region undergo leaching because humid climate and heavy rainfall decompose the residues of perennial species of vegetation, which fall in the form of leaves, dead and dried twigs and other vegetable matter and micro organism that develop under the canopy. The genesis of Siwalik soils clearly reveal their origin of alluvium derived from Siwaliks and deposited in flood plains. The soils have been named locally as *purani mitti* (paleao soil), *maira, rohi, kalar ali* (recent soil) etc;

depending upon their general characteristics and the significance attached to them from the angle of agricultural production.

Moisture Index

Moisture index was devised in 1948 by Thornthwaite in an attempt to identify, whether a station has positive or negative water balance i.e; a surplus or a deficiency of precipitation.

Water balance is evaluated on the basis of two important climatic elements such as temperature and precipitation, because their variation in the soil is related to the water problem in any region. Thornthwaite has taken two parameters for calculating moisture index. These parameters are precipitation effectiveness and potential evapotranspiration. Precipitation effectiveness is a technique, whereby the efficiency or usefulness of rainfall is related to crop growth, water supplies for industrial potential. Potential evapotranspiration (PE), which assumes an unrestricted supply of water to the surface (e.g. by irrigation) refers to the water need of a plant and to a theoretical maximum loss, actual evapotranspiration which is the observed or true loss of water through evaporation. It is apparent, that the actual evapotranspiration must be compared with precipitation in order to obtain the moisture index and also the potential evapotranspiration. When precipation is exactly the same as potential evapotranspiration all the time and water is available just as needed, there is neither water deficit nor water excess, and the climate is neither moist nor dry. As water deficiency becomes larger with respect to potential evapotranspiration the climate becomes arid. On the other side, if water surplus becomes larger, the climate becomes more humid. The relation between water surplus and water need constitutes an index of humidity. If there is water deficit and no surplus, the ratio between water deficit and water need is called an index of aridity.

Since water surplus and water deficiency occur, in different seasons, both must entre into a moisture index, the one affecting it positively and the other negatively. Although a water surplus in one season cannot altogether prevent the occurrence to water deficiency in another seasons, there might be a partial compensation of the water deficiency by the antecedent water surplus through the soil or even as ground water, for water surplus provides seasonal additions to subsoil moisture (Subrahmanayam, 1983). Deep-rooted perennials may make partial use of this subsoil water and thus minimize the effect of drought situation, since transpiration does not entirely cease but proceeds at reduced rates. In an overall view the amount of annual water surplus gives an approximate knowledge of the average runoff of a place while water deficiency provides information in irrigation planning. By such conside-ration, Thomthwaite, proposed a moisture Index (IM) based on the annual values of the humidity and aridity indices:

$$I_m = Ih - 0.6Ia \text{ or } Im = \frac{100s - 60d}{n}$$

Where I_m = moisture index

S = annual water surplus

d = annual water deficiency and

n = annual water need (or PE)

all expressed in the same units.

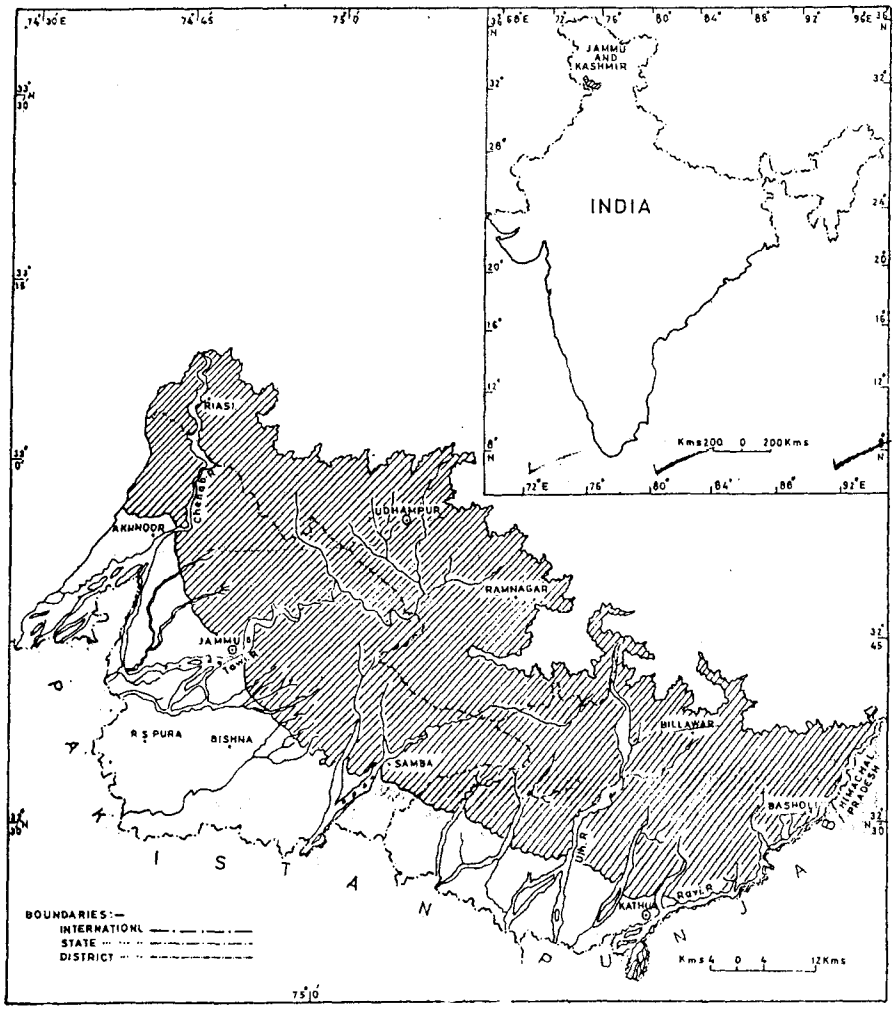

Fig. 1

Location of Jammu Siwalik

The moisture index (I m) of study region has been worked out on the basis of above method. It indicates that Jammu, Kathua, Mansar and Udhampur recorded indices of - 1.18, + 8.61, +19.75 and 27.43 respectively. According to above method the positive values of moisture index signify moist climates and negative values dry climates.

The knowledge of water surplus and water deficiency not only helps in assessing water requirements of crops, but also provide information for the cropping pattern in a region. The agricultural potential of a region largely depends on its ability to meet the optimum water requirements of crops in the various stages of their growth, called as

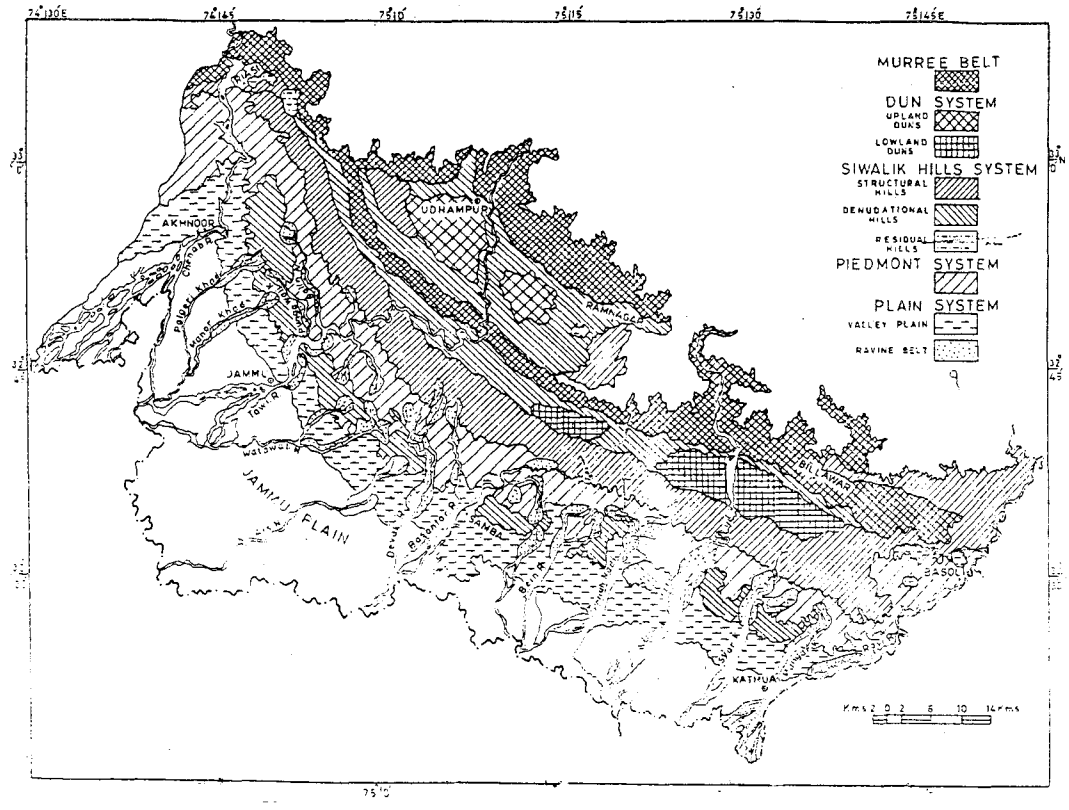

Fig. 2

Jammu Siwalik - Geomorphic Regions

moisture adequacy index. It depends on effective precipitation or assured irrigation.

Thomthwaite's method of moisture index was improved by Subrahmanyam, as "Moisture Adequacy Index". According to him, it would be more rational and appropriate if a water balance element like the index of moisture-adequacy (Ima) is considered instead of mere rainfall, since rainfall never fully reflects the moisture status of a region and also because plants do not use water from the precipitation alone that falls upon them. It indicates moisture availability in relation to water need or in other words, the agricultural suitability of a region. So that, moisture adequacy is utilised instead of rainfall. He defined it in terms of a ratio of actual evapotranspiration to potential evapotranspiration. By such considerations, Subrahmanyam was led to propose a moisture adequacy index (Ima), based on the annual values of the actual evapotranspiration (AF) and potential evapotranspiration (PE). Ima = AE / PE.

The moisture adequacy index for the study region ranges between 0.75 and 0.90. It is highest in the soils of Udhampur and lowest in Jammu as appended in Table 6. Highest moisture index (0.9), has been observed in forest soils which are suitable

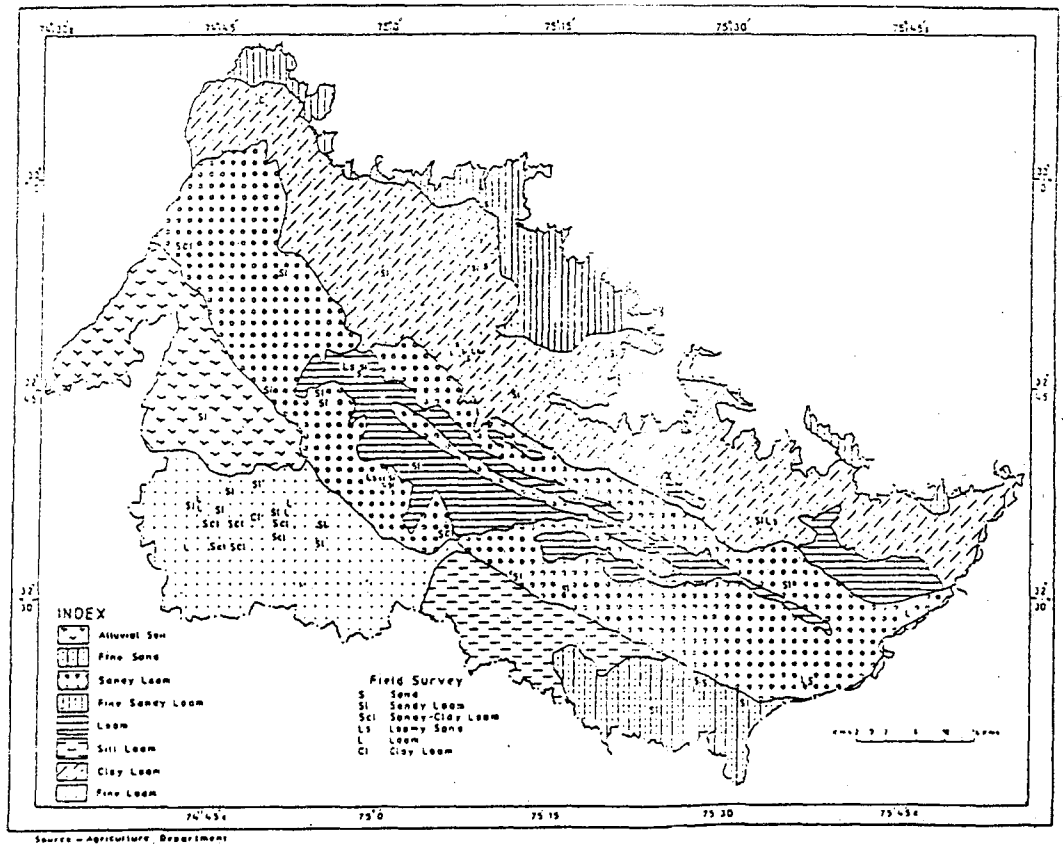

Fig. 3

Jammu Siwalik - Soil Types

for maize, rice, wheat, pulses and oilseeds cultivation. In Jammu and Kathua index of moisture adequacy varies from 0.75 to 0.80, the soils are best suitable for rice and wheat cultivation.

Agro-climatic Zones

Water deficit and surplus are two parameters of great importance for assessing the irrigation requirements and judging the agricultural potential of any region. Traditional varieties of crops and cropping system often do not make efficient use of available soil and water resources. Latest techniques of resources management, which help in more effective conservation and utilisation of rainfall and the soil are needed along with the new crop production systems, which increases productivity and minimises instability. Numerous attempts have been made to obtain a classification that will help in identification of regional boundaries between areas of uniform climatic conditions. However, most of the climatic classifications are bioclimatological in nature, that is, they relate the extent and type of natural vegetation on the surface of the

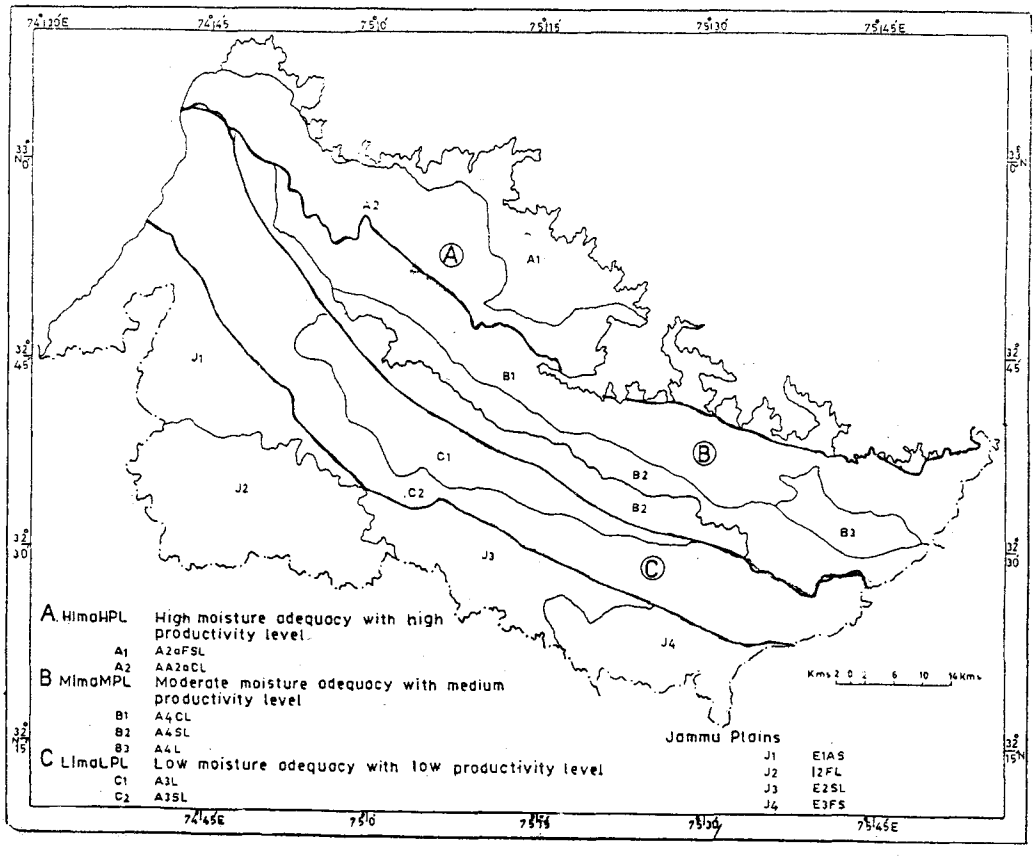

Fig. 4

Jammu Siwalik - Agro-Climatic Zones

earth to the climatic conditions. Hence, quantification of climate for agricultural production should be based on the ability of the climate to meet crop demands for water and suitability of the thermal regime (Subramaniam and Rao, 1989).

The meteorological data of four stations are available in area under study. But the agricultural productivity has been worked out from 11 villages as already discussed. In order to compare the agricultural productivity with the moisture adequacy index, we have combined all the villages which fall near Jammu, Kathua, Mansar and Udhampur meteorological stations and their productivity index has been applied. Village Rahya, Ramgarh and Pargalta fall near Jammu. Similarly, village Rakh-Lachipura and Tehr in Kathua, village Sagnoon and Patyari in Mansar and village Rathain and Jib falls in Udhampur. The remaining villages fall in Jammu plain.

In the present study, moisture adequacy index has been taken as a major variable in comparison to moisture index as the former gave appropriate results with agricultural productivity than with the latter.

Macro Agro-Climatic Zones

(i) High Moisture Adequacy With High Productivity Level

Physiographically this zone is located in Udhampur and Ramnagar upland Dun, covering an area of about 730.32 Km^2. In this zone moisture adequacy index ranges above 0.90. with intervening dry period of 3 to 4 months. The agricultural productivity index ranges between 108.15 and 120.45. Due to high ratio of actual evapotranspiration to potential (0.9), this zone can support crops for 5 to 6 months without irrigation. The major crops grown in this zone are maize, rice, wheat, pulses and oilseeds.

(ii) Moderate Moisture Adequacy With Mediums Productivity Level

This zone covers the area of Billawar, Basholi, Ramnagar and Jammu tehsil. It covers an area of about 741.32 Km^2. Physiographically this zone is located in the Billawar and Ramkot Dun and in Siwalik hills. In this zone the moisture adequacy index is moderate and it ranges between 0.80 to 0.85. There is a dry period of 4 to 5 months. The agricultural productivity index ranges between 73.31 to 112.32. Both irrigated and unirrigated crops like rice, maize and wheat are cultivated in this zone. Pulses, oilseeds, jowar and bajra are mainly cultivated in rainfed areas.

(iii) Low Moisture Adequacy With Low Productivity LeveL

Areas of Jammu, Samba, Hiranagar and Kathua tehsils come under this zone. Physiographically this zone is located in the Rolling Kandi belt, Siwalik hills and Piedmont region, covering an area of about 1954.03 Km^2. The moisture adequacy index ranges between 0.75 to 0.80, with intervening dry period of 5 to 6 months. In this zones the agricultural productivity is low and it ranges between 60.26 and 87.5. This zone can support the cultivation of crops like wheat, maize and rice on the basis of irrigated and unirrigated conditions. Where ever, irrigation facilities are available rice and wheat crops are cultivated on a large scale. Other crops like jowar, bajara, pulses and oilseeds are mostly cultivated on rainfed conditions.

For demarcating the micro agro-climatic zones, micro agri-climatic zones have been superimposed on a soil map. Soil is a basic constituent for the growth of crops, which conserve and utilise the rainfall. The following micro agro climatic zones have been worked out on the basis of major soil groups and soil moisture regime.

Zone 1: The upper portion of Ramnagar, Udhampur and Reasi tehsils comes under A_2a FSL group. This zone is dominated by Alfisols (Aqualfs), with fine sandy loam texture and with udic soil moisture regime. In this zone mainly rainfed crops like maize, rice, wheat, and pluses are cultivated. Soils of this zone are well drained, but due to high moisture ratio, it is more suitable for maize cultivation.

Zone 2: This zone covers the area of Reasi, Udhampur and Ramnagar tehsils. Group A_2acl falls under this zone with ustic soil moisture regime. Alfisols (Aqualfs) and Altisols (Udalf) of this zone are the major soil group with clay loam texture. In this

Table 1

Agricultural Productivity Index

(Based on sample survey)

Crops

Village	Rice			Wheat			Maize			Barley		
	Y	C	YC	Y	C	YC	Y	C	YC	Y	C	YC
1. Gajnsoo	1.502	0.404	0.606	1.304	0.338	0.440	1.229	0.31	0.038	1.288	0.0024	0.003
2. Musachak	1.403	0.50	0.701	2.424	0.404	0.979	-	-	-	-	-	-
3. Rakh-lachipura	1.246	0.203	0.252	0.708	0.362	0.256	0.835	0.078	0.065	1.815	0.016	0.029
4. Rahya	-	-	-	0.726	0.318	0.230	0.374	0.099	0.037	0.440	0.032	0.014
Ramgarh	-	-	-	0.605	0.424	0.256	0.555	0.164	0.090	-	-	-
6. Pargalta	1.125	0.002	0.002	1.022	0.314	0.320	0.633	0.137	0.086	0.678	0.017	0.011
7. Sagnoon	0.586	0.067	0.039	0.712	0.436	0.310	0.823	0.267	0.219	0.630	0.008	0.005
8. Patyari	0.374	0.006	0.002	1.342	0.316	0.424	1.016	0.162	0.164	1.384	0.018	0.024
9. Rathain	1.025	0.123	0.126	0.732	0.423	0.309	1.699	0.257	0.436	-	-	-
10. Jib	1.260	0.242	0.304	0.935	0.415	0.388	1.755	0.283	0.496	-	-	-
11. Tehr	0.481	0.241	0.116	0.488	0.352	0.171	1.078	0.160	0.172	0.773	0.016	0.012

Village	Pulses			Oilseeds			Millets			Productivity
	Y	C	YC	Y	C	YC	Y	C	YC	Index
1. Gajnsoo	4.696	0.0097	0.045	2.216	0.012	0.027	-	-	-	145.32
2. Musachak	-	-	-	-	-	-	-	-	-	185.8
3. Rakh-lachipura	0.215	0.130	0.027	0.036	0.017	0.006	0.258	0.050	0.013	79.02
4. Rahya	0.436	0.157	0.068	0.765	0.049	0.003	1.994	0.032	0.862	60.26
5. Ramgarh	0.790	0.091	0.071	0.774	0.036	0.027	1.866	0.024	0.044	66.26
6. Pargalta	0.773	0.152	0.117	-	-	-	1.092	0.042	0.045	87.5
7. Sagnoon	0.668	0.035	0.023	-	-	-	-	-	-	73.31
8. Patyari	1.016	0.193	0.196	-	-	-	0.557	0.025	0.014	112.32
9. Rathain	0.745	0.003	0.002	-	-	-	0.921	0.003	0.002	108.15
10. Jib	0.453	0.040	0.018	0.450	0.021	0.009	0.377	0.11	0.004	120.45
11. Tehr	0.226	0.067	0.015	1.765	0.058	0.102	-	-	-	05.78

zone both irrigated and unirrigated crops are cultivated. Major crops cultivated in this zones are maize, rice, wheat, pulses and oilseeds. The soil of this zone is more suitable for rice cultivation, because clayey soil can hold more moisture than more moisture than other soils.

Zone 3: Areas of Dansal, Ramkot, Billawar and upper part of Basholi tehsil fall under this zone. Group Aucl is represented by Alfisols (Xeralfs), with clay loam texture and with ustic soil moisture regime. Both irrigated and unirrigated crops like maize, rice, wheat, pulses and oilseeds are cultivated. Clayey soil of this zone is also suitable for rice and maize crops.

Zone 4: Siwalik hills area of Surinsar, Mansar and lower portion of Basholi tehsil comes under Ausl group. This zone is dominated by Alfisols (Xerolfs), with sandy loam texture. Ustic soil moisture regime is prevalent in this zone and mainly rainfed crops are cultivated. Soil of this zone is least suitable for maize and rice cultivation, because soil is well-drained and less water-retentive, which needs more frequent irrigation for successful crop growth than fine textured soils.

Zone 5: Central part of Basholi tehsil falls under A_4L group. Alfisols (Xeralfs), with loam texture is the major soil of this zone. Both irrigated and unirrigated crops are cultivated. Major crops cultivated in this zone are maize, rice, wheat, pulses and oilseeds. This zone has ustic soil moisture regime. Loamy soil of this zone is more suitable for growth of crops, because this soil has the advantage of both sands and clay compositions.

Zone 6: The upper portion of Samba and Hiranagar tehsil fail under A_3L group. This zone is dominated by Alfisols (Ustalfs), with loam texture and with ustic soil moisture regime. In this zone mainly rainfed crops like wheat, maize, rice, bajra, pulses and oilseeds are cultivated.

Zone 7: Rolling Kandi belt and Siwalik hills of Jammu, Samba, Hiranagar and Kathua tehsils are located in this zone. The group A_3SL is represented by Alfisols (Ustalfs), with sandy moisture regime. This zone has xeric soil moisture regime. In this zone both rainfed and irrigated crops are cultivated. The rainfed crops mainly jowar, bajara and pulses are cultivated on a large scale due to limited irrigation facilities. Soils of this zone are permeable and well drained, but less water retentive and need assured irrigation for better crop growth.

Jammu Plain

Plain areas of Jammu, Samba, Hiranagar, Kathua, R.S Pura and Bishna tehsil comes under the E_1AS, E_2SL, E_3FS and 1_2FS groups. These areas arc dominated by, Entisols (Aquents), with alluvial soil, Entisols (Orthents), with silt loam, Entisols (Psamments), fine sand and Inceptisols (Ochrepts), with fine loam texture respectively. These areas have xeric soil moisture regime. In Jammu plain, more than 95 percent of the area is irrigated and crops like rice, maize, wheat, vegetahles, oilseeds and pulse are cultivated. The agricultural productivity is far more than the Jammu

Siwalik, as these areas have assured irrigation facilities, economical land holdings and plain topography

The study region, as a whole is dominated by Alfisols, Ultisols, Entisols and Inceptiesols with sandy loam, clay loam, loam and silt loam texture which support the cultivation of wheat, maize, rice, jowar, bajra, oilseeds and pulses. The moisture adequacy index ranges between 0.75 and 0.90, with udic, usic and xeric soil moisture regime. Thus all zones of the region can support dry farming with moderate rainfall and limited assured irrigation facilities as the region is characterised by low to moderate agricultural productivity with reference to the Jammu plain.

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