

SLOPE AND AGRICULTURAL LAND USE: AN ANALYTICAL STUDY WITH REFERENCE TO POONA DISTRICT (MAHARASHTRA)

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ABSTRACT: The spatial variations in the agricultural land use, to some extent, can be attributed to the variations in the physiographic environment. This paper proposes to study the influence of slope upon the agricultural land use, using simple correlation technique. It is observed that slopes below three degrees offer maximum scope for cultivation, whereas the slopes above five degrees impose a serious limitation to the cultivation of crops.

Introduction

Poona District occupies a central position in Western Maharashtra. The western boundary of the district is along the crestline of Western Ghats, separating the Konkan lowland from upland Maharashtra. The peaks of Sahyadris in this zone, sometimes rise above 1000 mtr. (fig. 1). Eastwards from the Sahyadris (15-25 km.), is a landscape characterised by broad valleys, separated by flat topped interfluves.

The district can be divided into three climatic zones. The western zone of high rainfall receives average annual rainfall over 1000mm. The central-transitional zone receives moderate rainfall between 1000-600mm, and the eastern semi arid zone receives rainfall less than 600mm. The region is drained by river Bhima - the master stream of the area - and its major tributaries like Kukdi, Ghod, Bhama, Indrayani, Mula-Mutha and Nira.

Besides climate, the next important physical factor which exerts an influence upon the agricultural land use is relief (Symons 1967). Altitude affects agriculture through climate, but slope, which is a very important factor, works directly and indi-

rectly. Indirect effects are reflected in pedological and climatic effects, position of water-table, runoff and erosion. The most obvious direct effect of slope on agriculture is in the limitation of cultivation. This is one of the important factors which influence the agricultural landscape of a region.

Methodology

To study the correlation between slope and land use, an initial hypothesis was formulated that land use is significantly related to slope. To test this hypothesis, analysis was done at microlevel. Villages were first grouped into 135 physical regions based upon distribution and amount of average annual rainfall, relative relief, altitude, soil etc. (fig. 2). Landuse data for individual villages was collected from Tahsil headquarters and processed. The variables examined were area under different categories of slope (as percentage of total area) and the following problem variables:

- 1) Net Sown Area (as percentage of the total area).
- 2) Irrigated area (as percentage of the total area)

- 3) Area under grass (as percentage of the total area).
- 4) Double cropped area (as percentage of the NSA)
- 5) Area not available for cultivation (as percentage of the total area).

Relative relief was measured using 1000 yds × 1000 yds grid, analysing the topographical maps. Amount of slope in degrees

was calculated with the radius of the area (1000 yds × 1000 yds) as the horizontal equivalent.

Classification of slopes

The slope values in the study area were classified into five categories, based on two earlier classifications, by Macgregor (1957) and the British Geomorphological Research Group (1962).

Nature of slope	Macgregor degrees (1957)	B.G.R.G. degrees (1962)	Suggested by Authors degrees
Flat	-	0- 0.5	-
Gently sloping	0- 3	1- 2.5	0- 3
Moderately sloping	3- 6	3- 6	3- 5
Strongly sloping	-	6.5-13	5-10
Fairly steep	6-11	-	-
Moderately steep	-	13.5-19	10-20
Steep	11-18	19.5-31	20 & above
Very steep	25	13.5 & above	

Simple correlation technique was used to test the hypothesis and a correlation matrix (Table I) was prepared. Student's 't' test was applied to determine the significant 'r' values at .01 level of significance.

Slope and agricultural land use

The results obtained by working out the correlation coefficients reveal certain significant associations between slope and different types of land uses as follows:

The plains and slightly sloping, well drained lands, are ideal for the expansion of area under cultivation. This fact is reflected in the strong positive correlation ($r = 0.8134$) between gently sloping land and the Net Sown Area. As the slope increases, bringing the land under plough becomes difficult and expensive ($r = 0.2787$; $r = -0.6527$; $r = -0.6926$ respectively for strongly sloping, moderately steep and steep lands).

The areas which are unfit for cultivation, either due to excessive rainfall or steeper slope, are given to grass. Strongly sloping, moderately steep, and steep slopes, exhibit a positive correlation with the area under grass. ($r = 0.2454$; $r = 0.4914$; $r = 0.5547$ respectively). These 'r' values indicate that area under grass is less in the lower categories of slope and it increases with the increasing amount of slope.

At present, a very small area is under irrigation in the district. The potentials for irrigation are also limited. Flat surfaces and gently sloping lands offer maximum scope for the construction of canals, digging wells, etc. Higher the slope, greater is the cost of construction, and lesser scope for extension of the area under irrigation ($r = 0.5096$; $r = -0.2617$; $r = -0.3931$ $r = -0.3839$ respectively for gently sloping, strongly sloping, moderately steep, and steep slopes).

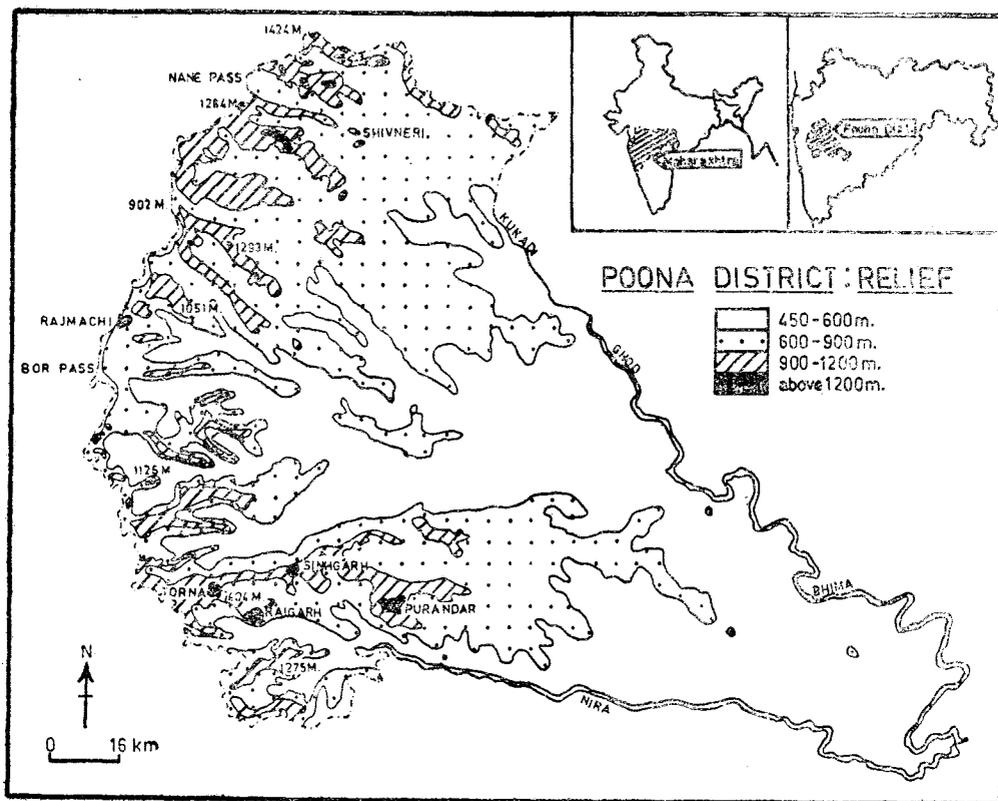


Fig. 1

Slope indirectly influences the area cropped more than once in a year. With ever increasing demand for food grains, intensification of agriculture is inevitable. In the study area, intensification i. e. double cropping, is possible only if assured supply of water is available. In other words, multiple cropping is associated with the extension of area under irrigation, which in turn is related to the nature of slope. ($r = 0.2836$; $r = -0.2305$; $r = -0.2371$; respectively for gently sloping, moderately steep and steep slopes).

Area not available for cultivation, includes area occupied by settlements, dispersed huts, roads, footpaths etc. No significant correlation between slope and area not available for cultivation is observed (except $r = 0.1912$ for steep slopes). Therefore, we may conclude that slope and

area not available for cultivation are independent of each other.

Conclusion:

Testing of the hypotheses with the help of simple correlation technique, throws light upon certain important relationships between different categories of slope and land use. The inspection of the correlation matrix indicates that slopes above 5° , impose serious limitations to the cultivation of crops. From the point of view of agricultural development in the study area, slopes below 3° are most significant. This gently sloping area, offers maximum opportunities for the extension of land under plough, double cropping and bringing more area under irrigation. Slopes above 5° generally are given to grass. At some places it is observed that slopes up to 20° are cultivated, but only with terracing.

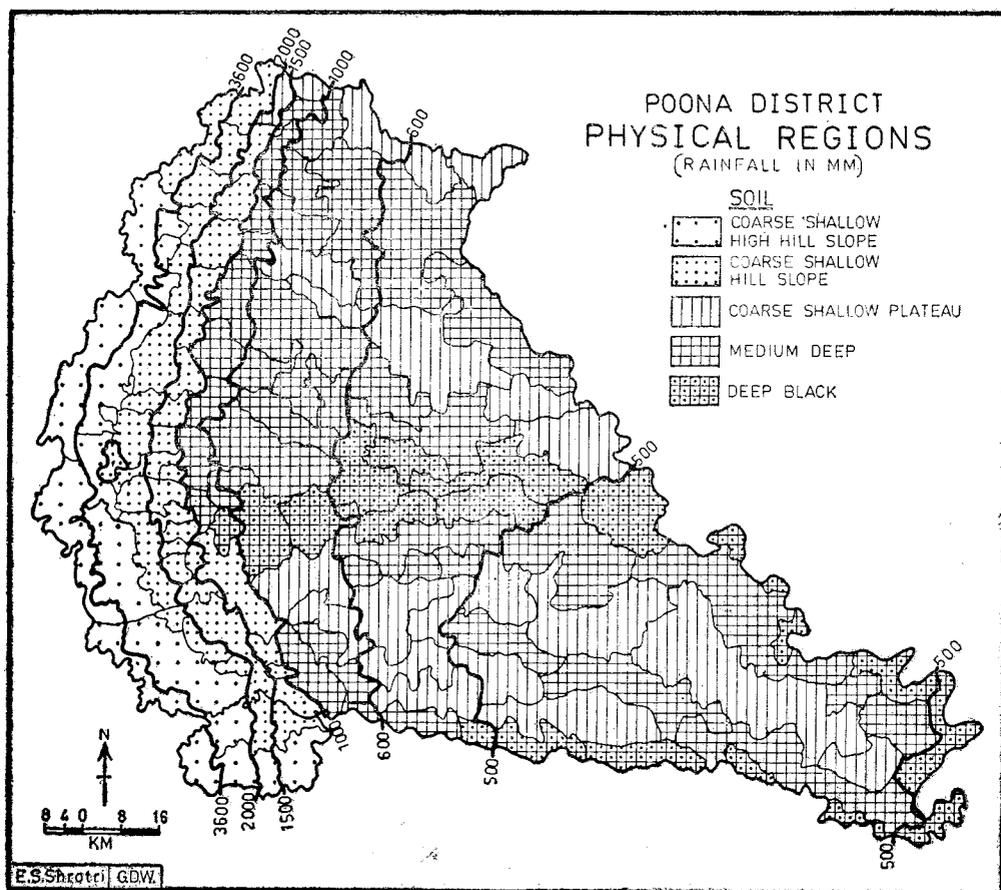


Fig. 2

Table (I)

Percentage of total area occupied by land use type

Slope ↓ (degrees)	Land use →	NSA	Area under Grass	Irrigated area	Double cropped area	Not available for cultivation
Gently sloping (0-3°)		0.8134	-0.6726	0.5096	0.2836	-
Moderately sloping (3-5°)		-	-	-	-	-
Strongly sloping (5-10°)		-0.2787	0.2854	-0.2617	-	-
Moderately steep (10-20°)		-0.6527	0.4914	-0.3931	-0.2305	
Steep (20° & above)		-0.6926	0.5547	-0.3839	-0.2371	0.1912

References

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