The concept of literacy generally refers to the minimum level of literary skills. In a district like Birbhum literacy among farm families especially in the age group of fifteen to fifty-nine years can contribute considerably towards the process of modernization of farming practices. Low literacy rate is one of the difficulties encountered by agricultural extension officers in the propagation of green revolution technology. It is noted that in rural India the education level is high in wheat, rice, sugarcane, and cotton producing areas and low in subsistence farming areas. A high rate of population growth is a matter of concern as it hampers the welfare of rural people and aggravates environmental problems. This calls for reduction in birth rate. Such an aim can be achieved by improving the literacy rate especially among women. It has been observed that formal educational opportunity and possibility of gainful employment influence the agro-economic uplift of the rural masses, which in turn may influence density of population.

16.1 Distribution of literates

According to the Census 1991 a total of 1,004,774 persons out of 2,555,664 persons or 39.32% of the total district population were found to be literate. For the rural population literates constituted 37.55%. A person who can both read and write with understanding in any language is considered to be literate. Out of a total of 1,194,106 rural males 555,265 males, that is a 46.50% and 318,259 female out of a total of 1,131,995 females or 28.11% were found to be literate. The proportion of literate persons to total population and of literate males to total male population and literate females to total female population differ significantly in the rural and urban areas.

In order to study the distribution of literate persons in different C. D. blocks, a chloroplat map has been prepared based on Census 1991 data, (Fig. 44). It shows the proportion of rural literates to total population in each block. This map reveals that educated persons are not equitably distributed over the rural areas. The highest rate of literacy is around 45%, and is found in Khoyrasol, Suri I, Sainthia, Labpur, Nanur, Mayureswar I & II. In all these blocks the proportion of female literates is slightly less than that of male literates. In Sainthia for example, about 33% of the total female and 50% of the total male population are literate. Literacy rate between 35% and 40% is more widespread in the west and south of the district in Rajnagar, Dubrajpur, Suri II, Illambazar, Bolpur-Sriniketan, Mahammadabazar, Rampurhat I & II and Nalhati I blocks. It appears to be poor, between 25% and 35% in the north in Muraroi I & II and Nalhati II.
LITERATES AS % OF TOTAL POPULATION
(1991)
BIRBHUM DISTRICT

Legend
% of literates

40 - 45
35 - 40
30 - 35
25 - 30

Scale 0 5 10 15 km

Fig. 44: Percentage of Literates (1991)
16.2 Rural literacy and rural population distribution

The distribution of rural population may be compared with that of rural literacy. It has been noted throughout that population distribution is sparse in the west and much more dense in the north and east. The blocks with low population density are Rajnagar and Mahammadbazar in the western part of the district and high density is found in Muraroi I & II, Nalhati II and Rampurhat II in the north. The rural density map of Birbhum may be compared visually with the map showing the distribution of rural literacy. It is found that literacy appears to decrease in proportion to rural population from east to west and population density also decreases in the same general direction. Literacy rate is quite high in the south and fairly low in the extreme north. For rural density quite the opposite is found to prevail as revealed by the map in the inset. Support for such superficial observations can be obtained through statistical analysis of the two sets of data. To describe the general relationship between the two variables in quantitative terms or to map the varying degree of correspondence between the two, statistical analysis is found to be a better choice.

As an initial step towards such analytical study, the regression of density of rural population on percentage of rural literates has been employed. Fig. 45 shows a scatter diagram in which rural population density i.e. \( D \) values have been shown along the Y-axis and rural literacy i.e. \( L \) values (obtained from the choropleth map of rate of literacy at the areal center of the C. D. blocks) have been shown along the X-axis (Appendix 1, Table M). The values of \( D \) and \( L \) at the areal center of each block have been taken as paired values for the scatter diagram and subsequent regression analysis. Paired values whose locations in the scatter diagram show graphical correlation between the two variables, have been utilized to draw the regression line, that is the straight line of best fit. The regression line obtained by the method of least squares is \( D_c = 1121.41 - 15.21 L \), which shows the linear relationship between rural literates as percentage of total population (\( L \)) and rural population density (\( D \)). Stated in statistical terms according to this relationship a C. D. block in Birbhum district with 40% literacy is expected to support a rural population density of 513 persons per sq km approximately (\( D_c = 1121.41 - 15.21 L = 513 \) persons approx.).

In a similar manner, the 'expected' (\( D_c \)) rural population density is computed for each block. The values, thus obtained may be plotted at the areal centre of the blocks and isopleths may be drawn through them. If such an attempt were made there would be two population density maps, one showing the actual distribution and the other depicting what the density distribution pattern would be if it were entirely dependent on literacy rate as defined by the regression line. In order to find out the strength of relationship, i.e. the degree of association between rural population density and literacy, the Pearson product moment correlation coefficient has been employed. This shows that the correlation coefficient \( r \) is -0.47. The value of \( r \) is obtained thus:

\[
\begin{align*}
    r &= \frac{N \sum LD - (\sum L)(\sum D)}{\sqrt{(N \sum L^2 - (\sum L)^2)} \times \sqrt{(N \sum D^2 - (\sum D)^2)}} \\
    \text{where, } r &= \text{Correlation coefficient} \\
    L &= \text{Independent variable, i.e. literacy as percentage of total rural population}
\end{align*}
\]
Selected Physical & Socio-economic Determinants of Rural Population Distribution in Birbhum

Scatter Diagram
BIRBHUM DISTRICT

Fig. 45: Scatter diagram (literacy and rural population density)
\[ D = \text{Dependent variable, i.e. rural population density} \]
\[ N = \text{Number of pairs of observed values.} \]
\[ \Sigma = \text{Summation} \]

For a sample size 19 the critical value of the correlation coefficient at 5% level (two-tailed) is 0.456. Therefore this correlation coefficient is significant. In other words, the null hypothesis that the correlation coefficient is zero is rejected. The Student’s 't' test has also been applied to test the significance of the $r$. The value of $t$ works out as follows:

\[
 t = \frac{r \sqrt{n-2}}{\sqrt{1-r^2}} = \frac{-0.47 \sqrt{19-2}}{\sqrt{1-(0.47)^2}} = 2.20
\]

The critical value of $t$ with 17 degrees of freedom at 5% level (two sided) is 2.11. Hence the calculated value of $t$ is significant. Taking the Pearson correlation coefficient, the explained variation \( r^2 \times 100 \) i.e. \( (0.47)^2 \times 100 = 0.22 \). Thus about 22% of the total variation in $D$ i.e. rural population density is explained by $L$ i.e. percentage of literates. Since the correlation coefficient of $-0.47$ does not indicate a perfect negative relationship between the two variables $D$ and $L$, the maps showing the 'relief of actual population density and 'percentage of literates-population density' will not match perfectly. The two will differ considerably from each other. Such differences are the absolute residuals ($D - D_c$). From these absolute residual values standardised residuals have been calculated and plotted at the areal centre of the respective blocks for the preparation of a second isopleth map (Fig. 46). This map depicts the relationship between the percentage of rural literates and rural population density.

The impact of percentage of rural literates upon rural population density is reflected in the above-mentioned map. The white colour indicates areas where the relationship appears to be very close. The darker the shading the weaker is the impact of the number of rural literates on population distribution. Such darker shading with plus values is found to occur in the north in the eastern part of Muraroi II, Nalhati I & II, Rampurhat II, eastern part of Mayureswar I, Mayureswar II, Labpur, Nanur and eastern part of Bolpur block. This indicates the occurrence of higher population density than what is expected if the number of literate persons in proportion to total rural population were the only determinant. Western parts of Rampurhat I and some parts of Mahammadbazar, Rajnagar, Dubrajpur, Rajnagar and Illambazar show negative values. Negative values indicate that rural population density in these areas is below the level ‘expected’ for the given proportion of rural literates. White areas indicating close correspondence between the two variables are seen in Muraroi I & II, Nalhati I, Rampurhat I, Mayureswar, Sainthia, Suri, Illambazar and western part of Khoyrasol. The isopleth of zero departure in the map brings out the fact that all other variables remaining constant the density of rural population is the same as is to be expected from the number of literate persons in proportion to total rural population alone. Areas of high departure values whether plus or minus in the map indicate that number of literates in proportion to total rural population is not a significant influence upon the distribution of rural population in those parts of the district.
Fig. 46: Relationship between rural population density and literacy