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Methodology and Collection of Data

3.1. Introduction
Investigation about the problems and prospects of ericulture in Assam with special reference to Barpeta district has been made in five major parts. First of all, role of sericulture especially of ericulture in the generation of employment and income in Assam has been analysed. Thereafter, spatio-temporal variation of ericulture in Assam has been described. Then, comparative analysis of different silk cultures in terms of their capacity to generate employment and contribution to income, profitability etc has been examined rigorously. Next, problems and future prospects of ericulture in Assam have been highlighted. Finally, a brief discussion on the scope and role of different financial agencies in the development of ericulture in Assam has been provided.

3.2. Role of Ericulture in the Generation of Employment and Income in Assam

First of all, the contribution of ericulture as well as sericulture as a whole to the total workforce of Assam and its variations during 1990s is explained by tabular method. The growth of production of eri cocoons and its price and also the contribution of eri cocoons to the NSDP of Assam during 1980-81 to 2004-05 has been estimated by running semi-logarithmic regression of the form $\ln Y_t = a + b.t + U_t$, where $Y_t$ represents either production, price or contribution to NSDP at time $t$; $t$ is the time in year; $a$ and $b$ are the two parameters. Here, $U$ is the random disturbance term and $b$ represents the annual exponential rate of growth of the concerned variable. The annual
average exponential rate of growth of employment generated in Assam due to ericulcure and broadly sericulture total during 1990-91 to 2005-06 (for which the data were available) has also been estimated by the regression method. After careful examination of the scatter diagram and trial of various spline functions (Gujarati, 2004) finally the semi log-linear equation $\ln Y_t = \alpha + \beta t + \gamma D + V_t$ is estimated. Here, $Y_t$ is the number of families engaged in sericulture/ ericulture at time $t$; $t$ is the time in year and $V$ is random disturbance term; $\alpha$, $\beta$ and $\gamma$ are the three parameters. Here, dummy variable $D$ is introduced that takes value 1 for any year from 1990-91 to 1995-96 and 0 from 1996-97 to 2005-06.

From 1995-96 to 1996-97, a sudden fall in number of families engaged in sericulture and particularly in ericulture is observed, which may be partly due to the conversion of Somanies\(^1\) into highly remunerative tea gardens and also due to the devastating flood in some areas of Assam mainly in the districts of North Lakhimpur and Kokrajhar. Many of the families practising various sericulture activities were affected and displaced to the safe areas where they could not run their sericulture activities. However, in the following years (since 1997-98) due to rigorous efforts on the part of the Government in the form of grants in aid to the rearers, gradually the number started increasing\(^2\). As it drifted down in 1996-97 but started increasing again from a lower base (almost parallel to that of earlier trend) it is better to introduce a dummy variable rather than fitting an exact spline function. Also the changes in intensity of ericulture during the same period are estimated through the variation in area under eri feed plantation per family associated with such activity.

\(^1\) Somanies is the garden of Som tree, the primary host plant of Muga silkworm
\(^2\) Though the number of families engaged in various sericulture activities declined severely from 1995-96 to 1996-97, the production has not declined rather than increased (but at a slower rate). The reason is that the rearers of some districts especially Karbi Anglong, Marigaon, Barpeta, Darrang, Dhubri produced more and overcompensated the loss in other districts viz. North Lakhimpur, Kokrajhar, Nalbari etc.
Thereafter, employment of families per hectare of eri feed plantation and per unit of production of eri cut cocoon in Assam is shown by using tabular method. Changes in output of eri cocoon per unit of area (hectare) with respect to variation in area (hectare) per family and also the changes in output per unit of land with respect to families per unit of land are estimated by running the similar semi logarithmic regression as used earlier. After computing the average contribution of ericulture to the family income of the sample households in the study villages, an equation of the form \( \ln Y_i = \alpha + \beta \ln X_i \) is estimated to know the elasticity of contribution of ericulture to average total family income with respect to the variation in average family income across the villages; i.e., to know whether there is any variation in dependence on ericulture with the changes in affluence of the families or incidence of poverty. Here \( Y_i \) represents average percentage contribution of ericulture to family income of \( i^{th} \) village and \( X_i \) represents average family income of \( i^{th} \) village. Similar method is also followed to examine the relationship between economic standard of the families and the adoption of weaving activity across the study villages. In addition to that, the relation between revenue generated annually from ericulture proper and the annual family income is examined by using coefficient of correlation between them. Impact of ericulture on the reduction in poverty is examined by tabular method. Moreover, the correlation between the reduction in incidence of poverty and the adoption of weaving across the villages is calculated to know, whether there is any significant change in incidence of poverty with the increase in adoption of weaving along with ericulture proper.

3.3. Spatio-temporal Variation in Erculture in Assam

Spatio-temporal variation in ericulture in Assam is discussed in chapter-5. First of all, district-wise variation in contribution of eri-cut cocoon to total state production
during 1990-91 to 2005-06 is described. Inter-district disparity of contribution of eri cocoon production to state total is measured by the coefficient of variation. Thereafter, exponential rate of growth of number of families engaged in ericulture in different districts has been estimated. Estimation has been done for the whole period as well as for different sub periods. District-wise variation in proportion of area under eri host plant to total ericultural land of the state during 1993-94 to 2005-06 is also measured by the coefficient of variation. Finally, district-wise over time variation in output of eri cocoon per hectare of land under host plant is shown by tabular method.

3.4. Comparative Study of Eri, Muga, Mulberry and Tasar in Assam

First of all, temporal variation in eri, muga, mulberry and tasar raw silk production in Assam during 1980-81 to 2004-05 has been analysed by tabular method. Also, annual exponential rate of growth of production during 1980-81 to 2004-05 has been estimated by running semi logarithmic regression of the form $\ln Y_t = \alpha + \beta t + U_t$, as used in chapter-4, where $Y_t$ is the quantity of output at time $t$; $t$ is the time in year; $\alpha$ and $\beta$ are the two parameters. $U$ is the random disturbance term with usual classical regression properties and $\beta$ represents the annual exponential rate of growth of $Y_t$. However, for estimating the annual exponential growth rate of production of mulberry raw silk during 1980-81 to 2004-05, polynomial of degree three has been used.

Thereafter, contribution of eri, muga and mulberry culture to total workforce in Assam has been discussed with the help of tabular method. Next, the role of eri, muga and mulberry culture in employment generation and their respective contributions to NSDP at market prices in Assam has also been estimated by using the similar regression method. Comparative analysis of production of eri, muga and mulberry raw silk per hectare and per family is done by using tabular method. For the comparison of
differences in impact of area per family on output per hectare is done by using the following test statistics.

\[ F_{\nu_2, \nu_2} = \frac{(\beta_1 - \beta_2)}{\{(n_1 - 2) s_1^2 + (n_2 - 2) s_2^2\}} / (n_1 + n_2 - 4) \]

Finally, cost, revenue and profit per unit of output of eri, muga and mulberry cocoon as well as per unit of investment (rupee) have been computed from the sample observations and compared. Also capital and labour output ratio as well as capital intensity in eri, muga and mulberry production is calculated and compared by tabular method to have an idea of the technology used for the production of the respective sericulture output. In addition to that, contribution of eri, muga and mulberry-culture to the foreign exchange earnings of the state are also discussed by tabular method.

3.5. Problems and Prospects of Ericulture in Assam and Role of Financial Institutions in Ericulture

Problems and prospects of ericulture in Assam have been discussed in chapter-7. Educational level of the members of sericulturist families, problems faced by the ericulturists is discussed by tabular method. Similarly, distribution of sources of fund of the ericulture practising families, government assistance to the ericulturists in the 10th plan under Catalytic Development Project in Assam and in the district of Barpeta has been shown in tabular method. In order to examine the prospects of ericulture, average revenue and cost functions are estimated and also plotted graphically for different level of broods practised by the sample rearing families. From that the profit function is also examined and estimated the level of profit maximising level of output. Also, the level of output at which average cost would be minimum is estimated by minimising the best fitted average cost curve with respect to the level of output of eri cocoon. Those are also compared with the existing level of output to see how much expansion is possible.
and thereby to maximise profit or minimise the average production cost and that indicates the scope for the expansion of the activity at the existing level of technology.

3.6. Collection of Data

The study is based on both primary and secondary data. For the purpose of analysis, secondary data on distribution of workforce, family engaged in eri, muga and mulberry and sericulture as a whole, production of cocoon or raw silk, area under respective host plants, Net State Domestic Product of Assam, export of eri products to abroad etc have been collected from various Census Reports, Directorate of Sericulture, Government of Assam, Directorate of Economics and Statistics, Government of Assam, Economic Survey of Government of India, Office of the Directorate of Central Silk Board (North-Eastern Region), Government of India, ARTFED and other official reports. Consultations with the experts of the said fields were also made for gathering relevant information.

Also for the study, primary data have been collected from 180 families chosen by multistage sampling procedure from the district of Barpeta, the fourth populous district in Assam with 16.42 lakhs population covering an area of 3245 square kilometres. Out of the total population of the district, 5.70 and 7.48 per cent belong to Schedule Casté and Schedule Tribes respectively. The literacy rate is only 56.24 per cent (2001 Census Report). There are 12 community development (CD) blocks in the district consisting of 1073 villages. Sericulture is practised in 140 villages, which are mainly concentrated in the CD blocks of Gobardhana, Jalah and Sarukhetry. Therefore, these three CD blocks were selected out of total 12 CD blocks of the district of Barpeta.

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3 Though contribution to total ericulture output of the state and number of families engaged in ericulture is much larger in Karbi Anlong, North Lakhimpur, N. C. Hills and Dhimaji district, growth rate of number of families engaged in ericulture and area under host plant is the second highest in the district of Barpeta. Moreover, growth of production per unit of land is the highest in Barpeta during the last decade.
Within these three community development blocks, nine villages namely Bashbari, Nimua and Khusrabari from Gobardhana CD block, Salbari, Hahchara and Bhuyapara from Jalah CD block and Gohia, Agdia and Garartari from Sarukhetri CD block were selected by stratified random sampling method. From the nine villages, total 180 sample families are selected (23, 10 and 17 from Gahia, Agdia and Garartari villages under Sarukhetry block; 14, 21 and 35 from Salbari, Hahchara and Bhuyapara villages under Jalah block and 18, 32 and 10 from Bashbari, Nimua and Khurabari villages under Gobardhana block respectively) on the basis of the proportion of families of the three blocks engaged in such activities in the respective villages. From each village, the sample families are picked by simple random sampling without replacement from all the families practising sericulture.

From each selected family, information regarding number of broods reared and production of cocoons and pupae in a year, number of people engaged in this occupation, average daily working hours used in rearing, spinning and weaving, cost of appliances of rearing, price of pupae and cocoons at which these are sold, production of yarn, labour hour required in spinning and shawl production, cost of handloom, price of yarn and final endi-products, the problem faced by rearers, other occupations of the family members, total annual family income, their educational status etc have been collected through a pre-tested questionnaire. Interview method was adopted in the collection of data. The survey was conducted during July 2005 to June 2006. Several subsequent visits were also made to some of the sample households to clarify some doubts and confirm some findings.

Information on the market prices of eri cut cocoon, muga, mulberry and tasar raw silk were not available from the secondary sources, which were also collected from the respondents and verified with the field officers of Sericulture Department of
Government of Assam. Though the rearers could inform about the price of current and recent previous years, they were unable to respond from their memory of much earlier years (like 1980). These were taken from the field officers’ personal record. Of course, a trend of procurement price of eri cut cocoons was available from the secondary sources (Directorate of Sericulture, Government of Assam), but there was a wide gap between the procurement price and market price. As per record, the procurement price of eri cut cocoon has been pegged at only Rs.80 per kg since 1997, whereas the market price has increased from Rs.80 per Kg during 1980-81 to Rs.320 per Kg during 2004-05. Therefore, hardly anybody sells her product to the government authority, as the procurement price has been much lower than the market price.

Similarly, information on number of families engaged in eri, muga and mulberry and as a whole sericulture is available from the Directorate of Sericulture, Government of Assam. But the number of people engaged in these occupations is not available. Therefore, the average number of rearers found in the sample households is considered here to estimate the number of individuals engaged in such activities. Total number of rearers is estimated by multiplying the number of families by three, the average number of rearers engaged in sericulture in the sample families.

In the same way, as silkworm rearing is a part time occupation of the family members in most cases and the members are not fully engaged throughout the day, the number of people engaged cannot be equated with the number of man-days generated in this occupation. Here generation of employment (man-days) is estimated through the number of man-hours (working hours utilised every day) required from the collection of leaves to the production of cocoons.

Normally everyday three hours are required for the maintenance i.e., collection of leaves, supply of food leaves to the worms and clearing of the rearing trays.
(removing of odour and unconsumed leaves) of a brood. Usually 20 days of gestation period are there for the harvesting of one brood of eri or mulberry cocoon during the summer. However, the gestation period extends to maximum 28 days (four weeks) during winter season. Therefore, the total man-hours required for harvesting one brood of eri or mulberry cocoon is 60 man-hours (= 3 x 20) during summer. Considering 8 hours of work as equivalent to one man-day, it becomes 7.5 working days. Whereas during winter season, number of equivalent man-days required for harvesting a brood of cocoon (eri or mulberry) is about 10.5. But, in case of muga-culture, constant engagement of labour is necessary from the time of placing tiny worms on the feed plants till maturity stage. The rearers have to stay round the clock in the somanies to protect the silkworm from the attack of birds, monkeys etc and to shift the worm from one plant to another as they crawl down in search of feed leaves. In general, the gestation period of muga worm is 23 days during summer and 42 days in winter. Accordingly, man-days required for harvesting one brood of muga cocoon vary from 23 during summer to 42 in winter. Mainly the adult male members of the family perform these jobs. Generally, wages are not required to be paid directly as most of the eri; mulberry and muga-culture activities are done by the household labourers. But to find out the implicit labour cost and net profit, prevailing wage rate in the similar other occupation is collected from the sample areas during that period and considered for the analysis of the present study. Sometimes, hired labourers are also engaged in rearing muga cocoon at the going wage rate.

3.7. Limitations of Data

Majority of rearers have provided some quantitative information such as figures of annual eri cut cocoon production, annual sales proceeds from ericulture, amount of
investment in plantation and collection of leaves etc, from their memory other than from books of accounts. The rearers whether rich or poor are found to be unwilling to divulge some basic information relating to grants received from government and have a tendency to exaggerate their poverty. Some of them even are not aware of the modern weight and measures system. Most of the rearers have not maintained proper books of accounts. Great care was, however, taken to smoothen to these tendencies in filling up the questionnaires.

Sometimes, the available secondary data specifically relating to production of cocoon and endi products differs from Central Silk Board and Directorate of Sericulture. During the survey, it is observed that the Directorate of Sericulture, Assam, Central Silk Board, Guwahati, have not maintained proper annual accounts as regards to various incentives provided by them from time to time to the eri growers of various blocks which is mentioned earlier. This has created a lot of problems in studying the generation of income and employment in the district of Barpeta through eri culture.
Map of Barpeta District indicating Community Development Blocks and the Survey Areas