



From tradition to transformation: sericulture, livelihood diversification and indigenous women's economic participation in Baksa district, BTR

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Abstract

Sericulture is a major traditional livelihood in Northeast India, especially among the indigenous populations, where Eri culture is tightly linked to home production and women's economic engagement. The paper analyses the linkages between sericulture, livelihood diversification and economic engagement of women in the Jalah sericulture cluster of Baksa District of the Bodoland Territorial Region, Assam. The study combines Central Silk Board's village-level Eri suitability information with demographic and occupational information from the Census of India 2011. Livelihood diversification was measured using the Livelihood Diversification Index (LDI), while women's economic participation was measured using Shannon Entropy-weighted Women's Economic Participation Index (WEPI). The data suggest that the majority of the population is engaged in agriculture; however, the livelihoods are diverse, with 52.84% of the main workers engaged in cultivation and an overall LDI of 0.619. The proportion of women in the total workforce was 38.80%. The results of the Shannon Entropy analysis showed that the component of women's economic engagement with the highest weight, and that was the most discriminating, was female household-industry participation (0.4605), followed by female agricultural labour (0.2062), other occupations (0.1960) and agriculture (0.1373). The findings imply that Eri sericulture provides a key pathway for enhancing livelihood diversification and women's economic engagement while conserving indigenous knowledge and traditional practices. Traditional sericulture needs improved technology, value addition, credit and market connectivity to make it a more robust livelihood system.

Keywords: Eri sericulture; Livelihood diversification; Indigenous women; Women's economic participation; Shannon Entropy; Livelihood Diversification Index; Traditional livelihoods; Rural transformation

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1. Introduction

Sericulture is one of the important agro-based livelihood activities in rural India. It has specific socio-economic and cultural value in North East India, where Eri and Muga production are still associated with indigenous knowledge, family labour and traditional textile methods. Such initiatives are also helping in providing rural employment and livelihood security in Assam and sustaining knowledge systems passed down through generations. Recent literature, however, shows that while

sericulture can promote rural development, income diversification and women's economic participation simultaneously, its developmental benefits are highly sensitive to access to technology, markets, quality inputs and institutional support (Shravanilakshmi et al., 2025).

The indigenous people of the Bodoland Territorial Region (BTR) take the Eri culture seriously. The breeding of Indi or Eri silkworm is deeply associated with the traditional livelihood activities and cultural identity of the Bodo community. Indian sericulture is a livelihood system that includes activities from host plant cultivation and silkworm rearing to cocoon processing and weaving with strong involvement of women (Brahma and Basumatary, 2024). The research also underlines the importance of Eri culture for rural development, cultural continuity and women's socioeconomic engagement.

Recent research has shown an increasing interest in the gender dimension of sericulture. Bhuyan et al. (2025) stated that in Assam, tribal women are very much involved in host-plant management, silkworm raising and cocoon processing, but a lack of scientific knowledge, particularly in pest and disease management and cocoon processing, can be a limiting factor for output. Another recent study has revealed that access to loans, high input costs, silkworm diseases, poor storage and low cocoon prices are the major constraints for tribal women in sericulture. The results show that the role of women in sericulture should not be seen as simply participation in labour but also in terms of livelihood stability, economic opportunity and value chain growth. Sericulture is also becoming recognised as a means for diversifying livelihoods. Cultivation is often combined with agricultural labour, domestic industries and other jobs in rural households, and sericulture can be incorporated with them instead of a replacement. Recent studies in the Eastern Gangetic Plains reveal that livelihood diversification is linked to enhanced livelihood resilience, and is affected by factors such as gender, education, market access and institutional support. In the study, Simpson's Index of Diversity is also used to measure livelihood diversification, which serves as the methodological basis for the present analysis.

A particularly important context is recent evidence from Baksa. Moshahary and Baruah (2026) revealed a positive cost-benefit ratio and found Eri culture among rearers in Baksa to be predominantly female-dominated, with women accounting for 97% of surveyed rearers. At the same time, weak market linkages, low technological transformation and shortage of host plants were highlighted as key obstacles. Recent studies on the entrepreneurial behaviour of tribal women in Assam also suggest great entrepreneurial potential among women involved in sericulture, while stressing the need for training, credit, market access and institutional assistance.

Although such studies contribute important evidence to the economic, cultural and gender dimensions of sericulture, relatively little attention has been paid to the relationship between sericulture, occupational diversification and women's economic participation at the level of a defined sericulture cluster. The majority of the existing studies have used household surveys, production economics, knowledge levels or entrepreneurial behaviour. A cluster-level analysis using officially available demographic, occupational and sericulture data can add to existing studies by looking at the wider socioeconomic environment in which traditional sericulture exists. Jalah region in Baksa District is a suitable site for such an assessment. The SILKS database of the Central Silk Board has many villages of the Jalah area listed according to the suitability for Eri food plants. The Census of India provides demographic and occupational data at the village level for Jalah (Part). The availability of these two complementary datasets enables the examination of the relationship between the documented Eri-sericulture potential and the broader occupational structure.

Therefore, this study investigates the shift “from tradition to transformation” through an analysis of the interaction between Eri sericulture, livelihood diversification and women’s economic engagement in the Jalah sericulture cluster. The study constructs a Women’s Economic Participation Index (WEPI) using chosen female socio-economic and occupational indicators and uses the Livelihood Diversification Index (LDI) to assess occupational diversification. The objective weights of composite indicators are obtained by using Shannon Entropy. The study conceptualises change as the gradual integration of indigenous sericulture with diversified economic activity, institutional support and women’s participation, rather than replacement of traditional livelihoods.

The study has three main contributions, i.e., first, it links the ecological potential of Eri sericulture to the larger socioeconomic structure of a given Jalah cluster. Secondly, it goes beyond the description of women’s engagement by employing Shannon Entropy-based objective weighting to find which variables of female occupational participation are the most spatially varied. Third, it regards sericulture as a diversified livelihood activity and not just as a silk-producing activity. This combination gives a valuable framework to comprehend the transformation from a traditional indigenous livelihood to a more diverse and women-centred rural economic system.

2. Study region

The present investigation was conducted in the Jalah sericulture cluster of Baksa District, Bodoland Territorial Region (BTR), Assam. Jalah is a significant rural environment in Baksa where agriculture, household-based economic activity and Eri sericulture co-exist. The Eri database of the Central Silk Board, village-wise, shows that several villages in the Jalah area fall under different Eri food-plant suitability classes, namely highly suitable (S1), moderately suitable (S2) and marginally suitable (S3) categories.

The ecological potential of the area is further illustrated in the Sericulture Development Phase II Atlas, an outcome of joint efforts by the Central Silk Board, North Eastern Space Applications Centre and Assam Remote Sensing Application Centre. The atlas indicates that there are 2,981.73 hectares of Eri-compatible territory in Jalah, out of which 1,207.79 hectares is highly appropriate, 903.73 hectares is moderately suitable, and 870.21 hectares is marginally suitable.

Table-1: Eri-Suitable Area of Jalah Block

Suitability class	Area (ha)	Percentage
Highly suitable	1,207.79	40.51
Moderately suitable	903.73	30.31
Marginally suitable	870.21	29.18
Total	2,981.73	100.00

Source: Central Silk Board/North Eastern Space Applications Centre, Sericulture Development Phase II Atlas

Hence, it is discovered that about 70.82% of the mapped Eri-compatible region is very or moderately appropriate, indicating a large ecological base for Eri-based livelihood activities. However, these categories reflect appropriateness rather than actual production intensity, and so are utilized in this study as an indicator of the environment of sericulture rather than as a direct measure of family participation.

The socioeconomic study at the village level is based on the Census of India 2011. The District Census Handbook for Baksa offers the village-level demographic and occupational statistics and serves as the primary socioeconomic database for the study.

3. Materials and Methods

3.1 Methods

The research approach was quantitative research based on secondary data to investigate the association between Eri sericulture, livelihood diversification and women's economic engagement in the Jalah sericulture cluster of Baksa District, Bodoland Territorial Region (BTR), Assam. Instead of measuring household-level sericulture productivity or revenue, the wider socioeconomic environment within which Eri sericulture operates was analysed. This method is especially relevant as sericulture is one element of a wider rural livelihood portfolio which includes cultivation, agricultural labour, domestic industries and other activities.

The analysis approach included village-level data on Eri appropriateness and demographic and occupational information. Livelihood diversification was measured using the Livelihood Diversification Index (LDI) and women's occupational engagement was measured using a Shannon Entropy-weighted Women's Economic Engagement Index (WEPI). The results were then analysed in the light of the known Eri-suitability conditions of the Jalah villages and current evidence on women's participation in sericulture in Assam and the BTR.

3.2 Study Area

The Jalah location was chosen as it is an identifiable cluster of Eri sericulture in Baksa District. The villages of the Jalah area have been identified in the village-wise Eri database of the Central Silk Board based on their Eri food-plant habitat. The classification consists of categories: highly suitable (S1), moderately suitable (S2) and marginally acceptable (S3). In the official database, certain villages belong to more than one category. Rather than pushing the settlements into one suitability class, these classifications were maintained. The village was the main unit of analysis because the study uses secondary Census information. The first list of villages was collected from the Central Silk Board and matched with the Census of India village directory using the village names and Census location codes. The analytical units for the Shannon Entropy computation were thirty-two matched villages for which complete occupational information was available. Villages for which occupational records could not be consistently confirmed were removed from the entropy computation rather than assigning approximated values

3.3 Data Sources

Three principal categories of data were used.

Table-2: Major Data Sources Used in the Study

Data source	Information obtained	Application
Central Silk Board, SILKS	Village-wise Eri suitability	Identification of sericulture villages
Census of India 2011	Population, workers and occupational structure	Demographic and livelihood analysis
Sericulture Development Phase II Atlas	Eri-suitable area by suitability class	Ecological sericulture context
Recent literature	Women's role, constraints and livelihood implications	Interpretation and comparison

Central Silk Board gives the village-wise Eri suitability information for Baksa covering the Jalah area. The demographic and occupational aspect is provided by the Census of India and the spatial extent of Eri-suitable places in terms of quantitative information is provided by the Sericulture Development Phase II Atlas.

Contextualizing the quantitative findings were recent studies from BTR and Baksa. Brahma and Basumatary (2024) highlight the cultural and socioeconomic importance of Indi/Eri to the Bodo. Moshahary and Baruah (2026) present current information on the economic viability and gender profile of Eri rearers in Baksa.

3.3 Recognition of the Jalah Sericulture Villages

The first sericulture cluster was found from the villages listed under the Jalah part of the Eri database of the Central Silk Board. These villages were then matched to the Census village directory using the village name and the Census location code.

Table-3: Jalah Villages Identified in the Central Silk Board Eri Database

Sl. No.	Village	Eri suitability
1	Ambari	S1
2	Anchali	S1/S2
3	Angulia	S1/S2
4	Baghajan	S1
5	Bakua	S1/S2/S3
6	Bamunkata	S1/S2/S3
7	Bar Chakadal	S3
8	Batabari	S1/S2/S3
9	Betbari	S2/S3
10	Bhalmanuhorbhita	S1/S2/S3
11	Bhalukamuri	S2/S3
12	Bhebla	S1
13	Bhumkirpar	S1/S2
14	Bunbari	S2/S3
15	Chahuguri	S1/S2
16	Dangarigaon	S1/S2/S3
17	Daodhara	S1/S2/S3
18	Dongpar	S1/S2
19	Dubagaon	S1/S2/S3
20	Ghogapar	S1
21	Golagaon	S1
22	Jala Gaon	S2/S3
23	Jalah	S1
24	Jangalbasti	S1/S2
25	Jarabari	S3
26	Karhana	S2/S3
27	Khalihamari	S1
28	Khuntamari	S1/S2/S3
29	Koklabari No. 2	S2/S3
30	Kujideor	S1/S2
31	Kundargaon	S2
32	Nalbari	S3
33	Naoputa	S3
34	Odalguri Gaon	S2/S3

Source: Central Silk Board, SILKS

A village which falls under more than one suitability class was preserved with the classification supplied by the Central Silk Board and not arbitrarily assigned to one class. This keeps the structure of the original government data set.

3.5 Demographic and Occupational Variables

The demographic and occupational structure of the listed communities were characterised using the Census data. The variables were total population, female population, total workers, female workers, main workers, marginal workers and the four broad occupational categories:

- a. cultivators; b. agricultural; c. labour; d. household industry workers; and e. other workers.

The same occupational groups were extracted separately for the female workers for building the component of women's economic involvement.

3.6 Livelihood Diversification Index (LDI)

The evaluation of livelihood diversification was done using a Simpson-based Livelihood Diversification Index (LDI):

$$LDI=1-\sum_{i=1}^n P_i^2$$

where (P_j) is the proportion of workers in the (j^{th}) occupational category and (m) is the total number of occupational categories.

Higher values of LDI mean that work is more diversified among occupations; lower values mean that work is more concentrated in a small number of occupations.

Four categories of occupation were considered, namely, cultivators, agricultural labourers, household-industry workers and other workers.

3.6 Women's Economic Participation Index

Women's economic involvement was measured by four women occupation indicators:

- a. female cultivators;
- b. female agricultural labourers;
- c. female home-industry workers; and
- d. female other workers.

The application of such indicators is designed to measure women's engagement in agricultural, household-based and non-agricultural economic activities.

Importantly, female workers in domestic industries were not considered sericulture workers. The Census category included several sorts of household industries and was used as a general indication of women's household-based economic involvement only.

Since the four indicators have different numerical ranges, they were normalized using min-max normalization:

$$Z_{ij} = \frac{X_{ij} - X_{jmin}}{X_{jmax} - X_{jmin}}$$

where X_{ij} represents the observed value, while X_{jmin} and X_{jmax} represent the minimum and maximum values of the respective indicator. The resulting values range between 0 and 1.

3.7 Shannon Entropy Weighting

Shannon Entropy was used to derive objective weights for the WEPI indicators. The normalized values were converted into proportions:

$$P_{ij} = \frac{Z_{ij}}{\sum_{i=1}^m Z_{ij}}$$

The entropy value was then calculated as:

$$E_j = -k \sum_{i=1}^m P_{ij} \ln(P_{ij})$$

where $k = 1/\ln(m)$ and m represents the number of observations. The degree of diversification was obtained as:

$$d_j = 1 - E_j$$

and the final weight of each indicator was calculated as:

$$w_j = \frac{d_j}{\sum_{j=1}^n d_j}$$

Indicators showing greater variability and therefore greater discriminatory information received higher weights.

3.9 Calculation of WEPI

The Women's Economic Participation Index was calculated using the weighted normalized indicators:

$$WEPI_i = \sum_{j=1}^4 w_j Z_{ij}$$

The weights obtained from the Shannon Entropy were analyzed.

Table-4: Shannon Entropy Weights Used in WEPI

Indicator	Entropy	Diversification degree	Weight	Weight (%)
Female cultivators	0.9084	0.0916	0.1373	13.73
Female agricultural labourers	0.8624	0.1376	0.2062	20.62
Female household-industry workers	0.6927	0.3073	0.4605	46.05
Female other workers	0.8692	0.1308	0.1960	19.60
Total	—	0.6673	1.0000	100.00

4. Results and Discussion

4.1 Eri Suitability Context

The grading by the Central Silk Board indicates a wide distribution of Eri appropriateness in the Jalah cluster. The existence of highly, moderately and marginally appropriate settlements shows substantial ecological heterogeneity within the studied area. The Eri suitability evaluation identifies 2,981.73 hectares of suitable territory at the block level in Jalah. Of this, very suitable is 1207.79 ha, somewhat suitable is 903.73 ha and marginally suitable is 870.21 ha. The large amount of highly and somewhat suitable land indicates that the Jalah area has a good ecological base for Eri-related livelihood activities. However, appropriateness does not determine real household participation. This difference is crucial since the present study relates to the socioeconomic environment of sericulture and not to an effort to estimate current production from secondary data.

4.2 The Livelihood System

The occupational pattern suggests that Jalah is still mostly an agrarian society. 52.84% of main workers are cultivators, 27.47% are other workers, 15.72% are agricultural labourers and 3.96% are household-industry workers.

Table-5: Occupational Structure of Main Workers

Category	Workers	Percentage
Cultivators	19,791	52.84
Agricultural labourers	5,889	15.72
Household-industry workers	1,483	3.96
Other workers	10,290	27.47
Total	37,453	100.00

The prevalence of farming underscores the enduring relevance of agriculture. But the pattern of some 47% of essential workers in other occupational categories points to a local economy that is not solely reliant on agriculture.

It provides the socio-economic background for the understanding of sericulture as a supplementary livelihood activity. Recent work on livelihoods has also highlighted the need to blend agricultural and non-agricultural occupations to promote resilience in rural livelihoods.

4.3 Livelihood Diversification

Using the occupational distribution, the aggregate LDI was calculated as follows:

$$LDI = 1 - (0.5284^2 + 0.1572^2 + 0.0396^2 + 0.2747^2)$$

$$LDI = 1 - 0.3810$$

Table-6: LDI Calculation

Category	P_i	P_i^2
Cultivators	0.5284	0.2792
Agricultural labourers	0.1572	0.0247
Household industry	0.0396	0.0016
Other workers	0.2747	0.0755
ΣP_i^2	1.0000	0.3810
LDI		0.6190

The LDI value of 0.619 shows a moderately varied occupational structure. This is a key result for understanding sericulture, as Eri raising can be integrated with an existing agricultural livelihood rather than households giving up cultivation.

4.4 Female participation in the labour force

Women made up about 38.8% of the total labour in the larger Jalah area. Their occupational distribution shows participation in agricultural, household and non-farm occupations.

Table-7: Occupational Distribution of Female Main Workers

Category	Female workers	Percentage
Cultivators	3,763	41.22
Agricultural labourers	1,965	21.52
Household-industry workers	679	7.44
Other workers	2,723	29.82
Total	9,130	100.00

Female cultivation and agricultural labour together constitute 62.74 % of female major workers. However, 37.26% work in household industry and other occupations. The presence of women in economic activities rooted in the household is especially relevant to Eri culture. Recent Bodo-specific research indicates that women are involved in the entire Indi/Eri production chain, and that sericulture plays a role in skills development, financial independence and household decision-making.

4.5 Results of Shannon Entropy

The Shannon Entropy analysis gives better knowledge of women's economic participation. The largest weight, 0.4605 (46.05% of the overall WEPI), was assigned to female household-industry involvement. Female agricultural work accounted for 20.62%, other jobs for 19.60%, and female cultivation for 13.73%.

Table-8: Ranking of WEPI Indicators

Rank	Indicator	Weight
1	Female household-industry workers	0.4605
2	Female agricultural labourers	0.2062
3	Female other workers	0.1960
4	Female cultivators	0.1373

The high weight of household-industry participation indicates that this indicator provides the greatest differentiation among the villages included in the entropy analysis. It does not mean that household industry is the largest source of women's employment; rather, it means that its spatial variation is greatest and consequently its information contribution to WEPI is highest. This finding is particularly meaningful in a sericulture context because Eri production has historically been associated with household-based production and women's labour. 4.6 Women and the Transformation of Traditional Livelihoods. The results indicate that women's participation should be viewed as a central component of livelihood transformation rather than as a secondary labour contribution. Recent evidence from Baksa provides particularly strong support. Moshahary and Baruah (2026) found that 97% of surveyed Eri rearers were women, while Eri rearing produced a cost-benefit ratio of 4.11. At the same time, market linkages, technology and host-plant availability remained major constraints. The present secondary-data analysis complements these household-level findings by demonstrating that women already participate substantially in the broader Jalah economy. The high WEPI weight of household-industry participation further suggests that household-based economic activities are an important dimension through which women's economic roles vary across the cluster.

4.7 Transition from Tradition to Transformation

The results support the interpretation that the evolution of Eri sericulture in Jalah can be characterized as integration rather than replacement.

Traditional Eri knowledge is vital but can be strengthened in its contribution to livelihoods by:

- a. enhanced technical knowledge;
- b. systematic production;
- c. women entrepreneurship;
- d. value addition;
- e. better market access;
- f. access to institutional credit; and
- g. better host-plant availability.

This interpretation is in line with the latest research on the Bodo that acknowledges Indi/Eri as a cultural practice, a livelihood activity and a means for women's socioeconomic engagement simultaneously. The current Baksa study also finds that Eri culture has livelihood potential but needs more market and technical assistance.

4.8 Implications for Livelihood Development

The findings suggest that interventions should move beyond increasing cocoon production and focus on strengthening the entire livelihood and value chain.

Table-9: Development Priorities for Jalah Sericulture

Priority	Expected livelihood benefit
Expansion of Eri host plants	Greater production potential
Technical training	Reduced production losses
Women-focused credit	Greater productive investment
Producer groups/SHGs	Collective bargaining and market access
Spinning and weaving	Greater value addition
Product diversification	Additional income opportunities
Digital and direct marketing	Improved market realization
Entrepreneurship training	Transition towards women-led enterprises

The need for such interventions is supported by recent evidence from Baksa, where inadequate market linkages, limited technological transformation and host-plant scarcity were identified as major constraints.

The Jalah sericulture cluster is a major confluence of traditional Eri culture, agricultural livelihoods, occupational diversification and women's economic engagement, the study reveals. The Eri suitability evaluation reveals the presence of a large ecological base, with 2,981.73 hectares being appropriate for Eri, and the socio-economic structure is still primarily agrarian.

The occupational study showed an aggregated Livelihood Diversification Index of 0.619, indicating a fairly diverse livelihood structure. The major activity is cultivation, in which 52.84% of the primary workers are engaged. But close to half of the workforce is engaged in agricultural labour, home industries and other occupations. This lends itself to a positive framework of Eri culture as a supplementary livelihood rather than a replacement lifestyle.

The gender dimension is very relevant. Women account for some 38.80 per cent of the entire labour force and are involved in agricultural, household-based and other economic activities. The Shannon Entropy analysis reveals that the most spatially differentiating component is women's economic participation in household industry (weight 0.4605), followed by women's economic participation as agricultural labourers (0.2062), other workers (0.1960) and cultivators (0.1373).

These results are consistent with recent evidence from Baksa that Eri rearing is largely female-dominated and economically viable. They also corroborate past research showing women's engagement in different phases of the Eri manufacturing chain. Indigenous women should thus be viewed not only as labour providers, but as major potential agents of livelihood diversification and value-chain change.

5. Conclusion

The study concludes that the change of Eri sericulture in Jalah does not need to include the abandonment of traditional techniques. Rather, the future of the sector is in connecting indigenous knowledge with technological advancement, women entrepreneurship, value addition, institutional lending, host plant development and improved market linkages. This method can help to change Eri culture from a household-oriented traditional activity to a more robust and diversified livelihood system, while at the same time it can keep its cultural relevance within the BTR.

Conflict of Interest: The author declares no conflict of interest.

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