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EMERGENCE OF SMALL TEA PLANTATIONS IN UDALGURI DISTRICT OF BODOLAND AREAS IN ASSAM (INDIA): EXAMINING THE CHALLENGES OF SMALL TEA GROWERS

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Abstract

Though small tea farms started considerably late in the Bodoland Areas in Assam, Udalguri district has emerged as the core of the entire Bodo region given its historical legacy of large tea plantations and growing awareness among the Bodo and other dominant communities of the district about higher returns from tea cultivation compared to rice-dominant traditional farming system. The rapid expansion of Small Tea Growers (STGs) highlights the improvement in local livelihoods, especially among landless labourers and unemployed youth. However, STGs face challenges such as high initial costs, market uncertainties, limited financial support and poor infrastructure, which hinder sustainable development. Thus, an attempt is made to analyse the emergence of small tea plantations in the Udalguri district, examining their spatial distribution, land use/land cover (LULC) changes, as well as the challenges faced by small tea growers based on primary data and remote sensing (LANDSAT) from 1991 to 2021. Understanding these multifaceted issues, a multiple linear regression methodology has been employed to investigate the impact of socio-economic factors on the income of Small Tea Growers. Primary data was collected with the help of a structured questionnaire from 234 STGs through purposive sampling. The research problem focuses on understanding what factors influence the income of STGs who play an important role in the tea industry, as these growers earn different income levels depending on different factors. The dependent variables were income (Rs/ha), years of schooling, age of growers, family size, years of experience, production (kg/ha) and area under tea (ha). Data was analysed to determine the strength of relationships between variables and income, with the model fit assessed using R and R^2. The results show that socio-economic factors significantly influence the income of STGs. The model exhibits a strong correlation (R=0.998). ANOVA results validate the model's reliability with a highly significant F-statistic. Overall, the results highlight the pivotal role of plantation size, productivity and family size in enhancing the profitability of STGs while other factors contribute minimally.

Keywords: small tea plantations, small tea growers, land use and land cover change, bought-leaf factories, Bodoland.

1. Introduction

The tea industry of India is very old and has been significantly contributing to the agrarian economy of the country since 1840 in the British colonial period (Behal, 2014). This industry has made a notable contribution towards production, marketing, consumption, and employment generation, where thousands of unemployed skilled and unskilled labourers are engaged in different parts of the tea-growing regions of rural India. Due to the prevalence of favourable environmental conditions concerning terrain, soil, rainfall, and temperature, in addition to an adequate labour supply, the Assam tea industry has become the biggest tea producer compared to other tea-growing regions of the country (Guha, 1977). However, in recent years the emerging significant challenges have led to the declining competitiveness of some large tea estates, attributed to factors, such as demand and supply imbalances, ageing bushes and failing replantation, maintenance neglect, quality deterioration, insufficient investment, high production costs, rising social expenses (including healthcare, education and housing) and labour shortage. On the other hand, some successful estates were interested in expanding their area under tea, but they were restricted as the government granted each plantation a certain and constrained amount of land. Peasants were therefore urged to intervene and ensure the sustainability of tea production. Small farmers surrounding tea estates have been converted to grow tea to supply the major plantations and their processing facilities with green leaves. At the beginning of the 1960s, the agricultural extension programmes of the country progressively extended to South Indian areas in Tamil Nadu's Nilgiris district (Reddy & Bhowmik, 1989).

The cultivation of tea in small holdings began initially in upper Assam, particularly in Golaghat, Sibsagar and Jorhat districts. Small-scale tea growing was explicitly suggested in 1978 by the late Soneswar Bora, the minister of cooperatives and agriculture. Given its higher economic return and sustainability compared to other traditional rice-based agriculture, the practice of small tea plantations (STP) has been widely spread from the upper Assam region (the core area of tea plantations in Assam) to most other parts of the state in recent times. As a result, a distinct group of tea farmers, comprising diverse ethno-religious communities called small tea growers (STG), are involved in tea growing and have become more popular on a local scale (Saikia, 2017). In the Draft Eighth Plan, the Tea Board of India (TBI) has prioritised promoting small tea producers to inspire young unemployed and landless people to start tea production in Assam and other tea-flourishing areas in India (Bhowmik, 1991). According to TBI, tea growing on small land holdings not exceeding 75 Bighas (approximately 25 acres or 10.12 hectares) is categorised as Small Tea Plantation. However, the Assam government classifies STPs as those which are having farm areas not exceeding 4.28 hectares or 32 bighas. In contrast, the All-Assam Small Tea Growers Association (AASTGA) identifies small tea growers as individuals with land holdings of less than 250 bighas or 33.44 hectares (Borah, 2013). The growth of STP in Assam has reached such a stage that its tea production of 334.15 million kg constitutes 48 per cent of the total tea production (696.67 million kg) in the state (TBI, 2022-23). Moreover, the state of Assam, constituting 50.72% of India's total production of tea, is the

biggest producer of tea in the country. Although tea cultivation started in upper Assam in the form of large-scale plantations during the British colonial period, small-holding tea cultivation has expanded tremendously across the state in the form of small tea plantations, largely since the 1980s, among individual farmers. Its growth in Assam has become such that currently it accounts for 24.33 per cent of the nation's total tea production. Assam currently has 1,22,415 small tea producers, which is against the country's 2,29,526, and around 1.5 million households in the state depend on small tea plantations (TBI, 2023). So far, the growth of small tea cultivation in lower Assam is primarily concentrated in the Udalguri district of the Bodoland areas, where it started in the early 1990s. This paper examines the origin and trend of the expansion of small tea plantations (STP) in the district and how the agricultural sector adapts to land use changes and other associated issues. It also analyses the impact of increased local producers' participation in the tea sector and the rise of bought-leaf factories on local livelihoods.

2. Database and Methodology

The study is primarily based on field data due to the lack of secondary data, which have been collected through a household survey of 234 small tea growers in No. 2 Rajagarh through purposive sampling, as this village is highly concentrated with STGs and where STPs are the primary occupation. The data obtained from the household survey have been interpreted in simple percentages. To understand the relation of STGs with bought leaf factories (BLFs) and estate factories (EFs) and the roles of factories in the expansion of STP, including their production systems, marketing strategies and related socio-economic impacts, interviews were conducted at 5 BLFs (Bodoland Tea Company, Suklai Tea Factory, Rajajuli TF, Nalapara TF, Phung TF) and 2 EFs (Boregajuli EF, Dimakuchi EF). To analyse the spatial expansion of STPs from 1991 to 2021 in Udalguri district, the data were extracted from Google Earth (12/1991) and (2/2021), which have been prepared using the software ArcGIS 10.8 and QGIS 3.28.6. The data obtained from the spatial distribution of STP of block growth of the area of STP (1991-2021) is shown in Table 2. Additionally, regarding changes in Land Use and Land Cover of Udalguri district, two satellite images from LANDSAT for the years 1991 and 2021 have been downloaded from USGS Earth Explorer, which are shown in Table 1, and a supervised classification method has been used using ArcGIS 10.8 and analysed by the Maximum Likelihood Algorithm. Again, to analyse LULC maps for 2010 and 2021 of No.2 Rajagarh village of Udalguri district, the data were extracted from Google Earth (11/04/2010 and 17/01/2021) and mapped by using the Software ArcGIS 10.8 and QGIS 3.28.6 and area change has been shown in percentage as well as area in ha (table 4). The secondary data about the distribution and growth of small tea growers and associated production patterns have been obtained from the Tea Board of India and various government reports.

Understanding these multifaceted issues, a multiple linear regression methodology has been employed to investigate the impact of socio-economic factors on the income of STGs. The research problem focuses on understanding what factors influence the income of STGs who play an important role in the tea industry, as these growers earn different

levels of income depending on different factors. The dependent variables were income (Rs/ha), years of schooling, age of growers, family size, years of experience, production (kg/ha) and area under tea (ha). Data was analysed to determine the strength of relationships between variables and income, with the model fit assessed using R and R^2.

Table 1: Details of Satellite Data Used

Sensor	PATH	ROW	Date of Acquisition	Scale/Resolution	No. of Bands
LANDSAT8 (LULC, 2021)	138	042	2021/3/2	30 Meter	7
	137	041	2021/1/28	30 Meter	7
LANDSAT 4-5 TM C2L1 (LULC, 1991)	136	041	1991/12/5	30 Meter	7
	136	042	1991/12/5	30 Meter	7
	137	041	1991/12/12	30 Meter	7

Data Source: USGS Earth Explorer

3. Study Area

The study area, i.e. Udalguri district, one of the five districts of Bodoland Territorial Region (BTR) in Assam, is located on the north bank of the Brahmaputra valley, covering an area of 2013.40 sq. km and lying between 26°39'45"N - 26°55'0"N latitude and 92°12'45"E - 91°57'30"E longitude (Fig. 1).

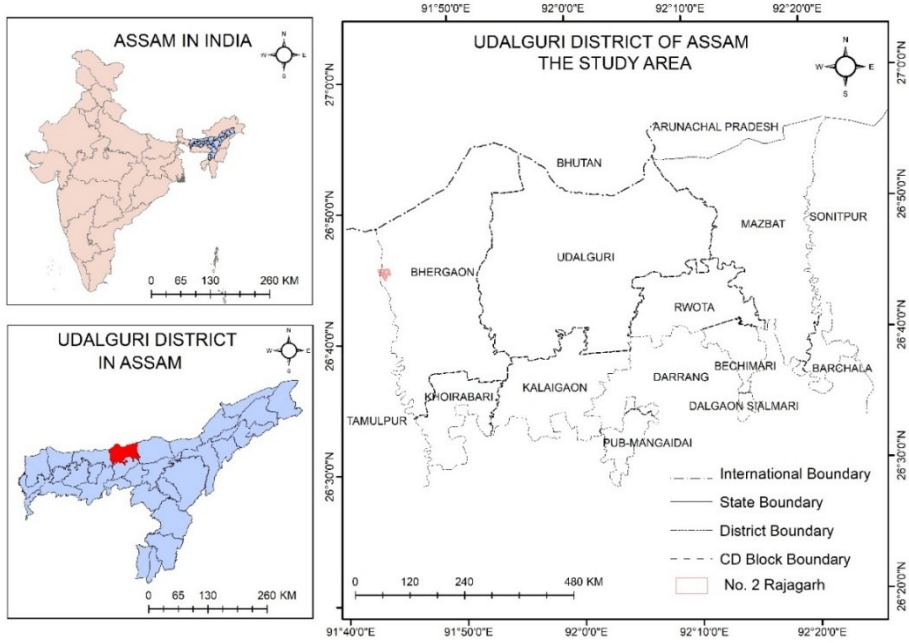

Fig. 1: Location Map of the Study Area (Udalguri District)

Source: Prepared by the author using the Software ArcGIS 10.8 based on a map from the District Census Handbook, Udalguri District, Census of India, Assam, 2011.

The district is bounded by Bhutan and Arunachal Pradesh in the north; the river Pachnoi in the east; Darrang district in the south; and Tamulpur district in the west. With a population of 831,668 (As per the 2011 Census), the district is characterised by diverse ethno-linguistic and religious composition. Besides the population of the Bodo community (31.76%), it is largely inhabited by non-tribal Assamese, Bengali and Nepali people. The Adivasi community, traditionally involved in tea plantations, also forms another important segment of the population in the district. The rural economy dominates Udalguri district. The urban areas comprising the towns of Udalguri (district headquarters) and Tangla constitute merely 3.90% of the district's total population. Udalguri district, being the core area of tea plantations in Bodoland, has twenty-five tea estates, which were established during the British period in the 1850s. Among them, Hattigarh Tea Estate, Majuli Tea Estate, Budlapara Tea Estate, Dhansiri Tea Estate and Mazbat Tea Estate are pretty big in their area and production. The district encompasses diverse soil types such as brown, red, yellow, bhabar, terai, shallow black and older alluvial soils. Udalguri district has a sub-tropical climate, which experiences high precipitation and temperature during the monsoonal season (April-October), which is ideal for tea cultivation. The district receives its highest temperature of about 38°C during the June-July months and the highest precipitation with 250-300 cm annual rainfall during the monsoonal season. In the district, a total of 7519 STGs are actively engaged in the STP sector, collectively occupying 8548.74 ha of land (TBI & Statistical Handbook of Assam, 2021).

4. Results and Discussion

4.1 Emergence of Small Tea Plantations in Udalguri District

The TBI pioneered small tea plantation expansion involving landless labourers and unemployed youth across the state of Assam. A similar approach can also be observed in the Udalguri district. Numerous small-scale tea farms were set up across the district with support from both TBI and large tea estates forming three major belts, viz. Dimakuchi, Udalguri and Mazbat from west to east (Bhobora, 2008; Barpujari, 2018). The first small tea plantation (STP) emerged in the Amjuli village area in the Udalguri belt in 1991, and simultaneously, almost in the same year, in the Dimakuchi and Mazbat belts. The initiation approach, however, varied across three belts. It was a collective effort primarily led by Bodo community entrepreneurs in Udalguri and Mazbat, while in Dimakuchi, individuals from multiple communities were involved in establishing the small tea plantations. Those involved in the process were largely enthusiastic peasants comprising educated unemployed youths, teachers engaged in venture schools, and some having abundant land but without technical efficiency for the modernisation of agriculture (Goni, 2015). Historically, though the concept of small tea plantations was mooted during the 1970s in upper Assam, the idea of small-scale tea cultivation came late in the Udalguri district (Bora, 2008; Borgohain, 2008). The STP in Udalguri district began as a Society in 1991 when Pronoy Basumatary, a former Assistant Manager of Bahi-Pukuri Tea Estate, and ten other Bodo youths established *Mwider Bagan* (Elephant herd) for tea cultivation on 6.5 hectares in Amjuli village under Udalguri belt, which was previously inhabited by some Bihari people

close to the Indo-Bhutan border and Corramore Tea Estate. Initially, the said land was non-cadastral, and this *tauzi* land belonged to the government. Most of the land was purchased from the Bihari people, which was identified as a 'ceiling surplus' (The Assam Fixation of Ceiling Act, 1956 as amended became effective on 15th February 1958, across all the plain districts of Assam. The ceiling limit was set at 49.05 acres, with an additional allowance of up to 9 acres for orchards. Later on, it was transformed into the *Myadi Patta* land. The Corramore Tea Estate under Williamson Magor & Co. Ltd. helped the *Mwider* Bagan Society's tea plantation. Subsequently, it expanded the plantation area to around 130 hectares by acquiring land from nearby areas, thereby establishing the Mwider Co-operative Tea Industry. After the demise of some of the founding members, the remaining stakeholders struggled to sustain operations collectively for some more time. However, in the later part of the 2010s, they ceased production and opted to divide the lands evenly among the individual shareholders. Similarly, within the same belt, *Jwnglari* Small Tea Garden was established in 1993 and is operated by small cooperatives through partnership arrangements (Daimary, 2024).

Pronoy Basumatary pioneered small-scale tea cultivation among Bodo youngsters in the Mazbat belt to combat unemployment (Basumatary, 2019). In 1991, he formed two groups, Badari and Rwdwmsri, organising 40 members and starting a nursery with clones from Lamabari, Bahi-Pukhuri, and Bettybari tea estates. Despite land allocation issues and opposition from Bodo farmers, they eventually found land in Paharpur, but were later dispossessed. In 1993, Badari members established an STP at Naoherua High School using their cultivated saplings (Basumatary, 2014). In the Suklai area, Kamala Bora and Gagan Dutta led the tea cultivation efforts. Bora brought seeds from Tinsukia in 1991, while Dutta, a High School teacher, started his garden with saplings from Atterighat Tea Estate in 1993, receiving technical support from the estate manager. In the Dimakuchi belt, pioneers like Davidson Daimari, Kogen Boro and others used their contract work experience to establish nurseries with cuttings from nearby estates.

4.2 Spatial Expansion of Small Tea Plantations (STPs) in Udalguri District

The growth and distribution of tea plantations in the Udalguri district are intricately linked with its climatic elements, such as rainfall and temperature, topographical characteristics like elevation, slopes, aspects and relief and soil characteristics. The first tea estate, Dimakuchi Tea Estate, was established in 1850 in the colonial era, and presently it is managed by McLeod Russel India Ltd., employing 603 permanent labourers and around 1300 contractual workers (As per the 2014 record), covering an area of 337 hectares (Baro, 2021). Large estates and STPs increasingly dominate the landscape of Bhergaon and Udalguri CD Blocks in Udalguri district. With over 7,519 registered STGs, plantation areas cover 8,549.74 ha compared to 12,640.57 ha of total tea estate area (Statistical Handbook of Assam, 2022). Bhergaon CD Block, with a higher concentration of STPs, shows the availability of suitable land and accessibility to manufacturers, driven by the concentration of small-scale tea farmers.

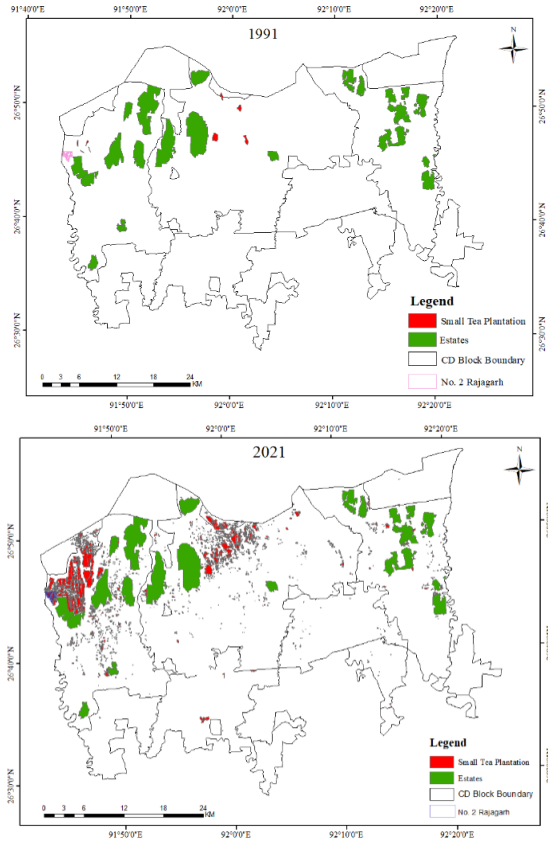

Fig. 2: Spatial Distribution of Tea Estate and Small Tea Plantations in Udalguri District, 1991 and 2021

Table 2: Block-wise Growth of Area of Small Tea Plantations of Udalguri District (CD Block having tea plantation), 1991 and 2021

CD Block	Total Area (ha) of CD Block, Udalguri	Area Under STP (ha)		% of STP Area to District's total STP Area	
		1991	2021	1991	2021
Bhergaon	50,279	38.34	10,994.27	15.04	56.13
Udalguri	57,900	216.48	7,511.4	84.96	38.34
Mazbat	32,900	-	709.06	-	3.62
Rowta	15,684	-	258.42	-	1.32
Kalaigaon	16,600	-	29.98	-	0.15
Khoirabari	17,100	-	80.33	-	0.41
Dalgaon Sialmari(Pt)	5,900	-	5.81	-	0.03
Total	**196,363**	**254.83**	**19,589.35**	**100**	**100**

The block-wise growth of STP in the district from 1991 to 2021 shows significant regional disparities and trends in land utilisation (Table 2). In Bhergaon CD Block, there is a substantial increase in STP area growing from 38.34 ha in 1991 to 10,994.27 ha in 2021 which constitutes over 56% of the district's total STP area (Fig. 2). Udalguri Block, despite having a smaller total area under STP in 1991 (216.48 ha), experienced significant expansion reaching 7,511.4 ha in 2021 (38.34%). The other CD Blocks like Mazbat, Rwota, Kalaigaon and Khoirabari showed minimal growth or no STP area in 1991, with only slight increases by 2021. Overall, the district's total area under STP grew substantially, with Bhergaon and Udalguri emerging as the dominant contributors to the expansion.

4.3 Implications of Small Tea Growers on their Livelihoods

The rapid growth of small tea plantations in the Udalguri district during the last three decades raises questions about the potential contribution of small tea plantations to improving the local livelihoods of farmers. The shift away from traditional crops towards tea cultivation originated from its higher profitability compared to traditionally grown food crops, including paddy, and has brought about marked changes in the agricultural landscape in the district as in other parts of the state (Sharma & Barua, 2017). Initially, small tea growers (STGs) in the district cultivated conventional crops like straw thatch, ragi millets, and mustard. However, they later shifted to sugarcane, areca nut, and pulses due to market demand. However, market uncertainty and unreliable weather led to low prices of such traditional agricultural products. Finally, the transition took off in the 1990s, particularly among the marginal farmers, who found tea cultivation more lucrative, because the daily income after 3-4 years of investment became much higher compared to other traditional food crops. In this way, many farmers in the district were attracted to the high economic returns of small tea growers through planned utilisation of unused or under-used fallow land, grazing land, wasteland and even kitchen gardens for the purpose (Saha, 2018). However, tea farming, which requires significant initial and continuous investment, becomes a hurdle for numerous small-scale farmers. Hence, access to institutional financial support is vital for their advancement. While India's Tea Board provides subsidies and banks extend loans, numerous small growers encounter difficulties due to the absence of permanent land titles, a requirement for accessing these resources (Deka, 2010). Therefore, the pioneers sold assets like land and livestock to invest in STP. Another advantage of small tea plantations is that tea growers can plant additional commercial trees like areca nut, agarwood, betel leaf, black pepper, etc., within the tea plantation area, which augments their income. According to the interlocutors, many small tea growers have already experienced success with the plantation of these crops in generating sufficient income. The small-scale tea plantation has been regarded as a major source of employment and income generation among the rural inhabitants of the district. It is well-known that many labourers are required to nurture tea plants, pluck, prune, and so forth (Das, 2012; Das & Das, 2020). Before the emergence of small tea plantations, Adivasi and other migrant labourers were traditionally employed in tea estates due to their inherited knowledge and skills in tea cultivation (Behal, 2006). Thus, the emergence of STP in the district increased income

opportunities for women labourers, leading to economic empowerment. The small tea plantations also created new job opportunities among the local Bodo community, leading to improved livelihoods and economic stability. The involvement of women as tea pluckers diversifies the tea garden workforce by addressing labour needs. However, the female labourers face challenges in balancing work with childcare responsibilities.

4.4 Adaptation with Small Tea Plantations

It was mentioned that initially, many pioneers were linked to large tea estates, supplying materials and engaging in various activities. Despite having fertile land, significant capital was required for expenses on saplings and labour. Some pioneers established nurseries using cuttings from nearby estates rather than investing directly in buying saplings (Sharma & Barua, 2017). Williamson Magor & Co Ltd. supported growers with seed, cuttings and training, and also provided tractors and agricultural inputs, which were later deducted from the cost of raw tea leaves. The estate factories have taken green leaves from STGs since introducing small tea plantations by making contractual agreements with the growers. At the initial stage of tea cultivation, growers were doubtful about their prospects. Over time, growers gained confidence in their tea cultivation endeavours and encouraged their successors to continue the tradition. Educated youths with modest savings increasingly opt for tea cultivation as a promising occupation in the rural economy.

Immediately after taking up small-scale tea cultivation, the growers do not get any earnings for up to 3-4 years after the inception of the plantation. During that period, they must depend on traditional food crops if their primary occupation is cultivation. Given this, some small farmers traditionally involved in rice cultivation have not been found to switch over to tea cultivation completely. Hence, in many other cases, the transition to tea cultivation does not entail converting the entire land at once; instead, it takes place gradually, plot by plot. There have been various challenges in supplying green leaves to the factories. Initially, estate factories were the sole purchasers of green leaves but struggled with low capacity, leading to lower rates and rejection of leaves. Depending only on organised tea estates, the area under small tea plantations increased to such an extent that within ten years (1991-2000), the estate factories could not take and process the increased production of leaves from the STGs. The growers repeatedly failed to get an acceptable and adequate price; sometimes their leaves were returned in the name of poor quality, and the low capacity of the estate factories. When there was no bought-leaf factory, the pioneers typically found it easier to negotiate agreements with tea estate factories with large land holdings (more than one hectare). In contrast, it proved challenging for small and marginal growers (less than one hectare) to secure agreements with these estate factories. As such, it was a big issue for those small growers, as estate factories needed green tea leaves in bulk to fulfil their annual capacity. As a result, those growers had to supply green leaves through leaf agents.

Besides the above, Udalguri district faced an alarming militancy issue during 1990-2004, posing challenges for the pioneers of small tea plantations in the district, who were often demanded large sums of money by the militants. This situation impacted the survival of many STPs in the district (Barua, 2015). Additionally, several managers of major tea estate factories fell victim to militant groups during these periods of growing tensions. The small tea growers also encountered suspicion from the Indian Army, who saw them as potential messengers to the militants. The situation, however, witnessed improvement after 2004 following the All Clear Operation conducted by the Indian Army against the National Democratic Front of Bodoland under Ranjan Daimary (NDFB-R) in Bhutan.

4.5 Emergence of Bought-Leaf Factories

As the STGs do not have their own tea processing factories, they must rely on either large or private estate factories. Among the factories, those that do not possess their tea gardens and purchase green leaves from the STGs are known as bought-leaf factories (BLF). According to TBI, BLFs are tea factories that acquire 75% of their green leaf requirements from various sources (TMCO, 2003). The advent of bought-leaf factories in the Udalguri district had a positive and encouraging impact on confirming the position of STGs within the tea sector. Despite challenges such as price fluctuations, intervention by leaf agents, limited capacity, and financial and technical constraints over the years, small tea growers have increased their land holdings and productivity over time (Hannan, 2019). Before the advent of bought-leaf factories, large tea estate factories exclusively used to purchase green tea leaves from STGs. During the 1990s, the green tea leaves were supplied to estate factories to the tune of 5,00,000 kg to 6,00,000 kg per day by STGs in the district. On the other hand, the total capacity of each estate factory had been 10,000 kg to 20,000 kg per day. In the Udalguri district, there are 25 estate factories spread across three tea belts: Bhergaon, Udalguri, and Mazbat. The growers often faced serious challenges during the peak season from August to October. Coping with them, they had to prune the garden or dispose of the leaves on the roadside due to an excessive supply. This situation resulted in the establishment of a Cooperative Tea Factory in the district. The first cooperative factory “Mwider Bagan”, which was established in Amjuli small tea plantation by the local Bodo community, is no longer operational. Initially funded by borrowing from Marwari traders, this factory faced financial struggles and ultimately had to be given to the Marwari entrepreneurs due to their inability to repay the loans.

The concept of bought-leaf factories (BLF) emerged roughly a decade ago in 2013, with the establishment of Bodoland Tea Factory as the pioneering BLF, succeeded by Rajajuli Tea Factory. During 1996-2006, there was a significant increase in the number of STGs and the area under small tea plantations in the district. However, this led to a situation where supply became consistently high, but the demand remained low. In response to this imbalance, the individuals sought to address the growing production of green tea leaves in the district by establishing a bought-leaf factory. Indigenous people did not solely establish the initial bought-leaf factory due to the financial challenges they faced in setting up a factory independently. Consequently, a collaborative effort between Marwari

traders from northern India and indigenous entrepreneurs led to the establishment of the first BLF in 2013, located in Suklaikhuti. As of 2022, there are a total of 18 bought-leaf factories in the district, and a few more are in the process of establishment. Among these, 13 bought-leaf factories are located in the Bhergaon block and five in Udalguri block. However, due to fewer small tea growers in the Mazbat block, it remains reliant on large tea estate factories.

With a rapid increase in the number of BLFs in the district, some factories are encountering a crisis in search of an adequate quantity of green leaves (Sharma & Barua, 2017). This shortage raises concerns about maintaining the quality of green tea leaves, as bought-leaf factories typically accept all types of green leaves. The processing of poor-quality leaves can adversely impact the tea market and significantly affect the marketing environment due to the production of poor-quality processed tea. In addition to purchasing leaves from growers, the bought-leaf factories often provide financial support in advance payments at the beginning of the season to STGs. These factories, mostly established on a partnership basis or as public limited firms, emerged after 1963-64, particularly in South India. According to the STGs of Udalguri district, they are not getting a better price for green tea leaves from bought-leaf factories. Therefore, they had to establish Farmer Producer Companies and Co-operative Factories. The bought-leaf factories have a major role in controlling the mechanism of price determination and quality tea produced by these players, affecting domestic price levels and damaging the quality perception of Indian tea export markets. There are different viewpoints regarding bought-leaf factories, the BLF owners, small tea growers, Association members and leaf agents in the entire tea production process and marketing system. However, with the emergence of BLFs in the present day, the growers now have the flexibility to select factories based on the competitive offer prices for green tea leaves. The growers can now even enter into agreements with multiple bought-leaf factories or estate factories for a better deal. Given the reliance on estate factory owners' behaviour and constraints, many growers opt to supply green tea leaves to the BLFs, where there are fewer restrictions regarding the quality of the leaves.

4.6 Changes in Land Use / Land Cover: Udalguri and No. 2 Rajagarh Village

Land cover signifies the spatial distribution of the different land cover classes on the earth's surface, and can be directly estimated qualitatively as well as quantitatively by remote sensing, land use and its changes require the integration of natural and social scientific methods to determine which human activities are occurring in different parts of the landscape, even when the land cover appears to be same. Multi-temporal satellite imagery can provide the essential measurement of spatial and temporal phenomena. Eight LULC classes, i.e. forest, tea garden (including both BTE & STP), Agriculture, settlement, water bodies, sand bar, barren land and vegetation classes, are classified for the years 1991 and 2021. The results confirmed that the total area of the study area was 201340 ha (2013.40 sq. km). The areal coverage and percentage of each LULC for two periods, including 1991 and 2021, are summarised in Table 3. The LULC classification for the TM 1991 image shows that the majority of the study area was under agriculture, covering 86765 ha

(43.09%). Vegetation and settlement or built-up area covered an area of 32033 ha. (15.91%) and 19296 ha. (9.58%) respectively, whereas the aerial coverage of the Tea Garden and forest was 12762 ha (6.34%) and 14701 ha (7.30%). The other land coverage of the districts constitutes sand bar 11475 ha (5.70%), barren land 11102 ha (5.51%) and water bodies 13206 ha (6.56%) (Fig. 3). In contrast to the previous year period, in 2021, the greatest share of LULC from all classes was vegetation 37920 ha (18.83%). Agriculture covered an area of 72760 ha (36.14%). Tea garden and settlements or built-up areas constitute 33110 ha (16.44%) and 23620 ha (11.73%) respectively. The last aerial coverage was sand bar 12750 ha (6.33%), water bodies 11560 ha (5.74%) and forest 9620 ha (4.78%) respectively. From 1991 to 2021, land use land cover of the district shows that forest cover declined by 2.52% and agriculture by 6.96%. Tea gardens expanded by 10.11%, replacing significant agricultural areas. Settlement areas grew by 2.15% while barren land decreased by 5.51%. The minor shifts occurred in water bodies (-0.82%) and sand bars (+0.63%).

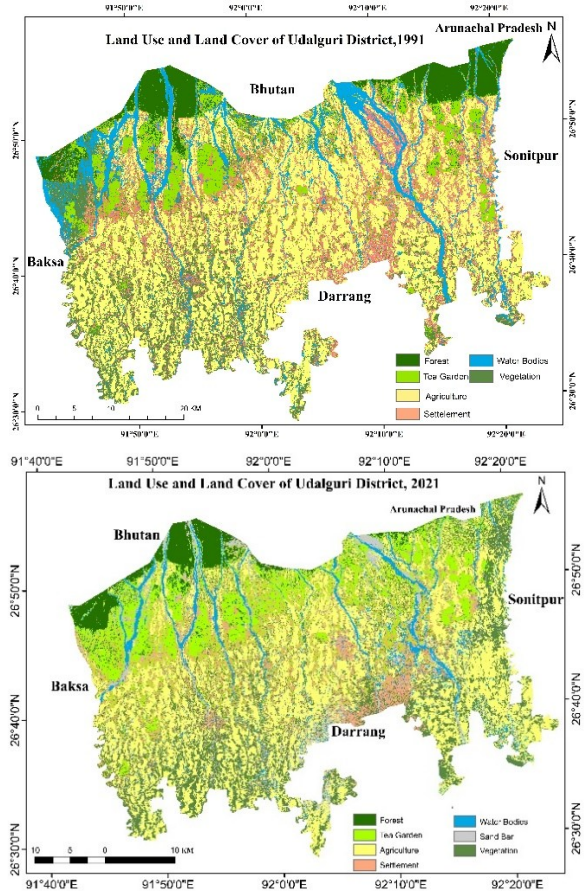

Fig. 3: Land Use / Land Cover of Udalguri District, 1991 and 2021 based on Landsat 4-5 TM (1991) and LANDSAT-8 (2021) datasets

Table 3: Area and Amount of change in different land use/ land cover categories in Udalguri District during 1991-2021

Land use/land cover categories	1991		2021		Change Between 1991 and 2021	
	Area in Ha	Area in %	Area in Ha	Area in %	Area change in Ha	Area change in %
Forest	14701	7.30	9620	4.78	-5081	-2.52
Tea garden	12762	6.34	33110	16.44	+20348	+10.11
Agriculture	86765	43.09	72760	36.14	-14005	-6.96
Settlement	19296	9.58	23620	11.73	+4324	+2.15
Water Bodies	13206	6.56	11560	5.74	-1646	-0.82
Sand Bar	11475	5.70	12750	6.33	+1275	+0.63
Barren land	11102	5.51	0	0	-11102	-5.51
Vegetation	32033	15.91	37920	18.83	+5887	+2.92
Total	201340	100	201340	100	0	0

It is observed that there has been a rapid proliferation of small tea growers with varying land-holding patterns, and the resultant diversification of economic activities has significantly changed the natural landscape of Udalguri district. Here, it focuses on how the shift from rabi crops to small tea plantations impacts land use and land cover (LULC) in different parts of the district. The study, based on an efficient methodology, has been able to identify diverse LULC types like small tea plantations, water bodies, forests, arecanut plantations, settlements, roads and other traditional crops, including paddy in No. 2 Rajagarh covering an area of 377.25 ha. This effort provides insight into spatial changes, highlighting the effects of agricultural transition on land use and environmental conditions due to the expansion of a small tea plantation in the village.

The analysis of the resultant LULC maps for 2010 and 2021 reflects the pivotal role of small tea plantations in LULC change in No. 2 Rajagarh village during 2010-2021 (Fig. 4). In 2010, autumn rice, open space, and maize dominated the landscape with a proportional coverage of 33.99%. However, due to a substantial increase in small tea plantation areas, its spatial extent has experienced an expansion of more than 2.7 times from its proportion of 11.51% to 31.86% during 2010-2021 by largely replacing autumn rice and maize cultivation (Table 4). On the other hand, winter rice cultivation has been introduced in the selected low-lying areas of the village. The land use land cover map of No. 2 Rajagarh village has been prepared on the cadastral map obtained from the Survey and Settlement Training Centre by incorporating a Google Earth background image through plot-by-plot digitisation in QGIS for 2010 and 2021.

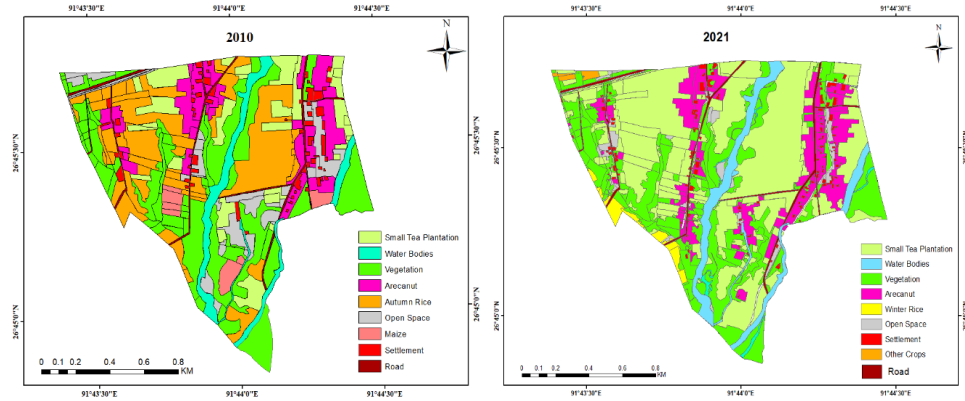

Fig. 4: Changes in Land Use / Land Cover in No. 2 Rajagarh, 2010 and 2021 based on data extracted from Google Earth (11/04/2010) & (17/01/2021)

Table 4: Pattern of Land Use / Land Cover Change in No. 2 Rajagarh (2010-2021)

Land use/land cover categories	2010		2021		Area Change between 2010 and 2021	
	Area(Ha)	Area(%)	Area(Ha)	Area(%)	Area change(Ha)	% difference in area change
Small Tea Plantation	43.42	11.51	120.20	31.86	76.78	20.35
Water Bodies	33.44	8.86	31.30	8.30	-2.14	-0.56
Vegetation Cover	76.09	20.17	72.2	19.14	-3.89	-1.03
Arecanut	41.64	11.04	41.93	11.11	0.29	0.07
Open Space	35.97	9.53	23.24	6.16	-12.73	-3.37
Settlement	27.70	7.34	29.64	7.86	1.94	0.52
Road	26.73	7.09	26.73	7.09	0.00	0.00
Autumn Rice	64.99	17.23	0.00	0.00	-64.99	-17.23
Winter Rice	0.00	0.00	22.95	6.08	22.95	6.08
Maize	27.27	7.23	0.00	0.00	-27.27	-7.23
Other Crops	0.00	0.00	9.06	2.40	9.06	2.40
Total	**377.25**	**100**	**377.25**	**100**	**0.00**	**0.00**

The analysis further reveals that the discontinuation of autumn rice and maize in the village has also been replaced by the cultivation of various crops, including vegetables, particularly in the low-lying patches unsuitable for tea. Thus, the shift from autumn rice and maize to small tea plantations indicates the preference for monoculture, largely in the form of tea plantations, leading to reduced crop diversity in the village. However, the expansion of small tea plantations has not affected the area under vegetation cover and the arecanut plantation in the village much.

4.7 Socio-Economic Determinants of Income among STGs: Insights from Multiple Linear Regression Analysis

A multiple linear regression analysis was conducted to examine the effect of various socio-economic factors on the income of small tea growers. The dependent variable is income (Rs/ha), and the independent variables included total number of workers (day/ha), years of schooling, Age of growers, family size, years of experience, production (kg/ha) and area under tea (ha). The results of the analysis are presented in Table 5.

Table 5: Model summary and coefficients of Multiple Linear Regression Analysis

Model Summary[b]

Model	R	R Square	Adjusted R Square	Std. Error of the Estimate	Durbin-Watson
1	.998[a]	.995	.995	26406.315	1.717

a. Predictors: (Constant), Total no of workers/day/Hectare, years of schooling, Age, Family Size, Year of Experience, Production(kg/ha), Area (Tea in ha)

b. Dependent Variable: income(Rs/ha)

ANOVA[a]

Model		Sum of Squares	df	Mean Square	F	Sig.
1	Regression	34474122053036.810	7	4924874579005.259	7062.843	.000[b]
	Residual	157588322040.313	226	697293460.355		
	Total	34631710375077.120	233			

a. Dependent Variable: income (Rs/ha)

b. Predictors: (Constant), Total no of workers/day/Hectare, years of schooling, Age, Family Size, Year of Experience, Production(kg/ha), Area (Tea in ha)

Coefficients

Model		Unstandardized Coefficients		Standardized Coefficients	t	Sig.	Collinearity Statistics	
		B	Std. Error	Beta			Tolerance	VIF
1	(Constant)	-11875.128	14266.547		-.832	.406		
	Family Size	4085.581	1123.933	.021	3.635	.000	.605	1.652
	Area (Tea in ha)	295720.948	10541.997	.906	28.052	.000	.019	51.864
	Production(kg/ha)	1.188	.395	.095	3.007	.003	.020	49.693
	Age	-76.859	259.241	-.002	-.296	.767	.702	1.425
	years of schooling	579.200	728.245	.004	.795	.427	.810	1.234
	Year of Experience	-665.589	491.711	-.009	-1.354	.177	.444	2.250
	Total no of workers/day/Hectare	-246.055	720.902	-.004	-.341	.733	.128	7.841

a. Dependent Variable: income(rs/ha)

Residuals Statistics

	Minimum	Maximum	Mean	Std. Deviation	N
Predicted Value	12370.16	3254053.25	286218.11	384652.578	234
Residual	-258101.953	62286.234	.000	26006.629	234
Std. Predicted Value	-.712	7.716	.000	1.000	234
Std. Residual	-9.774	2.359	.000	.985	234

a. Dependent Variable: income(rs/ha)

The R-value of 0.998 indicates a very strong correlation between the predictors or independent variables and the dependent variable, which is income (Rs/ha). The R^2 (0.995) suggests that the independent variables in the model explain 99.5% of the variability in income. The ANOVA results show the regression model is highly effective at explaining income (Rs/ha), with most variation explained by factors like plantation size, production and family size, leaving only a small unexplained portion. The very high F-statistic and significant p-value (0.000) confirm that the model is reliable, and these factors strongly influence income. Tea plantation size and production are the most impactful, as larger areas and higher yields significantly boost income, while family size also helps, likely by reducing labour cost. The other factors, like education and experience, have less impact, and age or workers per hectare show minimal effect.

The intercept value (-11875.2) is not statistically significant (p=.406), which indicates that when all independents are zero, the expected income is not meaningfully different from zero. There is a positive relationship between family size and income, as the coefficient (4085.581) indicates that as family size increases by one unit, income increases by Rs 4085.581, which is statistically significant ($p < .001$). The area under tea (Ha) has the strongest positive relationship with income, as the size of the tea plantation increases the plantation size by 1 ha, income jumps by a considerable amount. The production also positively influences income as each additional kg per hectare increases income by Rs 1.188, which is statistically significant. Age has a negligible effect on income (-76.859, $p = .767$), which suggests that the age of the growers does not meaningfully impact income. There is a slight positive effect of years of schooling and income (579.200), but statistically not significant ($p = .427$). There is a negative effect of years of schooling and income on the grower. Hiring more workers and more years of experience does not seem to help increase income.

4.8 Challenges Associated with the Sustainability of STGs

STGs in Udalguri district encounter significant challenges that impact their production and market relationships. The high costs and limited access to essential inputs such as fertilisers and pest control impact operations. The seasonal labour shortages during peak periods further hinder productivity. A lack of technical knowledge regarding modern cultivation practices results in inefficient or improper fertiliser use, impacting both soil health and crop yield. The fragmented landholding patterns add logistical and cost burdens and hamper efficient crop management. The limited financial support and access to credit prevent STGs from investing in improved equipment or resources. In terms of market relationships, STGs often depend on middlemen to sell their production due to a lack of direct buyers. This dependency reduces their bargaining power and cuts into profit margins. Moreover, price fluctuations create income instability and make it difficult to plan or expand. Due to inadequate road infrastructure and rural settings, STGs face delays in delivering fresh leaves to processing factories, which affects quality. The high costs of hired transportation add to their expenses, reinforcing reliance on middlemen for market access. A survey of 234 STGs in the Udalguri district revealed several significant challenges

impacting their production and market relationship. Approximately 68% of growers reported high input costs with an average annual expenditure of Rs 16,200 on fertilisers and pest control, consuming nearly 35% of their income. Seasonal labour shortage affected 72% of growers, particularly during peak season, increasing wages by 25% from Rs 320/day to Rs 400/day. The fragmented landholdings on an average of 0.85 ha were a concern for 60% of respondents, increasing logistical and transportation costs by 18%. The limited access to credit was reported by 63% of growers with average loans of Rs 22,000 meeting only 50% of their operational needs. Furthermore, 78% of STGs relied on middlemen receiving Rs 14/kg for fresh leaves compared to the market rate of Rs 20/kg, leading to a 30% reduction in profit margins. The poor road infrastructure delayed leaf deliveries for 55% of growers, reducing quality and income by 12%. Additionally, 58% lacked technical knowledge, leading to inefficient fertiliser use. These challenges collectively affect the sustainability and profitability of STGs in the district.

5. Conclusion

The foregoing discussion reveals that the small tea plantation, which began largely in the northern part of the Udalguri district, particularly around the large tea estates in the early 1990s, experienced an increase in area and number of small tea growers during the last two decades in Bhergaon and Udalguri CD blocks along with establishments of BLFs. The expansion of small tea plantations, however, remained very slow in the Mazbat CD block, where it is still exclusively reliant on tea estate factories to provide green leaves. Given higher returns from small tea plantations compared to traditional agricultural practices, including rice, the area under autumn rice and maize has been witnessing a decline with the expansion of the area in the district. The process of simplification, i.e. Small Tea Plantation, varies from the Tea Estates in terms of production structure and market strategies, including the spatial dimension. However, the shift from tea estates to small tea plantations carries mixed economic implications, including empowerment of STGs and challenges of economic sustainability. Consequently, mollification neither entirely ends nor directly replaces production methods that were inherited from colonial innovations in the plantation sector.

Although the expansion of small tea plantations brings about changes in land use/land cover, their impact on crop diversification through the introduction of mixed cropping appears to be more economically beneficial. Moreover, the involvement of local entrepreneurs in the tea sector diversifies income sources beyond traditional agriculture. The bought-leaf factories not only buy the green leaves from the STGs at a competitive price but also generate employment opportunities, aiding poverty alleviation. So far, the future of small tea growers in Udalguri district is concerned, and it hinges on a variety of factors, including market dynamics, government regulations, environmental considerations, and socio-economic circumstances. Adoption of modern agricultural practices and technology can enhance productivity and quality, enabling small tea growers to compete effectively. Moreover, government policies related to agriculture, land use and taxation significantly impact the viability of small tea growers. Supportive policies such as subsidies,

access to credit and extension services can facilitate growth in the tea sector. Access to markets, especially for small-scale producers and ensuring fair prices for their green leaves are crucial for the sustainability of small tea growers. Strengthening cooperatives or forming collective marketing arrangements will help small tea growers negotiate better prices and access wider markets.

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