

Indigenous Agricultural Systems of North-East India: Livelihood and Natural Resource Management.

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Abstract

Farmers and members of indigenous tribes in the North-eastern part of India have over the course of decades, developed a wide variety of locally adapted agricultural systems. These agricultural systems have been successful in preserving genetic resources for food and agriculture, while at the same time providing small farmers with a reliable source of food and a means to support themselves. In this article, a brief overview of these agricultural systems has been presented to promote and acknowledge the contribution they have made to the sustenance of the livelihoods of thousands of households over time.

Keywords: Indigenous agriculture, traditional agriculture, rural livelihood, Northeast India, Natural resource management

1. Introduction

Generations of farmers and herders have developed, shaped, and sustained specific agricultural systems and landscapes around the world, ensuring food, nutritional, and economic security as well as the preservation of natural and cultural diversity (Singh

& Rana 2019). The traditional farming method is an age-old ecologically sustainable cultivation system that was built by ancient farmers over generations of engagement with nature and natural food, fodder, and fiber sources. Traditional farming is practiced in many parts of the world. It refers to an indigenous farming technique that relies on self-sufficient, locally available resources and does not rely on external inputs. It is a community-based farming system that fosters an appreciation for the local environment while also uniting the locals. India is rich in traditional farming systems due to the diversity of its agro-ecological ecosystems, which are inhabited by diverse ethnic groups who have practiced age-old farming in location-specific circumstances for millennia (Chhetry & Belbahri 2009).

The region of north-eastern India is a mega-cultural landscape, as it is home to more than a hundred distinct ethnic groups, each of which observes its own cultural traditions and celebrates the changing of the seasons in its own unique way. The North East Region (NER) comprises eight states namely- Arunachal Pradesh, Assam, Manipur, Meghalaya, Mizoram, Nagaland, Sikkim, and Tripura having a population of 3.78 per cent of the country's total population, constituting 54 per cent tribal population concentrating hugely in the hilly region (NITIAayog 2021). Agriculture provides livelihood support to 70 % of the region's population. By virtue of its location, this region is also considered to be one of the two mega biodiversity hotspots in all of India. It is home to one of the greatest genetic diversity pools (Barooah & Pathak 2009). As the land use system in this part is mostly dominated by shifting cultivation, where crop and pest management is carried out by incorporating indigenous knowledge and traditional ecological knowledge of the communities, the traditional farming system in the northeast of India is unique and complex in its own right (Chhetry & Belbahri 2009). In addition to having a wide variety of plants, this area, which is part of the eastern Himalayan ecosystem, also has a great deal of cultural, social, and linguistic diversity that has been preserved by indigenous tribes (A. Singh & Singh 2007). The area is home to an abundance of indigenous knowledge systems, particularly those pertaining to agriculture, food, medicine, and the management of natural resources. This conventional and diversified agricultural system contributes to an increase in the productivity and fertility of the soil, which in turn promotes food and nutritional security, as well as the generation of income and employment, and the alleviation of poverty. The north-eastern region of India consists of eight states covering a total area of 262,185 square kilometers, accounting for 7.9% of the country's total geographical area. This region is home to more than one hundred significant indigenous tribes and immigrant communities. Temperatures can range from minus 37 degrees Celsius to 37 degrees Celsius, and the altitude can be anywhere from 150 meters to 7,300 meters above sea level. The agricultural sector, including crops, animal husbandry, fisheries, and forestry, contributed 26 percent to the northeastern region's gross domestic product (GDP) in 2008-09 engaging 56 percent of the region's total workforce (Birthal 2010). Indigenous peoples and other communities in the region make use of bioresources in a manner that is consistent with indigenous and traditional knowledge that encourages the sustainable use of natural resources and their conservation. The tribal farmers have been utilizing hundreds of major and minor crops that have been adapted to their local environment

in the various agricultural systems that they have developed. This has enabled them to survive despite facing challenging and difficult circumstances.

Fig. 1 Map showing North-eastern states of india



Source:www.mapsofindia.com

2. Materials and Methods

The present study is purely based on secondary reviews of various works available on the Indigenous Agricultural System of North East India. The materials were accessed from various online sources such as journal articles, conference proceedings, book reviews, procured through Google Scholar, JSTOR, JGATE, Research Gate and ACADEMIA, and other websites. The researchers have undertaken an extensive review of the available and accessible resources. However, the researchers do acknowledge the possible exclusion of the non-accessed materials, which might have slipped through the sight of the researchers. Furthermore, all the works referred to in this article have been duly acknowledged in the references.

3. Result

Around the world, rural farmers and indigenous tribes have devised a variety of locally adapted agricultural systems that are traditionally managed using time-tested methods. These agricultural systems have managed to preserve genetic resources for food and agriculture while giving small farmers a secure source of food and a means of subsistence. The tribal communities of the North-eastern region predominantly depend on biodiversity and land use activities for their livelihood. The indigenous farming system of the region is succinctly described in the following pages.

- A. **Jhum or Shifting Cultivation System:** In the northeast, shifting cultivation is very commonly practiced. About 450,000 families were recorded to be employed under this system covering a total area of 44000 square kilometers with Nagaland, Mizoram, and Manipur reporting the highest levels of impact. The *jhum* cycles range from 5 to 15 years in the Northeast (Poffenberger et al. 2006). Depending on available resources, *Jhum* includes forest management,

hunting, crop cultivation, and fishing. It is a customary communal activity that has been carried out continuously since the beginning of agriculture, ceremonially approved and self-contained. It entails slashing and burning local trees and shrubs to clear a space for agricultural use. The Naga Hills, Meghalaya Hills, Tripura Hills, Arunachal Pradesh, Sikkim, and other hilly areas of the region all practice it. The rules and functioning of such traditional institutions, including that of natural resource management, are centered on locally acceptable value systems and are operational within each community (Tripathi & Barik 2003). In addition to raising trees, bamboo, and other plants, the Garo of Meghalaya have the most effective system for crop and animal husbandry cultivation. *Jhumming* is primarily practiced by women in Nagaland to facilitate the conservation of agrobiodiversity through the cultivation of multiple (15 to 30 species) crops on the same plot of land. Scientifically, it contributes significantly to partial soil sterilization, enhances the physical structure, and increases nutrient availability in the soil, thus promoting better germination, healthy seedlings, and increased yield while also aiding in the management of weeds. It has been discovered that the population that engages in the practice of shifting cultivation has access to two other sources of sustenance offered by the *jhum* fields, which are surrounded by forests and nature. The surrounding forest resources help the shifting cultivators by increasing the amount of food readily available to them in the event that the *jhum* crops do not fare well or are unable to be harvested due to external threats such as fires and landslides. In addition, these farmers who engage in piggery and keep swine make use of the vegetable waste and inferior grains which have been produced by the shifting cultivation practices as their piggery feed (Bhuyan 2019).

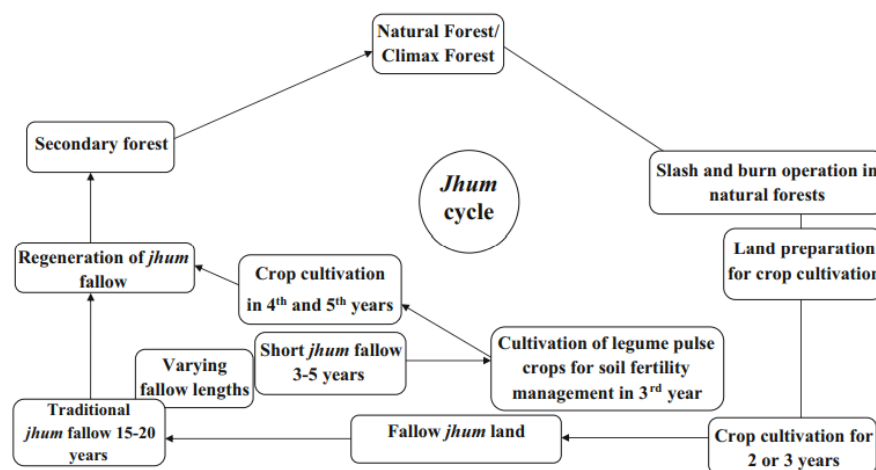


Fig.2 Diagrammatic representation of traditional *jhum* cultivation system.

Source:(Giri et al. 2020)¹

- B. **Paddy-cum-fish cultivation:** Paddy-cum-fish cultivation, also known as *Aji* cultivation, is a multipurpose water management technique that integrates land, water, and agricultural systems by preventing soil erosion, preserving water for irrigation, and cultivating paddy-cum-fish. It is undertaken at an elevation of approximately 1,525 meters msl on a 30 km² area of flat ground in the Lower Subansiri district of Arunachal Pradesh, which has a humid tropical climate. The land yields consistently year after year, which is the main incentive of the practice. One of the most advanced rice farming techniques in the valley, it optimizes output to input ratio by recycling crop residues, using organic waste, and pig manure, and is very efficient in terms of water and energy utilization (Singh & Rana 2019). Apatani's paddy-cum-fish agro-ecosystem is incredibly successful (Majumder et al. 2010), 3–4 times the average yield of paddy in the state, economically feasible, and has a low cost of cultivation and few external inputs, making it a highly organic form of farming (Rai 2005). The ecosystem of the Apatani settlement in north-eastern India is a great example of the economic independence of a traditional agricultural society that engages in sedentary agriculture that is environmentally sound.
- C. **Bari Farming System:** The *bari* farming system is a type of homestead gardening practiced by the Thengal-Kacharis, a Boro-Kachari ethnic group. It has evolved over time and has had a significant impact on biodiversity protection, consumption, and management. *Bari* is a functional unit where various crops, including trees, are produced along with livestock, poultry, and/or fish production in order to fulfill the fundamental needs of the rural household. The *bari* typically lies adjacent to the main residence. A typical homestead includes houses for the extended family, horticultural and Vegetable gardens, trees, bamboo plants, threshing areas, cattle and poultry shelters, and ponds. *Baris* offer a variety of foods, including fruits, vegetables, herbs, spices, garment materials, wood, and other building supplies. Through a variety of behaviors and knowledge systems that have been passed down from generation to generation, women in this community have played a significant role in the sustainable use of *bari* bioresources (Barooah & Pathak 2009).
- D. **Bun cultivation:** This method of farming is most prevalent in the state of Meghalaya. For the past three decades, farmers have been practicing bun cultivation on hill slopes and valleys to boost yield, preserve soil moisture, and reduce erosion and land degradation. Crops are planted on a succession of

¹ Giri, K., Mishra, G., Rawat, M., Pandey, S., Bhattacharyya, Bora, R. N., Rai, J., & P, N. (2020). Traditional Farming Systems and Agro-biodiversity in Eastern Himalayan Region of India. In G. R, S. R, & S. D. C (Eds.), *Microbiological Advancements for Higher Altitude Agro-Ecosystems & Sustainability* (pp. 71–90).

raised beds known locally as "*Bun*" that are constructed along the slope of the hills in this method. The cut and hill method is used to level the area between two buns. Following exposure and drying for a while in the dry season, the phytomass is gathered on the raised beds along with the soil. The vertical distance between terraces is often no greater than one meter. These steps assist in reducing soil erosion, keeping the most amount of precipitation possible inside the slopes, and securely disposing of extra runoff into the foothills (Jeeva et al. 2006).

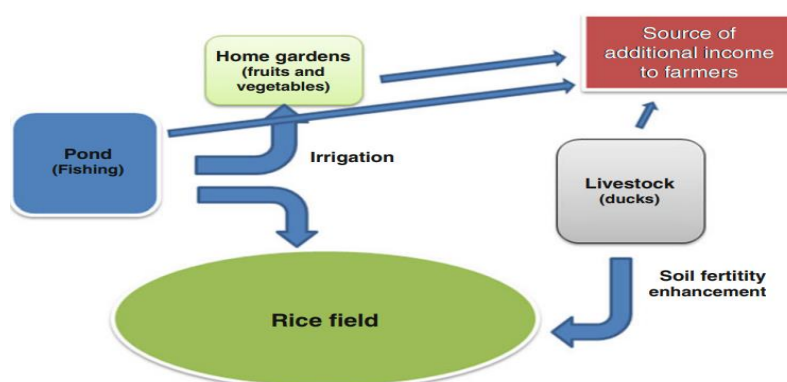
- E. **Bamboo drip irrigation system:** Bamboo drip irrigation is a localized technology created by the tribal farmers in Meghalaya's Khasi and Jaintia hills district. The evolution of indigenous agricultural systems can clearly be seen in the use of bamboo drip irrigation, which is a superb illustration of human ability and innovation. Stream and spring water is tapped using bamboo pipes to irrigate plantations of areca nuts (*Areca catechu* Linn.), betel vines (*Piper betle* Linn.), black pepper (*Piper nigrum* Linn.), and other horticultural crops (Jeeva et al. 2006). The 18–20 L/min of water that enters the bamboo pipes is transported several hundred meters before being reduced to 20–80 drops/min at the plant's location (Singh & Rana 2019). The use of bamboo drip irrigation reduces water loss and leaks. This system makes use of locally accessible bamboo species.
- F. **Traditional tree-based farming practices:** Among the indigenous people of Meghalaya, tree-based farming has a long history. Depending on the agro-climatic conditions, trees are heavily incorporated into agricultural production practices. With edible and timber-valued trees, a variety of native and cultivated crops are grown. Various tree species are grown for their food, fiber, medicinal, and other minor agricultural products. Vegetables, fruits, forest tree species, plantation crops, and agricultural crops are all grown on the land collectively. By maximizing the joint output of agricultural crops and trees, traditional tree-based farming techniques help to preserve and improve the field. Following are a few of Meghalaya's traditional tree-based agricultural farming techniques: homestead agricultural practices, Khasi pine-based farming practices, Arecanut-coconut-betel-based farming practices, Alder-based farming practices, *Aquilaria*-based farming practices, Bamboo-based farming practices, and MPTS (Multipurpose Trees and Shrubs)-based farming practices, and Tea based farming method (Jeeva et al. 2006).
- G. **Alder-based agriculture in Nagaland:** *Alnus nepalensis* (Alder) trees are used for agriculture in some parts of Nagaland. Taking advantage of Alder trees' ability to fix atmospheric nitrogen, Khonoma farmers and farmers in a number of other villages in Nagaland have incorporated this tree species into their *jhum* system (Nakro 2011). *Alnus nepalensis* is a deciduous or semi-deciduous tree that can reach heights of up to 30 meters and has a trunk diameter of 60 centimeters (rarely 2 meters). Its twigs are ribbed and glabrescent, and its bark is dark grey, frequently with yellowish patches and slightly raised lenticels. Indigenous farming systems, such as Alder-based farming, hold great promise, with crops grown alongside Alder and the routine

pruning of Alder leaf biomass in the soil enhances soil nutrients (Rathore et al. 2010). This indigenous intervention has a positive impact on the yield of *jhum* crops. It is an agroforestry system wherein alder trees are planted to improve soil fertility with crops such as maize, job's tears, millet, potato, chili, pumpkin, barley, and so on. In this approach, Alder seedlings are planted on sloppy terrain meant for farming, as it develops quickly until it is six to ten years old. An alder tree, which is not a leguminous tree, uses nodules on its roots to fix atmospheric nitrogen. Furthermore, along with biomass, the tree litter enriches the soil with nutrients including calcium, potassium, phosphorus, and potassium (Singh & Rana 2019).

- H. **Zabo System:** This farming system is a composite kind that combines forestry, agriculture, livestock, and fisheries practiced by the Chakesang tribe of Phek district, Nagaland. *Zabo*, which translates to "impounding of water," was developed to deal with inadequate rainfall. This farming system involves the integration of agriculture, forestry, horticulture, fishery, and animal husbandry with soil and water conservation measures. The first part of this system consists of protected forest land regions below and around the peak of the hill. This serves as the space where collected rainwater is stored. The second component consists of collecting water in ponds which serve as de-siltation tanks dug in accordance with the size of the catchment and the quantity of water anticipated. The water is transported to a bigger main tank after being stored for two to three days. Every year, the de-siltation ponds are cleaned out, and the resulting material-which is rich in nutrients and organic matter-is dispersed around the terraced rice fields to increase soil fertility. A little below the main water storage tank are bamboo livestock enclosures that make up the third section where a few families would keep their pets in single enclosures. The fourth component is the rice fields, which receive water from the main tank during irrigation. The excrement and urine of the animals are carried to the fields by the water as it flows past the livestock enclosures, giving the land much-needed fertilizer and nutrients. Under this system, six varieties of paddy are cultivated. Other crops such as maize, Job's tears, beans, oilseeds, vegetables (garlic, chili, onion, brinjal, tomato, potato, cabbage, cucumber, pumpkin, colocasia), and fruits (papaya, banana, plum, peach, lemon, Indian gooseberry, wild apple) are cultivated along the sides of the terrace fields. Livestock such as buffalo, cattle, and goats are reared near the ponds, and Fish is cultivated in the water ponds constructed on the farm (Singh & Rana 2019).
- I. **Rice-Based Integrated Farming System:** Rice-based integrated farming system is a traditional cultivation system practiced by the tribal communities of Tripura. This system of cultivation is based on indigenous knowledge whereby fish, livestock (cow, buffalo, and goat) poultry, fruits, vegetables, and crops are grown together on the same farm. This mixed farming method is carried out due to small landholdings. Under this system, a small portion of the land (5-10%) is used for rainwater harvesting which is primarily used for irrigation of cultivated lands and fish rearing. Fruits and vegetables are grown

along the edges of the rice fields and cows, goats, and ducks are reared in and around the field whereby animal excreta is used as organic manure to fertilize rice fields. This farming method aids in increasing soil fertility and crop production thereby making it more sustainable. Vegetables such as Colocasia, okra, amaranthus, brinjal, cucurbits, potato, sweet gourd, banana, leafy vegetables, etc. are commonly grown along with banana clumps, guava, coconuts, and areca nut plants under this system of farming. This integrated rain-fed farming system which includes agriculture, horticulture, and animal husbandry is also found in the state of Sikkim (Giri et al. 2020).

Fig.3: Conceptualized framework of rice-based farming system in Tripura and its multifarious benefits.



Source: (Giri et al. 2020)²

- J. **Terrace Rice Cultivation of Sikkim:** Terrace rice cultivation, also known as “*Thang*” is a major traditional farm practice of Sikkim. Thangs are the flat land riverbanks along with typically terraced slopes in the lower hills. In this system, rice is mainly grown with pulses and beans along the raised bunds of the terrace. After harvesting, the fields are used for growing other crops such as maize, wheat, buckwheat, oilseeds, and vegetables. This terrace system aids in the preservation of the agro-biodiversity and livelihood of people in this region (Giri et al. 2020).

4. Discussion

² Giri, K., Mishra, G., Rawat, M., Pandey, S., Bhattacharyya, Bora, R. N., Rai, J., & P, N. (2020). Traditional Farming Systems and Agro-biodiversity in Eastern Himalayan Region of India. In G. R, S. R, & S. D. C (Eds.), *Microbiological Advancements for Higher Altitude Agro-Ecosystems & Sustainability* (pp. 71–90).

The overview of Northeast indigenous agricultural practices reveals the diverse agro-based livelihood that is fairly simple. These practices have been the only source of livelihood sustaining the majority of the people in the region for decades. In fact, it continues to be the sole livelihood in many parts, especially the hill dwellers. The utilization of resources from forests in the development of agricultural technology results in practices that are both "cost-effective" and "practical" (Sabar 2012). This traditional approach to farming strikes a healthy balance between satisfying our present requirements, preventing further damage to the natural world, and ensuring that future generations can have access to a plentiful supply of natural resources (Jeeva et al. 2006). In these systems, there exists a vast array of agricultural biological diversity. Although they are not suitable for the production of large quantities of food on a large scale, traditional agricultural practices make a significant contribution to the food supply in developing countries (Sabar 2012). The environment-friendly scientific basis of traditional agricultural practices and institutions that encourage the conservation of natural resources has served as the cornerstone of sustainable agriculture for millennia, particularly in countries on the threshold of modernization (Singh & Rana 2019). This diversity is reflected in the indigenous method of agricultural production, in which the farmers actively manage the land and ensure that it is used in a sustainable manner. The indigenous agricultural system of the northeast which makes use of traditional practices, technologies, and cultural acceptability, demonstrates how it not only assists people in the management of biodiversity and soil degradation but also enables them to flourish in a way that is compatible with the ecosystem in which they live. In addition, the application of biomasses as well as organic manures under this system in conjunction with agroforestry practices boosts the fertility of the soil which encourages high agricultural yields. Integrating these characteristics with modern biotechnological approaches can, as a consequence, help in the development of more inventive technologies that have global implications in addressing the constraints of similar ecologies and/or meeting the problems of climate change and increasing challenges of the 21st century. Nonetheless, the discussion over how and why the ancient system could be integrated with current knowledge has been fuelled by claims that it is ignored and has an impact on the market economy at its core. The distribution of hybrid paddy, the cultivation of cash crops, the allocation of harvesting equipment, the use of chemical fertilizers, and other similar mechanisms are the primary focuses of the vast majority of the programs that are currently being run, particularly those that are geared toward the expansion of agricultural production. However, the indigenous farmers have a dismissive attitude toward the promotion of adopting mechanized technologies and chemical fertilizers. As a matter of fact, the inclination to keep the conventional system in place is not based on the advantages of traditional agricultural practices alone; rather, it is based on the people's life experiences with local ecosystems and processes. Given that they have ingrained traditional knowledge, including expertise in agriculture; people have been able to sustainably maintain the resources necessary for their way of life as well as the ecosystem. Unfortunately, in the past, this knowledge had been generally overlooked, which led to the failure of successive policies (A. K. Singh & Rana 2019). Such knowledge systems should be

acknowledged and encouraged in order to combat the vulnerability of livelihood sustainability, food production, preserve biodiversity, and protect natural resources, all while keeping ecological degradation and climate change in mind. Last but not least, when taking into account the fact that the influence of outside elements has led to the loss of such information, it is imperative to combine traditional knowledge with modern knowledge in order to ensure that the general community can benefit from it and that a sustainable way of life can be maintained. As rightly been put forward by Bhuyan (2019), any form of transformation must take into account the needs and value systems of the society in question in addition to being an improvement over the status quo. In other words, the transformation process itself should be extensive and sustainable from a social, ecological, and economic standpoint.

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