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Traditional agricultural practices of the angami tribe of Khonoma village of Nagaland

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Abstract
The agricultural sector, among various productive sectors, has the dubious distinction of being one of the most polluting sectors in the world. The green revolution, which is meant to enhance agricultural productivity, witnesses, in fact, the acceleration of several environmental problems such as climate change, food unsafety, biodiversity loss, soil degradation and environmental pollution. Thus, modern agriculture is said to have been associated with the loss of crop genetic resources in the Third World due to the adoption of HYV seeds and planting of the vast fields with genetically uniform cultivars. Consequently, traditional agricultural practices have regained increased attention worldwide as a climate-smart approach. Taking Focus Group Discussion and Key Informant Interviews as the primary tool for obtaining data, this paper tries to examine the age-old agricultural practice as adopted and refined by the Angami tribe of the Khonoma village of Nagaland. A semi-structured questionnaire was administered to gain the required data from the respondents. Khonoma is found to have two systems of agricultural farming, i.e., the unique and sophisticated Alder-based jhum cultivation and the terraced cultivation. Both these systems of cultivation at Khonoma have been proven to have immense positive environmental implications vis-a-vis modern agriculture.

Keywords: traditional agriculture, intercropping, angami tribe, alder tree, terraced cultivation, jhum cultivation

Introduction

Agriculture provides the basis of subsistence for the population through the production of food and raw materials. Traditionally, the inhabitants of each country or region depended on the bread-basket filled by the farmers, i.e., everybody depended on agriculture and was interested in its fate. At one point in time, India was a food-scarce country, but the situation changed after the Green Revolution broke out in 1965. The green revolution, though, boosted agricultural production and achieved the targets of high food production, but at the cost of huge environmental degradation such as water pollution, and soil contamination resulting in degradation, climate change and biodiversity loss (Patel *et al*. 2020; Singh and Singh, 2017; Zhang *et al*. 2017; Phungpracha *et al*. 2016; Srivastava *et al*. 2016) [10, 15, 19]. Thus, it is important to take note of the fact that the agriculture that we have been practising worldwide now is associated with lots of environmental issues. FAO (2016) [4] reports that agriculture, forestry and other land use are responsible for about 21 per cent of the total greenhouse gas emission in the world. The deleterious effects of pesticides, inefficient fossil fuel usage, chemical fertilizer inputs, genetic monocultures and factory farming of livestock have become increasingly apparent. Therefore, feeding the growing population and sustaining the quality of the environment are the two major challenges of agricultural practices.

One approach to address these inherent problems of modern agriculture is to build upon traditional methods which evolved over the first 10,000 years of agriculture. Such a system of agriculture, having the inputs of traditional know-how, produced a tremendous variety of domesticated crops along with livestock and was sustained for thousands of years. It is worth mentioning that traditional agricultural practices have been an integral part of food production in India for ages and have the potential to mitigate the adverse effects of climate change with spatial and sequential diversity (Patel *et al*, 2020) [10]. As against the mono-cropping of a few species such as rice, corn, wheat, etc. in about 80 per cent of the world's arable land, diminishing seriously the genetic diversity of global agriculture (Adams *et al*. 1971) [1], traditional agriculture promotes double cropping, mixed cropping, crop rotation, agroforestry, use of local variety and thus ensures the diversity that is being decimated as a result of the modern form of agriculture. Such farming practices have the potential for enhancing crop productivity and mitigate climate change (Tripathi and Singh, 2013) [16]. Traditional agriculture as such is said to have the adaptive and mitigation ability towards anthropogenic threats that can provide sustainable production and environmental safety (Watson 2019) [17].

Though much of this traditional know-how has been feared decimated over the years, nevertheless, there is still a vast store of farming know-how in many of the interiors of less developed countries. Researchers are beginning to appreciate that many traditional farmers in the developing world are still practising farming methods that are in balance with the surrounding ecosystems, stable, sustainable and highly efficient. Farmers, who have sometimes been portrayed as ignorant and not adaptive, have actually been utilizing very sophisticated methods

of agricultural production for centuries. These farming systems can perhaps help the developed world to grow food with fewer chemical inputs, slow erosion, control pests, decrease our dependence on fossil fuels and feed an expanding global population.

Traditional agricultural practices sustain productivity by efficient utilization of available local resources and develop site-specific agricultural practices that are compatible with the regional climatic condition and spatial and sequential diversity (Lincoln 2019) [9]. In the North-Eastern part of India, the application of such traditional practices has made many of the tribes resist the onslaught of the vagaries of the monsoon. The practices of the Karbis and Rabhas of Assam, Apatanis and Nyishis of Arunachal Pradesh are worth mentioning in this regard. The Lungsor, the traditional drip irrigation system of Karbis, along with their belief in the use of different leaves as pesticides, have made them resist the adverse impacts of modern agricultural methods (Sarma and Das, 2009) [14].

Rationale and objectives of the Study

In the quest for sustainable development and at a time when agricultural, environmental and social scientists across the world are talking about sustainable agriculture, many tribes in Northeast India have been cultivating their land in a very traditional and sustainable way. This paper basically tries to explore different aspects of traditional sustainable agriculture that are being practised by the tribes of Nagaland and especially the agricultural practices of the Angami tribe of Khonoma village with the following objectives:

- To know about the Khonoma system of traditional Alder-based agricultural practice,
- To explore the issue of sustainability of the Khonoma system of agriculture,

Materials and Methods

1. Study area

1.1 Background of Khonoma

Khonoma village – referred to as Khwunoria by the residents, who are of the Angami Nagas – is estimated to be around 700 years old. The village is known after a plant, *Glouthera fragrantisima*, locally known as *Khwuno* that grows in the area (EIA Report, 2009) [3]. The village is located 20 km southwest of Kohima in Nagaland and is surrounded by hills that are over 8000 feet. It runs along a ridge and the domain extends from the terraced rice fields in the valley to the ridge of the Barail Range. It is estimated that Khonoma consists of 123 sq. km. area and experiences a sub-tropical climate with an average rainfall of 2000 – 2500 mm. May to August is the period of heavy rains, September to October is occasional rain and November to April is the period of the dry season. The temperature of the region varies from 16^0 C to 31^0 C in summer and in winter from 4^0 C to 12^0 C.

The village population is around 3,000 and has 500 hundred households, not all of which are inhabited year-round (Village Development Board, 2004) [12]. The household size of the village is 6 on average out of which 3 are the average working members. The literacy rate is remarkably high at 70%. Khonoma's fame came chiefly, though not entirely, through its standing as a warrior village. From the 1830s the village was recorded as putting up fierce resistance against British colonial rule until the village was finally sieged and freed after a treaty, but not before the village had been burnt down completely (EIA, 2009) [3]. Khonoma now is known for its unique practices of agriculture, and conservation of nature and has the distinction of being the first-ever green village in the region.

Christianity began to be introduced in the village in the 1890s. The early converts faced ostracism but the advantage of education slowly won them over. After the 1930s Khonoma was responsible for producing some of Nagaland's most respected doctors, professionals and musicians.

2. Data

The study is based both on primary and secondary data. Secondary data is obtained mainly from various books, journal articles and book chapters and other scientific studies carried out in the study area.

In order to obtain primary data regarding conservation and traditional farming practices, participatory rural appraisal (PRA) techniques such as focused group discussion (FGD), key informant interviews and direct observation methods were administered. For this purpose, a semi-structured interview schedule was prepared and administered. FGD was held with the members of the Khonoma Nature Conservation and Tragopan Sanctuary (KNCTS) and Khonoma Youth Organisation (KYO). Audio-visual aids, digital photography, field notes, etc. were some of the field tools utilized for the study.

Results and Discussion

1. Traditional Agricultural Practices of Nagaland

In Nagaland, agricultural systems are mostly based on traditional, cultural, geographical and socio-economic factors. Cropping systems vary from mono-cropping to multi and relay cropping. There are three recognized systems of agriculture in the state (Kikon, 1999) [7].

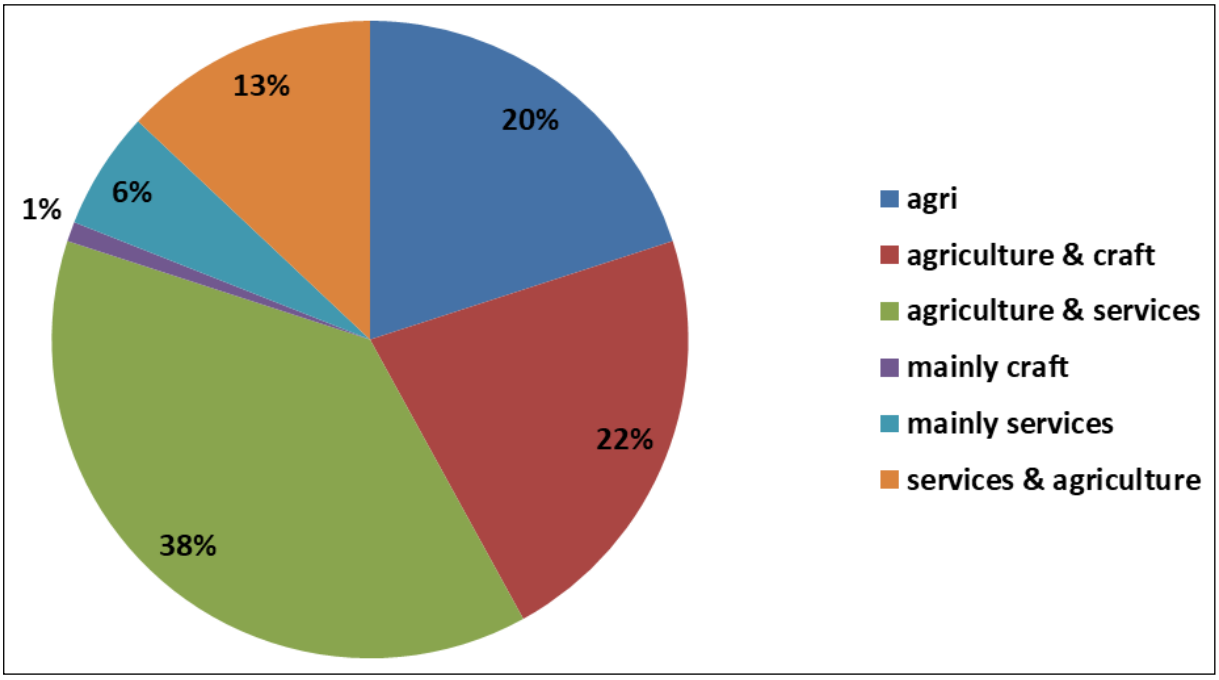
Wet Rice Terraced Cultivation (WRTC)

The crops are planted along the terraces built along the slopes in the WTR fields. Abundant rainfall and/ or irrigation are important factors. Rice, cabbage, potato, garlic, etc. are grown on such cultivation.

Jhum
It is the most common method of cultivation. Mixed cropping is practised in the jhum field with rice as the main crop along with maize and millet. Between 15 to 60 different species of crops can be found in a single jhum plot. Besides rice, millet, and maize crops like beans, oilseeds, root crops and vegetables are also grown.

The Home Garden
It is located close to the house and is used for growing vegetables, fruits and other crops for domestic consumption. Potato, cabbage, tomato, chilli, bean, carrot, onion, etc. are grown in the home gardens.
It is worth noting here that Wet Rice Terraced Cultivation (WRTC) is a unique and sophisticated farming system developed by the Angami, Chakhesang and Zeliang tribes centuries ago and has been practised since then (Kevichusa, 1999) [5, 6]. This unique agricultural practice has a positive implication on the environment of the village and its surrounding areas.

2. Livelihood options at Khonoma
The people of the village are engaged in different kinds of activities for their livelihood. Though agriculture, craft, services, business and tourism activities are found to be the main occupations in Khonoma their primary occupation is subsistence agriculture. Both Jhum and terrace cultivation are practised by the villagers. The Khonoma village is famous for its unique agricultural practice i.e., alder-based jhum cultivation and also the terrace cultivation which they had been practising since time immemorial.
Figure 1 illustrates the livelihood options in the village. It is apparent from the figure that most people depend on agriculture for their livelihood apart from services, crafts, petty businesses, etc.



Source: Primary Survey

Fig 1: Livelihood options at Khonoma

3. Farming systems prevalent in Khonoma
Khonomians practice mainly two types of farming in the village. They are terrace cultivation and alder-based jhum cultivation.

3.1 Terrace cultivation of Khonoma
Cultivation is the mainstay for the Khonoma villagers. It is usually done once a year and the land for it is prepared during November and December. As it is a hilly terrain, the soil horizon is narrow, deep ploughing is not favourable and therefore hand ploughing of the soil is administered. The soil is levelled during February and March but needs to wait for the monsoon to start for sowing the seeds of various crops. To maintain soil fertility, no chemical fertilizer is used, rather bio-fertilisers obtained from the Alder tree are applied in the field. By May, the irrigation channels are cleared. It is worth mentioning here that the upland conservation has ensured the availability of irrigation water. The upland forests have been conserved by the community under the name "Khonoma Nature Conservation and Tragopan Sanctuary (KNCTS)". Water channels have been constructed using the natural slopes of the hill in order to flow the water to the paddy fields from the conserved hill. It is noteworthy to mention here that even in the month of March, there is ample water on the terrace fields which the people opine, is the result of the upland conservation of forests in the village.

The sides of the fields are plastered with mud paste to fill in the burrows and all other openings so as to prevent the water from exiting except at the designed outflow points. The soil is then turned around allowing the weeds to decompose and adding fertility. Once again, the soil is levelled and during June – July the rice is transplanted followed after a while by first weeding. Now the field is left to dry and water retention in the fields is again ensured by plastering the surface and plugging the holes. A second weeding is done in August before the harvest in September. The system is labour-intensive. Seeds come from the previous year's stock and chemical inputs are not used. Rice yield varies according to the fertility of the land and is taken care of by the family members. However, most families reckon on a yield of about 300 kg of unhusked rice.

As mentioned above the terraced fields are filled with water even in the dry season, therefore, the farmers culture fish in these plots. Thus, fish-cum-paddy is a common practice in these fields at Khonoma. The fishes reared in such kinds of fields are mainly of carp variety and Rani (local variety) fish etc. which are consumed by them locally. The plots where the pisciculture is practised are marked with some bamboo pieces, indicating that the plot is still being used and not for open access. This is the way to show their ownership and it is agreed upon and abide by every member of the village.

3.2 Jhum Cultivation

Jhum cultivation, in many ways, is interwoven into the culture and traditions of Nagas. In Nagaland, over 40% (approx. 7000 sq km.) of the geographical area is subjected to Jhum cultivation and more forests are being cut down every year. This is the traditional farming system for more than 80% of the Naga people who are traditional subsistence farmers. Though many scientists say that the jhum is not sustainable, there is no denying that Jhum is a time-tested system of cultivation, drawing upon traditional knowledge and indigenous practices in the state and especially at Khonoma. It is deeply rooted in the Naga psyche, having evolved through the years and being rooted in customs, beliefs and folklore (Odyuo, Koza & Verma, 1999) [8]. It is interesting to note that in selecting the jhum plot some traditional knowledge and belief system are particularly considered. Some of the examples of traditional knowledge and beliefs associated with the Jhum and came across during the FGD can be cited as follows:

- Forest with a predominance of ferns is not chosen but a plot with a lot of earthworm casting is selected.
- Dreams about barren scenes, infertility and nudity suggest the need to review the usefulness of a site. But, dreams of feasting, and fertility suggests for selection of the site.

3.2.1 The Alder-based Jhum Cultivation of Khonoma

Traditionally, the Jhum or slash and burning activities lead to large-scale deforestation, loss of bio-diversity & wildlife, soil erosion, loss of soil fertility & decline in crop yield. In areas where jhum is practised using traditional methods, environmental degradation has been severe, affecting the environment quality and also the quality of life of the local people. But, against these negative implications, a unique and highly productive form of jhum has been developed and introduced in Khonoma based on the Alder tree (Alnus nepalensis). Alder tree, which is native, nitrogen-fixing and fast-growing tree are grown in most parts of Nagaland above an altitude of 1000 meters. However, the antiquity of the Alder-based jhum is attributed to the Angami farmers of Khonoma village who have perfected it into a fine art (Yaden, 1999) [18].

The Alder trees are usually planted at times of slash and burn and when the jhum field is abandoned for almost the entire cycle of about nine years, the trees get matured. It takes about four years for the Alder tree to get matured after which the pollarding is started. The Alder root has root nodules which improve soil fertility by fixing atmospheric nitrogen into the soil. Besides the nitrogen fixation capacity, the Alder trees, which are planted along the boundary of the agricultural fields, also provide organic manure to the soil. One matured Alder tree can provide up to 20 kgs of organic manure for the crops. Normally, the jhum cycle is 9 years, but in the case of the Alder system, the same plot can be cultivated twice in four years without affecting the productivity of the soil. This helps less and less of the area to be brought under jhum and thus necessitating less felling and clearing of primary forests. Moreover, Alder-based plantation in the agricultural field reduces soil erosion due to their spreaded roots. The branches of the Alder tree are cut steeply and smoothly at a height of four feet from the ground. Such practice allows the main trunk to grow horizontally while leaving the uncut branches for apical growth. The crops beneath the tree become free from being overly shaded. Cut branches are used as fuel wood & timber and mixed cropping is done for two years with the crop mixture varying during both years. During these two years, the apical growth of the Alder tree is restricted and again allowed to grow profusely during the fallow phase. People of Khonoma shift their Jhum field every four-five year and the Alder tree revives the fertility of the soil. It is estimated that more than 80% of the firewood requirement is met from the pollarded branches of Alder trees in the Jhum fields which greatly decimate the pressure on the forest for firewood. Thus, the Alder-based jhum cultivation also ensures a very good forest cover at Khonoma.

4. Crop diversity in Khonoma village

Khonoma is famous for its variety of rice production. Taking advantage of Alder-based cultivation the Khonomians are found to have grown a variety of indigenous rice crops which are put to a different use. There are a number of rice varieties planted in the terraced fields (Table 1). Those fields located at the periphery of the village's primary rice-growing valley, near the woods, receive the shade and cold water and are planted with rice varieties suited to cold water.

Table 1: Rice variety found in terraced fields at Khonoma village

Variety	Yield (TIN/PLOT)	Suitable For	Uses
ThevÜrÜ(big)	30	Warm water	Food item
ThevÜrÜ(medium)	27	Warm water	Food item
ThevÜrÜ(small)	32	Warm water	Food item
Ngoba(red)	30	Excess water	Food item
Ngoba(white)	30	Excess water	Food item
Ngodi(red)	29	Warm water	Food item
Rheninya(white)	30	Warm water	Snacks and rice bear
Krumiavinya(white)	30	Warm water	Snacks and rice bear
Dzukounya	29	Cold water	Snacks and rice bear
Kenonya	29	Warm water	Snacks and rice bear
Shunino	30	Warm water	Snacks and rice bear
TsorenyÜ	30	Warm water	Snacks and rice bear
Abor	29	Warm water	Snacks and rice bear
TekhwerÜ	30	Warm water	Snacks and rice bear
Rosholha	29	Warm water	Food
Dzukounya	30	Cold water	Snacks and rice bear
Akaulha	29	Cold water	Local bear
Üisevolhunya	30	Cold water	Local bear
Mekrielha	30	Warm water	food

Source: Primary survey.

It is to be noted that labour, not the land is the constraint in growing rice and other products around the year for most of the families in the village. It seems that 80% of Khonoma's households are self-sufficient and the rest depends upon the markets. Apart from the rice variety grown primarily on the terrace fields the Khonomians also grow various kinds of vegetables and spices on their jhum plot. Table 2 depicts an exhaustive list of agricultural products produced in the jhum fields.

Table 2: Vegetables and spices grown in Khonoma

Paddy	Cardamon	Sweat Potato
Maize	Garlic	Tapioca
Wheat	Coriander	Onion
Finger millets	Citrus fruits	Carrot
Gram	Banana	Tomato
Chillies	Guava	Brinjal
Sugarcane	Peach	Peas
Ginger	Potato	Cabbage
Cauliflower	Cabbage	Leafy vegetables
Cucumber	Gourds	Mustard
Pearl millet	Several species of beans	Squash

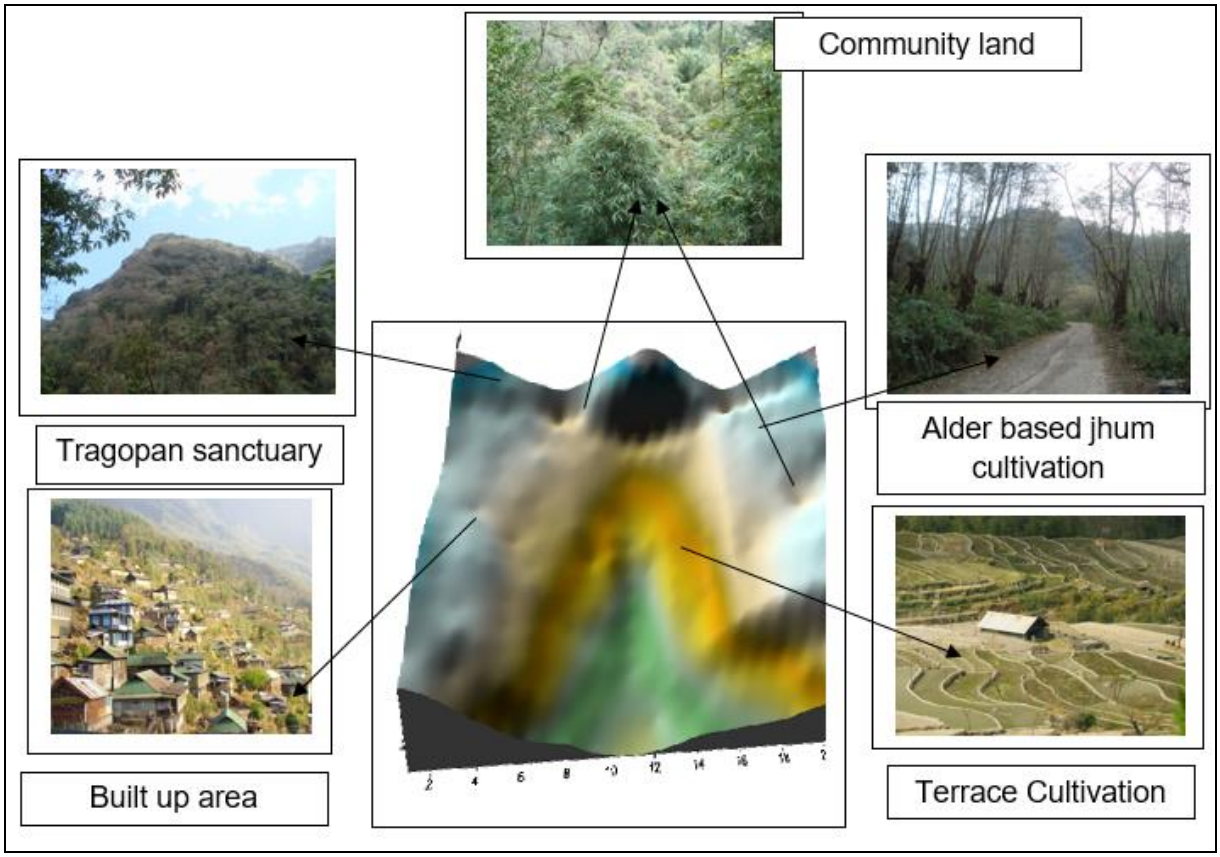
Source: Primary survey

5. Land use pattern

Land use in Khonoma follows a particular pattern which depends entirely on the altitude of an area. Jhum together with the wetland terraced rice cultivation is how the village land is put to use apart from the built-up area and small home gardens. All activities are distributed as per the elevation, which can clearly be explained with the help of Figure 2.

The topmost part of the land (hill) i.e., land at the higher elevation is categorised as community land, which is totally protected and belongs to the Khonoma Nature Conservation and Tragopan Sanctuary (KNCTS). The area is dominated by dense forests which are rich in various flora and fauna. The buffer zone which falls under community land is used to graze domesticated Mithun (a breed of cow). Moreover, people collect various non-timber forest products from this area (such as medicinal plants, wild apples, various leafy vegetables, etc.).

The private land is located below the community land where alder-based jhum cultivation is practised. Artificial boundaries are made with various boulders and bamboo fencing which separate community land from private land. During the period of cultivation, these boundaries are used as protection by not allowing *Mithun* to enter the area for grazing.



Source: Prepared as observed during the field study.

Fig 2: Land use of Khonoma village

The village is situated below the jhum plots. The area further down the human settlement is marked for terraced cultivation. Different varieties of vegetables and around 30 varieties of rice are cultivated in these terraced fields. Fish-cum-paddy culture is also common here in the terraced agricultural fields.

Conclusion

Shifting cultivation is sustainable only when the fallow period is sufficiently long. However, it is no longer so as the fallow period is reducing as a result of the increase in population. Reduced fallow further reduces the production and thus puts tremendous pressure on the already scarce land. On the contrary, the people's aspiration goes beyond subsistence livelihood. This demands higher production which is only possible through the application of chemical inputs. But, in the traditional way of production, the application of chemical inputs is not known. The Khonoma system of cultivation develops a balance between our present needs, conserving natural resources and protecting the environment for the benefit of future generations. This agricultural practice, though, might not cater to the food needs of the mass, but, accounts for a substantial amount of local food production. Thus, the Angami practices of agriculture in Khonoma, i.e., the Alder-based Jhum and terrace cultivation, are unique in nature and more productive and reduce the pressure on cropland. It results in a robust watershed, a good environment, ample water of good quality, fertile soil and low soil erosion. The Alder tree is long-lived and also very effective at checking soil erosion and thus the villagers have created terraced Alder fields to further reduce erosion and retain soil fertility. The Alder tree is serving the dual purpose of fixing nitrogen on agricultural land on the one hand and also serves as forest cover in the area. The pollarded branches of the Alder tree multiply each time it is pollarded. Thus, without applying the chemical inputs, the Angamis of Khonoma are fulfilling their growing needs and at the same time minimizing the environmental cost of Jhum thus making the system sustainable. Therefore, the Alder-based cultivation is the storehouse of intergenerational knowledge of Nagaland's endemic community and stands in present due to the ability towards change. The government needs to support promoting and replicating such traditional agricultural practices in other parts of the region for the greater benefit of the environment and the people.

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