CHAPTER: 4 - IMPACT OF SHIFTING CULTIVATION

4.1 Introduction

Shifting cultivation is an important form of primitive agricultural land use. In this system forest area is cleared by slash and burn techniques. *Till 1950’s shifting cultivation, under its diverse forms of slash-and-burn system was a traditional method of cultivating tropical highland and mountain soils, mostly for providing a minimum subsistence to the peasantry* ([Jasbir Singh, 1997](#)). For primitive cultures, the cultivation was a remarkable innovation which is based on the revolutionary transition from forest based food gathering to agriculture based food production. The cycle of rotation was also long having enough time to regenerate the soil. This is how a nomadic cropping system for self-sufficient subsistence economy developed with labour efficient systems.

In course of time, various adverse effects arise due to cultivation of Jhum. With the increasing population, more pressure on land increased with shorter Jhum cycles. Short fallow periods are no longer adequate to restore the soil productive capacity therefore, decline in crops yield arise. With the increase in population pressure on the land and the Jhum cycle decreased. The main reason behind the persistency of this system of cultivation lies in its compatibility with the physical environment.
The sparse population, steep and undulating topography, community land tenure system and other aspects of socio-economy and cultural factors are some of the reasons that went in its favours, in Northeast region where shifting cultivation is practiced by most of the hilly people. There are various effects of shifting cultivation with large scale deforestation due to this cultivation it occurs undesirable ecological imbalances. Since, the hill tops particularly the catchments areas are the source of water, deforestation in the hills that lead to elimination of the sources of water which increased the run-off due to consequent inability of the soil to retain the water.

The clearance of forest causes deforestation which accelerates soil erosion and accentuates the variability in rainfall distribution. Burning of Jhum land can be considered as one of the worst impact on climate because it gives scope in high rate of soil erosion and soil erosion structural stability by runoff and winds. The availability of water in the soil for the crop production also decreases which is vulnerable to climatic variation. As the farmers cultivate the same plot of land for two years in some village, fertility of the soil decreases with its debilitating impact of crop production. The fragmentation of natural habitat loss native species and invasion of more exotic weeds arise and burning down of sun-dried vegetation pollutes the air with carbon-monoxide, nitrous oxide and many other harmful gases are some of the consequences of shifting cultivation on environment.
4.2. People’s view of Shifting cultivation

Shifting cultivation which is the most complex and multifaceted form of agriculture has become a subject of debate and intervention since the colonial era. The practiced has been criticized by numerous scientists, environmentalist, foresters, developmental practitioners, policy makers as well as the general public’s being primitive, backward, destructive or wasteful, unproductive and exploitative and the cause of widespread environmental degradation. Shifting cultivators are blamed for the destruction much of the world’s tropical forest, land degradation, atmospheric pollution and global climatic change. As a result, shifting cultivation in many forms as being destructive to the environment because forest areas are being converted to agriculture through its practices thus, diminishing the area under primary forest. Contemporary critics of shifting cultivation, pejorative terms that perpetuates misperceptions about shifting cultivators (Thruppetal, 1997). It has brought lots of changes in the ecological settings of the surroundings environment. The loss of forest cover influences the climate that contributes to loss of biodiversity. Further on, siltation, flooding and soil degradation affect the economic activity and threaten the livelihoods and cultural integrity of forest-dependent people. The cause of deforestation and forest degradation are complex. It has been identified that demographic factors are one of the important underlying causes.

While it has been recognized that shifting cultivation is one of the main culprits of tropical deforestation. Some of the demographic and economic factors that are already adding pressure on rich natural resources are:
1. Intensive Jhum cultivation
2. Deforestation threats
3. Rapid urbanization
4. Incidence of forest fires
5. High rate of unemployment

It has viewed that the land resource for agricultural activities should be assessed on the basis of slope, dissection index, soil and vegetation cover and land-use of a land at micro-level (Wagh, et al; 1984). In Nagaland the Jhum paddy covers an area of 95550 hectares (2011-12). There is no doubt that shifting cultivation is destabilizing the environment by means of deforestation, soil erosion and emission of carbon dioxide by the burning of Jhum fields. Nevertheless, the cultivators are left with no other choice because there is no suitable for alternative method to substitute. Some views of the people’s perception are:

1. The hill topography permits only the slash and burn method of cultivation, cultivation of terrace needs low-lying areas and it involves huge money. It has been found that the Government has promised to provide schemes for the terrace cultivation but the very schemes never reached the cultivators.

2. For most of the people living in rural areas there is no source of income unlike the people living in the urban areas their only source is encroachment of more land under agriculture and depend on the forest resources.
The farmers also practice soil conservation based on the physical barriers and live barriers. They use poles, logs, and bamboos across the slope areas as a contour bund to check soil erosion in the Jhum fields. Cash crops like cucumber, ginger, yam, etc., are cultivated in the contour bunds. This ensures food security as well as economic livelihood subsistence for the rural people. With these traditional approaches, the State Government has launched a programme known as the Communalization of public Institutions and Services and NEPED. The declaration of Vegetable village in Longkhum village in the district has suffered tremendous loss due to lack of marketing facilities. Hence, the State Government should come forward with a sustainable alternative approach towards land use system to ensure the security of livelihood for the shifting cultivators. Shifting cultivation affects the environment and productivity of land adversely. Alternative avenues of income, suitably harmonized with right land use practices, should be devised to discourage shifting cultivation. Efforts should be made to contain such cultivation within the area already affected by propagating improved agricultural practices. Already damaged by such cultivation should be rehabilitated through social forestry and energy plantations (National Forest Policy, 1988).

The view is that shifting cultivation is wasteful and inefficient mode of crop production. It is true that productivity from the point of land use is low under shifting cultivation (Barkakoti, 1990).
The climate induced variability of key parameters as assessed by few modeling studies have found unanimously that in addition to the existing development challenges being faced in forest cover in the Mokokchung district. The fluctuations in temperature and precipitation will impose added burden of the natural resources that has been conserved and protected so far through the method of traditional practices like community ownership and technical engagement of forest Department. It will be almost impossible to achieve the laid down objectives of afforestation and re-forestation to maintain sustainable management of forest resources.

4.3 Impact of Shifting Cultivation on environment in Mokokchung District

The district of Mokokchung is a land of village with 102 inhabited villages (2001 censes) and the people of the rural communities depend on environment for their livelihood subsistence. The land belongs to the individual, clan and community. Shifting cultivation which is also known as slash and burn cultivation is an old age practice deeply rooted within the Ao-Naga community. According to 2011 census, the total population of the district comprise of 1, 93,171 and out of this rural constitute of 1, 37,517 population. Approximately 70% of the cultivation practice shifting cultivation.

Out of the district geographical area of 161500 hectares, Jhum cultivation covers an area of 9770 hectares during the year 2011-2012. According to Nagaland Jhum Land Act 1970, Jhum land means such land which any member or members of a village or a community have a customary right to cultivates by means of shifting
cultivation or to utilize by clearing jungle or for grazing livestock and includes any beds of rivers provided that such village or community is in permanent location.

The study reveals that Jhum cultivators in the district are constantly modifying and innovating upon their traditional practices to improve but it still has a negative impact on the environment and their economy. The district was once known to be rich diversity today it has been exploited a lot due population pressure on agricultural land and by various human activities on environment. Over the years, the district has witnessed serious depletion on forest cover as well as on environmental changes.

The increase in population and encroachment of land under Jhum has however affected the environment to a greater extent. The burning of Jhum fields has also contributed slowly to the change in climatic variations. It is evident that large portions of wild fires that occur each year are caused due to burning of Jhum cultivation. This has caused numerous changes in the forest cover which eventually brought changes in the environmental condition of the district.

The district which has a tropical climate has raised its temperature by a few degree Celsius undergoing slight changes in the climatic condition. This slight alteration in degrees eventually affects in crop production. The year 2009 was the warmest year with drought like situation as the rainfall was uneven.

All these variations in climate have cause change in blooming of fruits and vegetables crops as well as in the reduction of natural resources. Moreover, farmers irrespective of their cultivation type have been the most affect with paddy crops and different kinds of cash crops yield lesser in the quantity of production. Among the
worst hit are the cultivators of cucumber under Aliba village. Almost a block of cucumber cultivation was dried off without bearing its fruit.

The delay in rainfall also constraint in the formation of dew drops thereby affects the pollination by bees and insects. With varies in altitude and changes in environment may varies from one village to another. Of all the cultivators of Jhum, Longkhum village is having the highest cultivators. A change in environment has been altered from the last five years. The frost formation seen only in Longkhum village which used to be accumulated upon few millimeters in thickness and lasted for several days has been reduced. Today, even due formation has been reduced within a span of 16 years starting from (1992-2008). The flow of rainfall is in an irregular pattern of which the highest rainfall was received in 1998 with 4878.33 mm and the lowest was in 2005 with 12305 mm. The Tonglong River which is the main barrier of water source for the villagers its volume of water has been reduced to a great extent. Drying up of natural perennial streams is also common in all the villages in the district. As a result of such seasonal shifts in weather condition the district had faced several landslides. The landslide that occurred on 22nd June, 1992 and 26th May, 2005 have been the district worst affect which was caused by the continuous heavy rainfall with more than 170.7 mm.
Field survey was conducted in the sampled villages to know more about the environmental impact and the social implications of the farming communities. It was carried out based on personal interviews and questionnaires as shown in (Fig: 3.12).

Forest resources are the most important assets for the Nagas. The district total forest cover in 2007 to 2008 was 139500 hectares but it has drastically decreased in 2010 to 2011 by 28976.79 hectares with remains the same from (2009 to 2011). Destroying of village forest is another problem according to 2008-09 the village forest cover was 134523.21 hectares but due to agricultural activities forest cover has been deforested a lot which has been reduced to 24000 hectares only.
The ownership and management of forest and turning large areas of forests cover under shifting cultivation has resulted into deforestation. During the first onset of Jhum, large tracts of trees are felled down and the felled trees products are used as timber and firewood. These process leads to the depletion at an alarming rate with people remain more or less ignorant about the long term consequences on the environment.

**Fig: 3.13 Deforestation cause by different activities (in %)**
Source: Field Survey (2010-2011)

The problem of deforestation is caused by human intervention by different activities. (Fig: 3.13) shows from the Field Survey respondents under different sampled villages. The overall deforestation is caused by shifting cultivation in which the highest response was in Longkhum village followed by Longsa village. Logging
and wild fires is also another problem of deforestation which are all inter-linked with the practice of shifting cultivation. In almost all the sampled villages cultivation of terrace is low; this is due to the hill topography. The deforestation status was also carried out in different villages to know more about the management of forest and deforestation. It has been observed that, forest cover in all the different ranges has been decreased to a large extent due to the pressure of Jhum cultivators and logging. Langpangkong, Tzurangkong, Japukong and Changkikong ranges have large hectares under forest cover with thick and dense vegetation.

The destruction of virgin forests causes more landslides which are common in these ranges. Numerous natural abode diversity of fauna and flora are also disappearing due to destruction of evergreen and moist-deciduous forest. *The destruction of the world’s tropical forest, which is disappearing at an alarming rate, is one of the today’s most urgent global environmental issues (K.C.Agrawal, 1998).*

The indigenous plant species *Rhododendrom Arboretum* (locally known as Metsuben naro) which was once abundantly embellishes the forest of Longkhum village has reduced expressively.

**Impact of environment in the district observed during Field Study**

1. Shifting cultivation has become non-sustainable.
2. Increase in population and pressure on agricultural land has brought huge forest under shifting cultivation.
3. Mass destruction of forest cover leads to deforestation and loss of biodiversity on environment.
4. Burning of Jhum is one of the worst impacts on climate as it produce huge junks of smoke and released into the atmosphere.

5. Rising of a temperature by a few degrees Celsius.

6. Decline in soil fertility with low yield is common in all the ranges.

7. Late monsoon and warm climate.

Keeping in view that, shifting cultivation is a way of life for the Ao-Naga community leaned with culture, customs and beliefs. Perhaps it will not go easily from the Naga farming system. Abolition of Jhum cultivation is not a realistic solution unless alternative methods for livelihoods are available. To ensure sustainable maintenance of the environment and productivity of Jhum cultivation some suggestions are pertinent:

1. Introducing of Alder trees (*Alnus nepalenis*).

2. Encouraged settled cultivation.

3. Topography of the district is undulating, use of broom grass on contours as vegetative barriers to reduce soil erosion.

4. Use of salt to control weeds must be banned as it loosens the soil which leads to soil erosion.

5. Introduction of leguminous crops in Jhum fields during cropping years to enhance land productivity and crop yields.

6. Afforestation must be encouraged under the guidance of village councils, district authorities along with forest department, NGO’s and other agencies.

7. Organic farming must be encouraged.

8. Balanced use of fertilizer to maintain soil fertility.
Plate 4.1 Emissions of smoke effecting the environment
Plate 4.2 Soil erosion in the hilly slopes under Jhum cultivation

Plate 4.3 Effects of Forest fire on vegetation cover
Plate 4.4 Virgin Forest Cover

Plate: 4.5 Massive Deforestation in Virgin Forest
Plate 4.6 Felled Trees for firewood
Plate 4.7 Women folks tending fire wood
4.4 Environmental Impact of Shifting cultivation

4.4.1 Degradation of Soil Fertility

Soils are the vital natural resource, on whose proper use depend the life supporting system and socio-economic development (Dr.K.Kire, 2006). The stability and future of many soils is under threat from a wide variety of human activities including over-grazing, poor agricultural practices, land-use change and forest clearance (Chris Park, 2001).

Shifting cultivation results in huge lose of soil and soil fertility and contributes a large volume of carbon to the atmosphere. It ultimately sustains on natural regeneration of soil fertility. It is an important period since the natural processes takes a minimum period to restore the cultivated land to its original fertility level. The maintenance of Jhum cycle varies according to different villages under Mokokchung district. It has been observed that, Jhum cycles have been drastically narrowed down due to constant practice in some villages. This period varies according to the bio-physical and agro-climatic conditions of the area usually known as the critical period (Sharma, 1984). It has been observed that, Jhum cycles have been drastically narrowed down. Due to the loss of soil nutrients, productivity of crop yield decreases.
It is true that productivity from the point of view of land use is low under shifting cultivation (Barkakoti, 1990). Larger forest areas are felled and burned down during shifting cultivation. The process of clearing jungles, burning, and dibbling of seeds accounts for nearly 3.7 tones/hectares of soil materials to slide down to foothills (Singh, 1978). There is very likelihood that organic matter of the surface soil is also oxidized causing reduction in the levels of organic matters and other nutrients in the soil. The large addition of ash which is rich in minerals destroys vast quantities of organic matter and bacteria which affects the soil formation processes and soil micro-organisms.

4.4.2 Deforestation

Forest plays a vital role by providing a wide range of choice for an independent spirited Ao-Naga. Shifting cultivation has become unsustainable and has been blamed for the forest degradation in the entire district of Nagaland.

It has a profound influence on the structure and function of human habitat locally as well as globally and also the largest reservoir of flora and fauna. The cause of deforestation is the extension of shifting cultivation which has been identified as one of the principal causes of deforestation in most of the tropical regions. The current district total forest covers an area of 28976.79 hectares.
According to 2008-2009, village forests cover was 134523.21 hectares but it has decreased to 24000 hectares in 2010-2011 this is due to massive destruction of forest. It has a protected forest that covers 428 hectares (2010-11). Loss of natural forest ecosystems always results in loss of biodiversity and often in a range of environmental impacts (Gordon Dickinson, Kevin Murphy, 2007). Of all the deforestation, village forest covers are the main regions that are highly deforested. The trend of village forest cover in the district from 2007-2009 was 134523.21 hectares but it has been narrowed down to 2400 hectares from 2010-11.

The cultivation of Jhum leads to loss of natural forest ecosystems creating huge impact on environment. The extraction and the felling of large tracts of forest cover on the onset of Jhum distribute the environment in many ways. Loss in forest cover results on climatic variation like-uneven rainfall, precipitation, wind, humidity etc. Further, on siltation, flooding and soil degradation and loss of biodiversity affect the economic activity and threaten the livelihood and cultural integrity of forest-dependent people. Deforestation is also cause by forest fires. The phenomenon of forest burning is responsible for killing of fauna, wildlife, forest species of plant and animal kingdom. Wild fires commonly occur on the onset of Jhum during the dry seasons of February and March months. Though using of fire is an integral part of land management in both agriculture and forestry, it has a wide ranging negative environmental impact.

According to the State Climate Change Projection, the temperature in the mid-century starting from (2020-2050) is likely to experience an increase in annual average temperature between 1.6°C and 18°C. While the southern districts
show higher increase in temperature with Kohima, Wokha, Phek, Zunheboto and Tuensang districts showing an increase of temperature between 1.7 C and 1.8C. The northern districts of Mon and Mokokchung are projected to have an increase in average temperature of between 1.6C and 1.7C. This shows that reduction in forest cover contribute to heating of the earth.

### 4.4.3 Loss of Biodiversity

Environmental protection, sustainable development, good management of natural resources and conservation of biodiversity are some of the emerging subjects of growing public concern in the world. Increasing attention is drawn on the issues of human impact on the fast depletion of biological diversity. The earth is a home of rich diverse and array living organisms where genetic diversity has relationships with one another and with their physical environment constitutes rich biodiversity. Moreover, the ethical, aesthetic, spiritual, cultural and religious values of human societies are the integral part of these complex resources.

The district has an absolute store house of rich biodiversity which has been preserved in its natural habitat for centuries. The inception of modern civilization and increase of population and continuing practice of traditional method of cultivation bring changes in the environment. The physical alteration of forest and jungles is one of the sole factors for the great loss of biodiversity. It
has witnessed a massive change in the forest cover. The felling of trees and forest permanently has brought great loss and the recovery would take many years. Longkhum village which is under Ongpangkong range is one of the rich biodiversity hot spot. Today, it has been endangered and the vicinity of reserved forest have been put into cultivation due to massive destruction of forest for Jhum fields. The blooming of Rhododendron Arboretum is decline which was once well adopted at the higher altitude with moderate climate and heavy rainfall.

One of the main causes for the loss of biodiversity is population explosion and resultant deforestation (K.C. Agrawal 1998). The loss in biodiversity affects the environmental climatic conditions of a region affecting the abode of various faunas. Migratory birds like grey peacock pheasant (*polyplectron bicalcaratum*) which is believed to be migrated from Indonesia, golden languor. Panther tigers etc. are some of the species which was found in abundance in the entire district is no more seen for the last 20 years. There has been maximum decrease in the total number of species.

The most deciduous and evergreen forest which adorned the entire district is an abode of exotic floras and magnificent faunas. Due to reckless cutting down of forest cover their population has been considerably reduced. There are many plants that do not exist anymore and no effort was been made to revive and preserve them. If proper preservation and conservation with effective implementation are not initiated they are definitely on the verge of extinction.
The status of biodiversity in the district has undergone drastic changed within a span of 50 years. There is adverse affects of human impact due to the encroachment of forest resources with the continuous practice of traditional cultivation. The private forest vested in the villages are been haphazardly and unscientifically exploited. All kinds of restriction is imposed in the Reserved Forest, sanctuaries, felling of trees, hunting, fishing etc., are still going on. It has increase dramatically and threats the very foundation of sustainable development and quality of life. Loss, fragmentation and diversity of species and genes in the biodiversity affect the ability of ecological communities to reset or recovery from disturbance and environmental change that includes long term climatic change.

4.4.4. Forest Fire

Forest fire is common in all the areas under shifting cultivation as burning of Jhum fields sets in during the dry seasons which are susceptible to fires. There is considerable loss of forest cover and its product due to frequent burning of forest. It has a wide range of negative environment impact.

*These immense fires are visible from space, disrupt air travels and increase carbon-dioxide adds to the atmosphere, treasure house of biodiversity* (Gordon Dickinson, Kevin Murphy; 2007). The burning of vegetation in forest
cover release large quantities of smokes into the atmosphere which impact the ecological environment by arising in climatic variations of an area.

Human induced in the environmental is at large and it increases on and on. The district has faced numerous fire incidents in 2009-2010 which was occurred during the time Jhum field burning. Altogether 80 hectares of forest cover were completely slashed down during these years. Due to this numerous natural biodiversity abode were loss.

Gasses warms the earth surface -18 C with the green house effect, the earth would be too cold for life. However, the more of these gases the atmosphere contains, the more heat is retained. Human activities add small quantities of water vapour to the atmosphere but, much more importantly, they added large quantities of carbon-dioxide and methane and these are increasing temperatures on earth (Kran Arms, 1990). Lots of initiatives were taken up by village communities as well as Government policies and NGO’s to deal with the fire incidents but still the rules and regulations which were implemented are also weaning away from the local communities. The State has banned jungle burning since 1996 but it was not adhered.

Measures and precautions should be implemented especially to the rural people who are mostly cultivating Jhum cultivation. Local communities together
with the fire department and different agencies must come forward to supplement rules and precautions in conserving towards our community forest covers.

4.4.5 Effect on Hydrological Cycle

Deforestation that results from the cause of shifting cultivation interference with the rain as vegetation plays a vital role in the rain cycle. The mass destruction of forest cover with forest canopy gaps lead to deforestation and this limit in rain formation due to low limited evapo-transpiration. It is undertaken as one of the primary sources for water vapour during the formation of cloud. The water catchment areas also dry out when forest cover are cleared which results into droughts.

4.4.6 Land Degradation

The productivity of land deteriorates easily in the areas where shifting cultivation is prominent. In India, people of the Eastern and Northeastern regions heavily practiced Jhum on hill slopes. With the increase land use, the cycle of cultivation is affected. It has been observed that, Jhum cycle has been reduced from 10-15 years now to 8-10 years. In some ranges in the district it has come down to 5-7 years. Due to the reduction in cycle, the resilience of ecosystems has been broken down and the land falls into deteriorating condition. Under this, the land is deteriorated with more vulnerable to soil erosion and loss of soil fertility.
4.4.7 Proliferation of Weeds, Pests and Diseases

Land preparation and the cultivation also create condition favorable for the gradual proliferation of crop-weeds, diseases and pests. Large canopy forest cover prevents the growth of weeds. However, when the forest cover are felled down for the preparation of Jhum field, weeds are more vulnerable to light, less competitive but with the aggressive growth rate begin to invade the cultivated land. In the first cropping phase, the densities of the weed are low but they increase rapidly during the subsequent cropping phase. In shifting cultivation, often the same species of crops are repeatedly planted and these may contribute to the specific crop weeds over a period of time. The shifting of land one after to another phase of every 1 to 2 years causes pests and diseases which are more common in the crops.