G E O G R A P H I C

ISSN 0975-4121

Peer Reviewed

Vol.15. JULY, 2020

PUBLISHED BY DEPARTMENT OF GEOGRAPHY AND RESOURCE MANAGEMENT, MIZORAM UNIVERSITY

G E O G R A P H I C

Volume 15 **July 2020**

CONTENTS

Articles

Farmers Perception on Land Degradation in Tuirini Watershed, Mizoram

- Vanlalṭanpuia
Ch. Udaya Bhaskara Rao
P. Rinawma

Abstract : *Local people's perception particularly, the farmers observation is valid to understand the causes and consequences of land degradation and for successful implementation of appropriate land management procedures to achieve sustainable agricultural development. A wide spatial variability in different forms of land degradation was observed in Tuirini watershed, which occupies about 411.38 km^2 in Mizoram through local peoples' perceptions and responses regarding soil degradation, deforestation and water scarcity. The present study is an attempt to analyze the factors responsible for various forms of land degradation along with farmer's perception in Tuirini watershed. The practices such as shifting cultivation, cutting of forest for fuel wood, lumbering and more interestingly, growing ginger resulted in large scale erosion and deforestation thereby led to massive land degradation. In addition, high pressure of the rapidly increasing population and high degree of land use change resulted in shortening of fallow period thereby induced land degradation. Regarding the water supply, the people in this watershed receiving good amount of rainfall but facing water scarcity due to lack of practicing rainwater harvesting.*

Keywords : *Land Degradation, Farmer's Perception, Soil degradation, Deforestation, Water scarcity.*

Introduction :

Land degradation is a serious threat to current and upcoming agriculture development and sustainability. Deforestation and top soil erosion seems to be the top most serious problems in the rainfed agriculture practicing regions of Tuirini watershed. Rainfed agriculture is constrained by water and nutrient stress and fertility loss in top soil, further affects adversely the agricultural development and production. Accelerated soil erosion, deforestation and non-adoption of soil conservation measures led to the degradation of land in Nigeria (Akinnagbe and Umukoro,2011). Soil erosion is a major threat to physical, economical and ecological environment which lead to environmental deterioration (Shit et al., 2015). Agriculture production is affected by water and also the nutrient stress particularly, in rainfed cultivation areas (Joshi et al.,1996).

To draw the strategies for sustainable land management, it is important to determine the causes and symptoms of land degradation through both the scientific methods and from the perspective of the inhabitants of the area (Lambin 1993; Martin & Lockie 1993). Different forms of land degradation were observed in the Tuirini watershed such as soil degradation, deforestation and water scarcity.

It is essential to assess the farmers perceptions about soil fertility in different management practices for which clear communication with farmers and recognition of their knowledge is highly essential (Yeshneh, 2015). A wide spatial variability in different forms of land degradation was noted within the study area through the local peoples' responses and their perceptions regarding land degradation on the basis of their experiences.

Aims and Objectives :

To enhance policy towards tackling the challenges that land degradation poses to local people, it is important to have full understanding of local people' perception on land degradation and its severe effects on their agricultural productivity. Understanding local peoples' perception on causes and impacts of land degradation and the conservation measures facilitate to give specific proposal for designing appropriate

Vanlalṭanpuia *is a Research Scholar in the Department of Geography & RM, Mizoram University.*
Dr. Ch. Udaya Bhaskara Rao *is an Associate Professor in the Department of Geography & RM, Mizoram University (Supervisor)*
P. Rinawma *is a Professor in the Department of Geography & RM, Mizoram University*
Corresponding author : chegondiu@yahoo.co.in

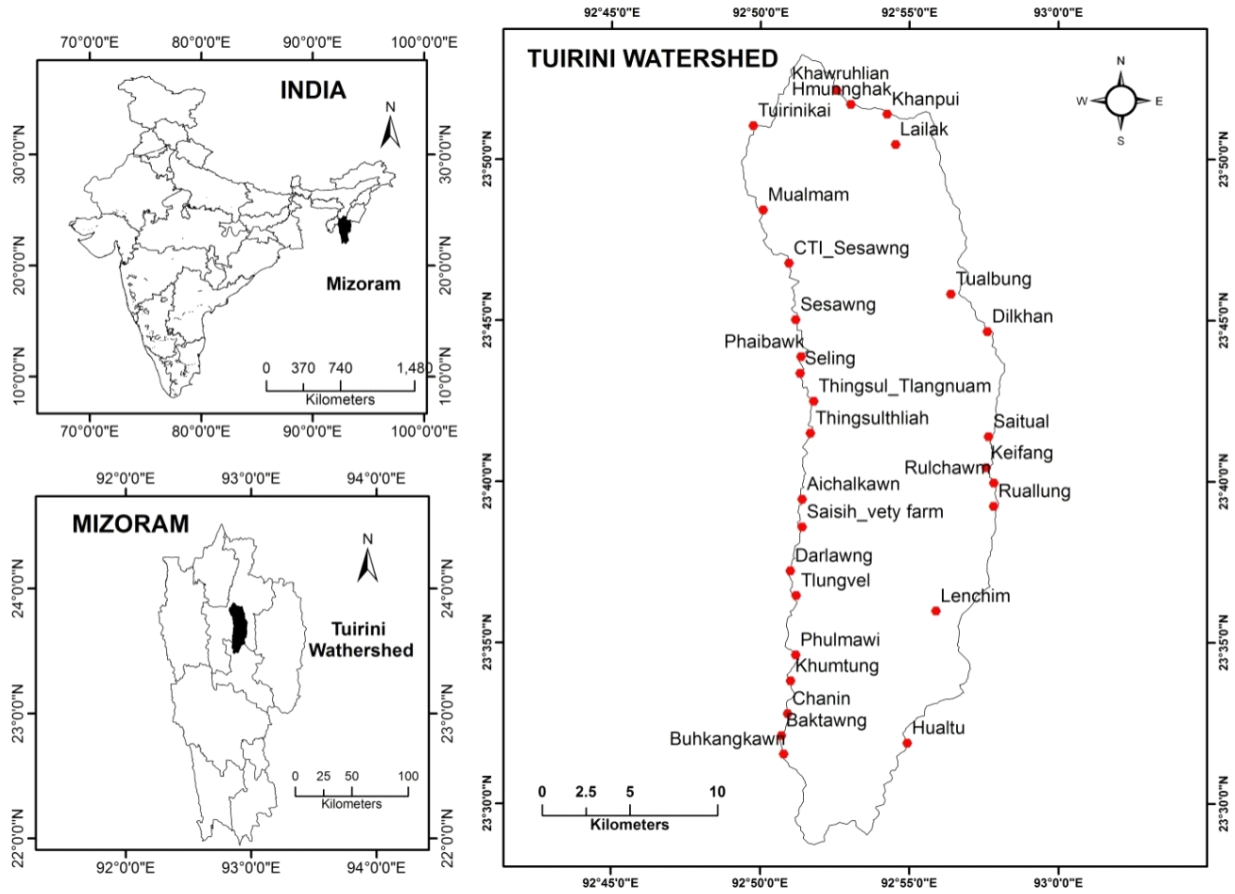

Fig.1 Location Map of Turini Watershed, Mizoram.

conservation strategies to combat land degradation in the study area.

Study Area :

The Tuirini watershed which lies between 23° 28' 40" – 23°53'15" north latitudes and 92°49'15"-93°58'15" longitudes was selected for the present study (Fig.1). It lies in the central part of Mizoram covering parts of Serchhip and Aizawl districts. The watershed stretches in N-S direction in an area of about 411.38 km^2 which occupies 1.94% of the total geographical area of Mizoram. It falls in survey of India topographical maps 84 A/13, 84 A/14 and 84 A/15.This watershed covers 29 villages. The total population is about 43,863persons as per the report on Village Profile & Development Indicators, Government of Mizoram (2017-18).The population density in the study area is 106 persons per km^2. The entire study area is neither too hot nor too cold throughout the year. The mean summer temperatures range between 21^0 C and 31^0 C while in winter it varies from 11^0 to 23^0C like in the other areas of Mizoram.

Materials and methods :

Interview and Questionnaire methodswere adopted for collecting the data on perception of farmers towards land degradation. Purposive random sampling method was applied to select farmers. About 276 farmers have been interviewed. The datasets were analyzedby percentile method.The base map of the study area was prepared using survey of India topographical maps and digital elevation models of the study area.

Findings and Discussion :

The entire study area experiences severe soil erosion and land degradation problems. The local communities have been observing that shifting cultivation especially growing ginger, fuel wood collection and commercial lumbering cause high rate of deforestation and

various forms of rill, gully and sheet erosion.

Soil Degradation :

The result reveals that the high proportion (100%) of the local people was aware about the problem of soil erosion. Both sheet and rill erosion are the prevailing form of erosion (98.9 % and 79.35%) in the study area (Table1). Gully erosion accounts 14.13% mostly along the

Table 1: Soil Degradation Characteristics by the respondents (n=276).

Sl No.	Questions	Characteristics	Frequency	Percent
1	Erosion faced in own farm	Yes	276	100.00
		No	0	0.00
2	Prevailing form of Erosion	Sheet	273	98.91
		Rill	219	79.35
		Gully	39	14.13
3	Severity of Soil erosion	Severe	204	73.91
		Moderate	72	26.09
		Minor	0	0.00
4	Impact of erosion on crop yield	Severe	195	70.65
		Moderate	78	28.26
		Minor	3	1.09
5	The rate of erosion over time	Increasing	261	94.57
		Same	15	5.43
		Decreasing	0	0.00
6	Causes of soil erosion	Erosive rain	18	6.52
		Slope Steepness	261	94.57
		Weak conservation measure	150	54.35
		Tillage	231	83.70
		Deforestation	267	96.74
7	Causes of Crop productivity decline	Heavy rainfall	0	0.00
		Rainfall Shortage/Drought	0	0.00
		Fertility decline	258	93.48
		Continuous cultivation	45	16.30
		Soil Erosion	237	85.87
		Shortening of jhum cycle	273	98.91
8	Soil fertility status in own plots	High fertility	21	7.61
		Medium fertility	252	91.30
		Poor fertility	3	1.09
9	Causes of Soil fertility declining	Soil erosion	276	100.00
		Repeated cultivation	21	7.61
		Improper Management	189	68.48
10	Changes in fertility over time	Improving	0	0.00
		Declining	270	97.83
		No change	6	2.17
11	Conservation measure applied/adopted	Yes	39	14.13
		No	237	85.87
12	If Yes, type of conservation measure applied/adopted (n=39)	Contour Trenching	9	23.08
		Changkham	18	46.15
		Terrace	12	30.77
		Others	0	0.00

Multiple response frames were used and some total count is more than number of respondents.

foothills where runoff appears to be more as these areas are prone to flash floods.

Therefore, the local peoplefelt that about 70.65% of the crop yields are controlled by the soil erosion in various forms. Shortening of Jhum cycle (98.91%) and fertility decline (93.48%) appear to be the two main causes for decline in agriculture production. Similarly, soil erosion (85.87%) and continuous cultivation (16.30%) without any break also affected the agricultural production. Moreover, deforestation (96.74 %), steepness of the slope (94.57%), tillage (83.7%) and inappropriate soil conservation measures (54.35%) also contribute to decline in agriculture production.

The soil fertility status reveal that about 7.61 % of local people perceived their lands as high fertility, 91.3 % judged as the medium fertility, and the remaining only 1.09 % respondents felt that their land as poor in fertility. Concerning the perception of local people to the causes of soil fertility decline on their agricultural land, the respondents ranked soil erosion (100%) as the main cause of soil fertility decline and followed by the improper management (68.48%) and repeated cultivation (7.61%). Of the total respondents, 97.83 % felt that declining the soil fertility change over time, only 2.17 % responded as stable over time and none responded as improving the soil fertility over time.

Response regarding the conservation measures adopted in their farmlands reveal that about only $1/7^{th}$(14.13 %) of the local people were practiced conservation measures. Among those practices, traditional way of conservation measures 'Changkham' adopted by the major local people (46.15 %) followed by terracing (30.77%) and contour trenching (23.08%) respectively.

It is the perception of the local people that growing of ginger enhance the intensity of soil erosion and leads serious soil degradation. Firstly, they need to cut down virgin forest for massive production of ginger and wait for about two to three foe yield. During that period, they clear the field regularly and plough the land for normal yield which causes high rate of soil erosion and degrade the nutrientsleading to soil degradation.

The cognizance of farmers' perception could confirm that they are conscious of their environment and its related problems. They are aware with those which affect the land productivity and those that result in landscape changes of soil erosion and can feel the fertility decline in their respective land.

Deforestation :

The local peoples' perception on deforestation reveals that hundred percent of the respondents accepted the deforestation they experienced in their own land. The main cause of deforestation is by the local activities of shifting cultivation (100%), fuel wood collection (94.57%) and commercial lumbering (36.96%) respectively (Table 2).

The implementation of Government policies also caused deforestation in the way of commercial forest plantation (75%) and government flagship programmes like New Land Use Policy (NLUP) (66.3%) and Mizoram Intodelhna Project (MIP) (60.87%), which were followed by road construction (7.61%). Besides these local and government activities, intentional or natural forest fire (6.52%) causes deforestation during the dry season. They felt that after the introduction of NLUP Phase-I, the local people started practicing shifting cultivation or plantation in their own land. These causea serious forest fire every year at least some part of the land which cannot be controlled. In fact, the peoples' perception on forest degradation in Mizoram reveals that shifting cultivation and fuel wood collection from forests are the major driving forces of forest degradation in Mizoram (ICFRE,2017).

Earlier, all of the local people used to have common land for practicing shifting cultivation in which the magnitude of forest fire was relatively less. Majority of the local people in different villages opined that they would like to abolish commercial forest plantation in their own land by the government due to clearing of the virgin forest of natural growth for growing different species of tree and bamboo. They felt that thoseplantations

of unnatural species of trees and bamboos disturb the ecosystem. They suggested that community-based forest management is the appropriate conservationmeasure for natural growth of forest whichcan check land degradation to large extent.

Shifting cultivation is the main dominant type ofagriculturepractice (80.43%) followed by the horticultural

Table 2 : Deforestation Characteristics by the Respondents (n=276).

Sl No.	Questions	Characteristics	Frequency	Percent
1	Deforestation faced in own land (Village area)	Yes	276	100.00
		No	0	0.00
2	Causes of Deforestation	By Local activities	276	100.00
		By Govt. activities	51	18.48
		By company or organization or society	0	0.00
		Forest Fire	18	6.52
3	If local activities	Fuel wood collection	261	94.57
		Shifting cultivation	276	100.00
		Raw material for House construction	0	0.00
		Commercial Lumbering	102	36.96
4	If Govt. activities	NLUP	183	66.30
		Road Construction	21	7.61
		MIP	168	60.87
		Commercial forest plantation	207	75.00
5	Type of agriculture practices	Shifting cultivation	222	80.43
		Terrace farming	36	13.04
		WRC	6	2.17
		Plantation (Horticultural crops)	147	53.26
6	Land use change occur	Severe	270	97.83
		Moderate	6	2.17
		Minor	0	0.00
		No change	0	0.00
7	Increasing distance of collecting raw materials from forest?	Increasing	276	100.00
		Decreasing	0	0.00
		No change	0	0.00
8	Period of jhum cycle in the past years	Recently	5 to 8	
		15 years back	11 to 15	
		30 years back	22 to 28	
9	Main type of crops	Rice	237	85.87
		Ginger	198	71.74
		Chili	9	3.26
		Vegetables	42	15.22
10	Type of fruit plantation	Banana	216	78.26
		Orange	15	5.43
		Papaya	129	46.74
		Others	12	4.35
11	Type of tree plantation	Teak	18	6.52
		Tung	9	3.26
		Others	0	0.00

Multiple response frames were used and some total count is more than number of respondents.

plantations (53.26%) and terrace farming (13.04%). Wet Rice Cultivation (WRC) is practiced by only 2.17% of stakeholders due to undulating terrain and less width of river banks which is the most common feature in Mizoram.

Further, about 97.83% people felt that land use is highly changing and only 2.17% felt that it is moderate. Unfortunately, local people have a feeling that the forest areas are speedily transformed from dense to sparse and converted to other land use types. The study areas of Mizo community have a tradition of allotting a portion of forest in the vicinity of the village, for Safety Reserve Forest to supply multi-resources for the villagers. But, due to the increasing pressure on land use change by socio-economic development and population growth, it is difficult to maintain the traditional way of forest conservation which affects the long distance collection of raw materials from the forest.

Land degradation also induces land shortages which results in shortened fallow period thereby continuous cultivation leading to high pressure on immediate accessible land (Ehui,1993). The perception on the period of Jhum cycle in the study area for highlighting that the duration of fallow period. In many cases soil fertility is a major indicator in assessing the status of land resources affected by land degradation. The continuous cultivation results in loss of soil fertility due to shortened fallow period (Haule et al., 2010).

It is revealed that due to the small population leading to less demand for Jhum practices, the fallow period is 22 to 28 years which is 30 years in the past. It is drastically decreased to 11 to 15 years in the past 15 years. Recently, the duration of fallow period is reduced to only from 5 to 8 years. This is due to the high pressure of demand by the rapidly increasing population and high degree of land use change.

Around 85.87 % of the cultivators growrice and 71.74 % grown ginger as main crop. Vegetables like cabbage, mustard, corn, brinjal, pumpkin, bean, chilli, tomato, etc., are also grown for a season. Fruit plantation like banana, orange, papaya, nimbu, hatkora, etc., are also found extensively in the study area. Regarding the method of agricultural practices in the crop types, the farmers felt that growing of ginger causes a serious degradation more than the other crops as it takes longer duration of about 2 to 3 years than any other crop. Due to this reason, the ginger cultivated areas are vulnerable to deforestation and also to severe soil degradation.

Besides,the massive plantation programmes implemented by the government, local people also undertake tree plantation especially, teak along the river valley side and also along the foot hills. As these practices are only for commercial purpose and do not have impact on afforestation. The local people felt that the causes of forest degradation are due to replacing the naturally growing forest.

Water Scarcity :

Water is a vital natural resource to human life which directly influences to public health and determines the living standard. The demand of water resource is ever-increasing due to continuous urbanization, population pressure and agricultural intensification, more importantly by the impact of climate change and rainfall variability. Water scarcity seems to be a crucial limiting factor of the farmers' vulnerability.

The response of local people to water scarcity is now a challenge in all areas of the world and even in the study area, especially, in the context of climate and land use/land cover changes.

Most of the villages in the watershed maintain the community-based water management. For this, the village council has employed persons to monitor the water supply, condition of the pipelines and source of water condition in the stream or river. The government provides water supply through a pipe line and funded to set up a large capacity of water tank. But, all the costs of the maintenance are borne by the villagers.

It is revealed from the total responses that about 71 % of the people face the shortage of water supply during dry season (Table 3). They used different sources of the domestic water like public tap, private connection, springs and bore

well or hand pump. About 60% of the respondents use public tap as the main source of water, followed by private connection (31.52 %) and the rest (7.61%) use spring as the main source of water. No one uses bore well or hand pump as the main source of water which is a subsidiary. Among the respondents, 65.22%felt that the water supply is available throughout the year, but, less supply during the dry season. On the other hand, 34.78 % felt that the water supply is not available throughout the year and have been facing water scarcity.

About 35.87 % stakeholders are not satisfied with their main source of water due to less supply and improper maintenance. They fulfill their needs from spring and bore well or hand pump. They pay 30 to 50 rupees for public tab and 150 to 300 rupees for the private connection per month. The local people have perceived that the dry season holds for five months, started from December

Table 3: Condition of water scarcity and water supply by the respondents (n=276).

Sl No.	Questions	Characteristics	Frequency	Percent
1	Face water scarcity in dry season	Yes	198	71.74
		No	78	28.26
2	Source of domestic water	Bore well/Hand pump	12	4.35
		Public Tap	213	77.17
		Spring	57	20.65
		Private Connection	87	31.52
3	Main source of water	Bore well/Hand pump	0	0.00
		Public Tap	168	60.87
		Spring	21	7.61
		Private Connection	87	31.52
4	Available throughout the year	Yes	180	65.22
5		No	96	34.78
	Month of water scarcity		Dec-April	
6	Cost of water for a month (in rupees)	Public Tap	30 - 50	
		Private Connection	150 - 300	
7	Satisfied with water supply	Yes	177	64.13
		No	99	35.87
8	If No, reason for dissatisfaction (n=99)	Less Supply	96	96.97
		Improper maintenance	3	9.09
		Others	0	0.00
9	Changing rainfall pattern	Severe	222	80.43
		Moderate	54	19.57
		No change	0	0.00
10	River water volume in dry season	Increasing	0	0.00
		Decreasing	198	71.74
		Rapid Decreasing	78	28.26
Rainwater harvesting				
11	Harvest rainwater	Yes	69	25.00
		No	207	75.00
12	Have big tank for storing water	Yes	54	19.57
		No	222	80.43
13	Consuming rain water (n=69)	Domestic needs	69	100.00
		Gardening	0	0.00
		Others	0	0.00
Public Tap				
14	How far is public tap from home	In meters	20 to 100	
15	Time taken for fetching	In minutes	5 to 10	

16	Frequency of supply	More than once a day	36	13.04
		Once in a day	12	4.35
		Once in two days	45	16.30
		Once in a week	96	34.78
		Twice in a week	63	22.83
		Twice in a month	24	8.70
17	Frequency of supply pipe broke down	Once in a week	0	0.00
		Once in a month	39	14.13
		Once in a quarter	57	20.65
		Once in a half year	114	41.30
		Once in a year	66	23.91
18	Fixed promptly when breakdown	Yes	231	83.70
		No	45	16.30
Natural Spring or Artificial spring				
19	How far is Spring from home	In meters	20 to 100	
20	Time taken for fetching	In minutes	10 to 30	
Private connection				
21	Frequency of water supply	24 x 7	6	2.17
		Once in a day	12	4.35
		Once in two days	15	5.43
		Once in three days	27	9.78
		Once in a week	216	78.26
22	If assistance is needed (n=33)	Bore well/ Hand pump	3	9.09
		Spring	6	18.18
		Public Tap	24	72.73

Multiple response frames were used and some total count is more than number of respondents.

to April in a year. The more irregular distribution of rainfall in space and time today as compared to earlier was the matter of concern to the stakeholders. About 80.43 % of the people observed that the rainfall patterns are severely changed and 19.57 % perceived it is moderate. During the dry season as compared to the previous years, about 71.74 % felt that the volume of the river water is decreasing and about 28.26 % perceived as rapidly decreasing.

Due to high amount of annual rainfall in the study area during the long rainy season, the local people do not seem to face water scarcity problem. Unfortunately, more than one-third of the local people faced that problem because only 25 % of the people harvested rainwater through rooftop and used for domestic needs. Only 19.57 % have a big size water tanks for rain water storage and 80.43 % do not have such type of tanks and they utilize only rainwater for immediate usage.

Among the users of the public tap as the main source of water, they need to walk for around 20 to 100 metres and wait for 5 to 10 minutes to fetch water. The frequency of water supply is highly different in the study area and it also changes with the season. Water supply occurs generally once and twice in a week (34.78 % and 22.83%) but some villages received more than that. It is found that some villages received public tap water once in six months. Most of the villages do not have a good source of water in their land and they need to take domestic water for miles with pipeline. The pipeline frequently broke down due to different causes and tried to fix promptly by the community itself. Generally, the local people felt that the supply of public tap is irregular during the peak rainy seasons due to problem of sedimentation and breakage of pipelines due to landslide. In the dry season also, there is not enough water to feed the village.

As mentioned, only about 7.61 % people used spring as the main source of water but users are increased rapidly in the dry season up to more than 60 % due to lack of water supply through public tap and private connection. Generally,

the natural springs are located in an isolated places which need to spend long duration to fetch water. But in some villages, artificial springs were constructed along the major road by drawing water from the nearby stream through pipelines. But these are also dried in the dry peak seasons.

Regarding the private connection in the study area, the general frequency of water supply is once in a month (78.26%). But some villages have good source of water which have favorable location where they receive in higher frequency. In some instances, when they do not satisfy with the water supply, bring water from other sources mostly by tankers or sometimes from public tap and even from springs.

Population Pressure :

The ever-increasing population also leads to degradation of land. There is a high growth of population in the watershed which causes stress on available arable land for agriculture and built-up area extension (Fig.2 and Table 4). As the population density is very high of about 106 persons/km^2 there is a need for rapid conversion of fertile arable lands into marginal land leads to satisfy their needs. The reduction of jhum cycle periods leads to intensive agricultural practices thereby land degradation in many forms.

Further, the increase in population leads to high demand of domestic necessities mostly for non-timber products in their nearby forest area which may lead to loss of biodiversity and further deterioration of land in the area.

Conclusion :

The study has revealed that how local people experience decline in soil fertility, soil erosion, deforestation which have impact on agriculture production and water scarcity in Tuirini watershed. They feels that the practice of shifting cultivation, fuel wood collection and increasing population causing land use

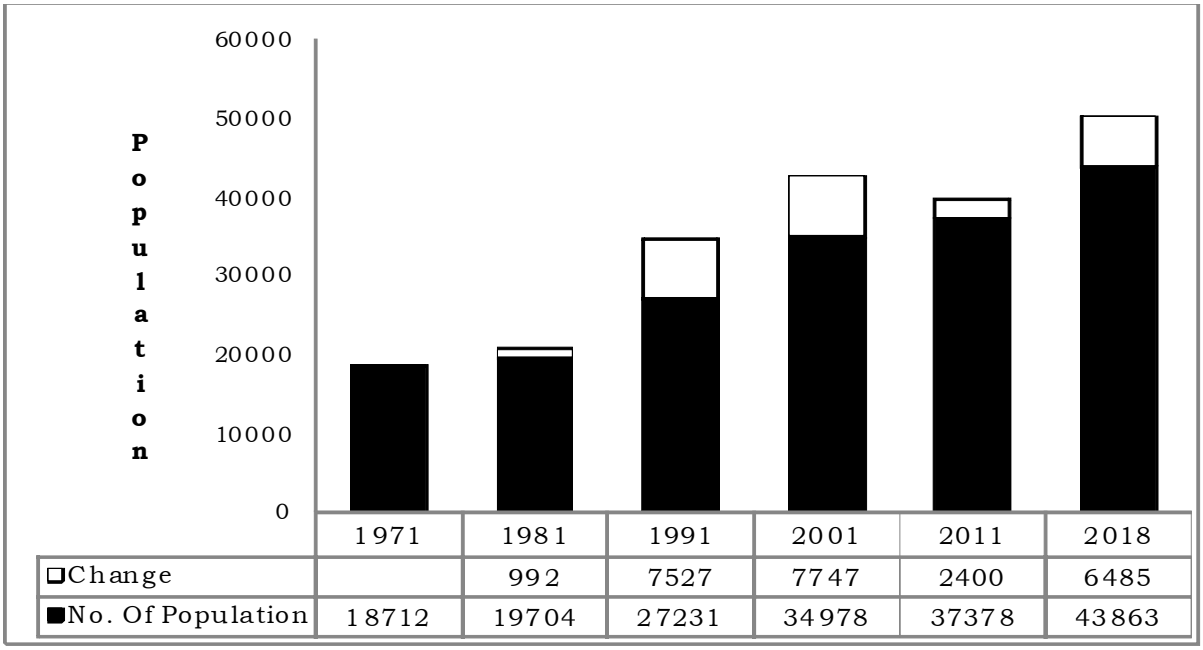

Fig 2. Population Changes in Tuirini Watershed.

Table 4: Population Statistics of Tuirini Watershed.

Year	Population (no. of persons)	Change	Population density (no.of persons per km^2)
1971	18712		45
1981	19704	992	48
1991	27231	7527	66
2001	34978	7747	85
2011	37378	2400	91
2018	43863	6485	106

change induces the deforestation and soil erosion and having a negative impact on the production of agriculture and reduces the fallow period. Due to the lack of rainwater harvesting techniques in the rainy seasons, the people have been facing serious problem of water scarcity during the dry seasons. The land degradation studies in this watershed promotes appropriate conservation strategies which are essential for achieving sustainable development of natural resources only through people's participation. They need to change their agriculture system of shifting cultivation to permanent land agriculture practices with the help of proper soil erosion banding techniques and introducing agroforestry. For reducing water scarcity, they must try to practice rainwater harvesting as possible during the rainy season.

References :

Akinnagbe O.M and E.Umukoro (2011) : Farmers' Perception of the Effects of Land Degradation on Agricultural Activities in Ethiope East Local Government Area of Delta State, Nigeria, *Agric. conspec. sci.*, 76(2): 135-141.

Ehui S. (1993) : *Environmental Degradation in sub-Saharan Africa: Issues for policy analysis*, In: Livestock and Resource Management Policy : Issues and priorities for research. Proceedings of the Research Planning Workshop, held at ILCA, Addis Ababa, 24-27 March 1992:119-126.

G.O.M. (2018) : *Village Profile & Development Indicators 2017-2018: Mizoram State*, Directorate of Economics & Statistics, Government of Mizoram.

Haule C.B.M., M.R.S. Mlozi and M.K. Mulengera (2013) : Land Degradation and Smallholder farmers response : A case of village in the southern parts of Ludewa District, Iringa Region. *Tanzania Journal of Agricultural Science*,12(1):11-21.

ICFRE (2017) : *Drivers of Deforestation and Forest Degradation in Mizoram*, Indian Council of Forestry Research and Education, Dehradun

Joshi P.K., S.P. Wani., V.K. Chopde and J. Foster (1996) : Farmers' Perception of Land Degradation: A Case Study, *Economic and Political Weekly*, 31(26):A89-A92.

Lambin E.F. (1993) : Spatial scales and desertification. *Desertification Control Bulletin*, 23:20-23.

Martin P. and S. Lockie (1993) : Environmental information for total catchment management: incorporating local knowledge. *Australian Geographer*,24:75-85.

Shit P.K., G.S.Bhunia and R. Maiti (2015) :Farmers' perception of soil erosion and management strategies in south Bengal in Inida, *European Journal of Geography*, 6(2):85-100.

Yeshaneh G.T. (2015) : Assessment of Farmers' Perceptions about Soil Fertility with Different Management Practices in small Holder farms of AbuhoyGara Catchment, Gidan District, North Wollo, *American journal of Environmental Protection*, 3(4):137-144.