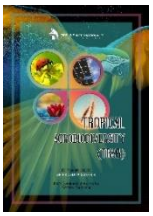
ZIBELINE INTERNATIONAL™ PUBLISHING

ISSN: 2716-7046 (Online)
CODEN: TARGCA

Tropical Agrobiodiversity (TRAB)

DOI: http://doi.org/10.26480/trab.02.2023.62.67



RESEARCH ARTICLE

ECONOMIC VIABILITY AND PROSPECTS OF OIL PALM CULTIVATION IN MIZORAM, INDIA

Vishwambhar Prasad Sati

Department of Geography and Resource Management, Mizoram University (Central), Aizawl – 796004, India.
**Corresponding author Email: sati.vp@gmail.com*

ARTICLE DETAILS

Article History:

Received 17 May 2023
Revised 20 June 2023
Accepted 03 July 2023
Available online 12 October 2023

ABSTRACT

The oil palm plantation first started in 2005 in Mizoram. Now, the cultivation of oil palm is practiced in the seven districts of Mizoram out of a total of eight districts. The agro-climatic conditions are suitable for growing oil palm in Mizoram. However, the output from its cultivation is not so high. This paper examines the economic viability and prospects of oil palm plantations in Mizoram. Data from two sources – primary and secondary were collected mainly on Oil palm potential areas, changes in the area under oil palm from 2011 to 2021, the status of oil palm cultivation, and farmers with oil palm fresh fruit bunches harvest – production and income. A case study of eight villages in the Mamit and Kolasib districts was carried out and 173 households (12.4% of the total households) were surveyed. A comparison of income earned from cereal crops and oil palm cultivation was carried out. It was noticed that income earned from oil palm was higher than cultivating cereals. Oil palm cultivation obtains potential areas. The arable land under oil palm cultivation is 3.17%, which is substantial. The highest area under oil palm plantations is in three districts – Kolasib, Mamit, and Aizawl. The Champhai district does not practice it. The other districts have scattered oil palm plantations. During 2011 and 2021, the area under oil palm cultivation increased by 24,714 ha. Meanwhile, oil palm growers are facing problems in terms of market facilities. Adequate market facilities can be provided to the oil palm growers. Further, its cultivation can be carried out on degraded land and jhum plots to minimize its negative environmental impact.

KEYWORDS

Oil palm plantation, economic valuation, cereal crop, marginal farmer, Mizoram.

1. INTRODUCTION

Oil palm (Elaeis guineensis) is the most economic activity in tropical and subtropical climatic zones of the world. It covers about 15 million ha of land across the world and contributes about 30% of the global production of vegetable oil (FAO 2009). Further, it obtains 60% of international trade in vegetable oils (World Bank 2010). The extracted oil palm has various uses as food, household products, vegetable oil, and biodiesel production. Approximately, 74% of global palm oil is used for food products and 24% is for industrial purposes (USDA 2010). Oil palm cultivation has expanded 43% of its area worldwide (RSPO 2011). The cultivation of oil palm began in 1910, initially in Indonesia, Malaysia, and Africa, and slowly spread to other tropical and subtropical regions. In India, oil palm plantations began in 1977 in Kerala, and later on, they spread to other southern and eastern states of India such as Tamil Nadu, Andhra Pradesh, Karnataka, Orissa, and West Bengal. The National Food Security Mission–Oil Palm (NFSM-OP) is dedicated to oil palm area expansion and productivity enhancement. During 2020-21, NFSM-OP is being implemented in 12 states and Mizoram is one of them (Annual Report 2021; Sati 2023; Sati 2022).

In North East India, Mizoram is recognized as the pioneer of oil palm cultivation. The Oil Palm Act was passed in 2004 by the Mizoram Legislative Assembly. It was implemented as the Public-Private Partnership (PPP) mode involving the State Agriculture Department, partner companies, and the farmers. The cultivation of oil palm was started in 2005 and now, seven districts – Aizawl, Mamit, Kolasib, Serchhip, Saiha, Lunglei, and Lawngtlai produce oil palm in the small holdings, replacing large Jhum plots (Sati 2022; Sati 2020). There are a total of five committees constituted in Mizoram for the cultivation of oil palm. These are the State Level Oil Palm Advisory Committee, Project Management Committee, Price Fixation Committee on Oil Palm Fresh Fruit Bunches (FFBs), District Level Oil Palm Zonal Committee, and the Village Level Oil Palm Growers Association. Three partner companies – Godrej Agrovet Pvt. Ltd, 3F Oil Palm Agrotech Pvt. Ltd., and Ruchi Soya Industries are involved in the development of oil palm cultivation in Mizoram. Their main functions are to develop oil palm nurseries, to produce quality planting materials, to provide extensive support to the growers, and to assist the farmers in availing loans. The companies buy FFBs from the farmers and process them to produce crude oil palm in the processing mills.

Oil palm development schemes are also implemented in Mizoram with the help of the Central Government. These schemes are ISOPOM, OPAE (RKVY), NMOOP (MM-II), and NFSM-OIL PALM. These have different periods of implementation and duration and possess a total of 26,679 ha of land under oil palm cultivation. So far, these companies have attained 13,680 lakh output. The Indian Council of Agricultural Research (ICAR) established an Oil Palm Seed Garden in Serzawl, Mamit District in 2013 with an area of 60 ha and two units are functioning. The state of Mizoram obtains tropical and sub-tropical climates and provides ideal conditions for growing oil palms (Sati 2017). The average temperature of 22.5° C, annual average rainfall of 2,400 mm, and substantial sunshine support the cultivation of oil palm.

The areas below 900 m altitude in all districts are the most suitable. In the meantime, smallholders, who are growing oil palm, are facing problems because of inadequate market facilities. The other adverse impacts of oil palm cultivation were also observed. It requires large labours, therefore,

Quick Response Code	Access this article online	
	Website: www.trab.org.my	**DOI:** 10.26480/trab.02.2023.62.67

Cite the Article: Vishwambhar Prasad Sati (2023). Economic Viability and Prospects of Oil Palm Cultivation in Mizoram, India. *Tropical Agrobiodiversity, 4(2): 62-67.*

population pressure is high on the oil palm growing areas. Further, oil palm needs more land and water. Due to high water pollution, the surrounding aquatic life is affected largely (Koczberski et al., 2001; Koczberski, 2007; Fitzerbert et al., 2008 a, Koh and Wilcove 2008). The environmental problem can be reduced by the expansion of oil palm cultivation areas in the anthropogenic-induced degraded areas and on the abandoned jhum plots (Sati 2020; Sati 2019).

The scholars have conducted studies on both economic and environmental aspects of oil palm cultivation mainly in the tropical and sub-tropical areas, however, no such study has been carried out in Mizoram. This study analyses the economic viability of oil palm cultivation. It examines the potential of oil palm cultivation in sustainable rural development. It studies the major problems, that oil palm growers face and suggests how can the economic viability of oil palm plantations be enhanced.

2. METHODOLOGY

2.1 Study Area

Mizoram state lies in northeast India, a landlocked and hilly state. It possesses 21,087 km^2 areas, shares 0.64% of the country's geographical area, and stretches between 21^o 58' - 24^o 35' N latitudes and 92^o 15' - 93 ^{o} 29' E longitudes (Sati, 2022). It is a remotely located and economically underdeveloped state. The landscape is fragile and prone to landslide hazards. The average altitude of Mizoram ranges from 500 m to 1000 m, which is quite suitable for the cultivation of oil palm. At present Mizoram has 11 districts (Figure 1). The state has a primitive economy, mainly based on the cultivation of cereals, fruits, and vegetables with low output (Sati, 2017). Agriculture is the main occupation and the major source of livelihood for more than 70% of the rural population. However, a large population is living below the poverty line. Under such a situation, oil palm cultivation may be a promising sector for rural livelihood security, if adequate infrastructural facilities are provided.

2.2 Data Collection and Survey Method

This study is based on the data gathered from secondary sources mainly from the State Agriculture Department. The data were collected on the potential area of oil palm plantation, the status of oil palm cultivation, the area under oil palm plantation in 2011 and 2021, and change in the area, and farmers with the highest oil palm FFBs harvest and change in FFBs harvest. The gathered data were analyzed and described to know whether the cultivation of oil palm is economically viable or not. Both qualitative and quantitative methods were used. Data were also gathered from primary sources using interviews with the heads of household in August 2020. A total of 173 heads of eight villages of Mamit and Kolasib were interviewed. The questions were mainly related to the income earned from both cereals and oil palm cultivation. The income from both occupations was compared and the benefit from the oil palm cultivation was analyzed. The area under oil palm and its production was gathered from these villages and productivity was calculated.

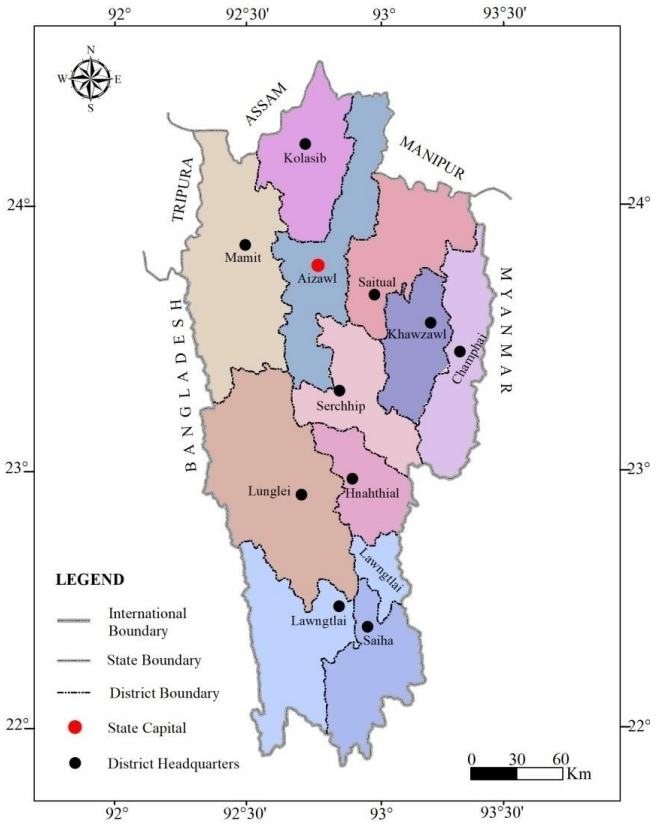


Figure 1: Location map of Mizoram

3. RESULT

3.1 The Potential of Oil Palm Cultivation

Mizoram has a high potential for cultivating oil palm plantations. As assessed by the agricultural department, approximately 66,791 ha of the area is suitable for oil palm cultivation, which represents 3.17% of the total geographical area (Table 1). The potential area is sufficient for future sustainable oil palm cultivation. Out of the total seven districts, three districts – Kolasib, Serchhip, and Mamit have a comparatively high potential area for oil palm cultivation. The tropical and subtropical climate further adds suitability for oil palm cultivation.

Table 1: Oil Palm Potential Area

S. No	District	Geographical Area (ha)	Oil Palm Potential area as assessed in 2021 (ha)	% of Geographical area
1	Aizawl	3,57,631	11,150	3.11
2	Serchhip	1,42,160	9,000	6.33
3	Saiha	1,39,990	2,000	1.43
4	Kolasib	1,38,251	14,141	10.23
5	Mamit	3,02,575	13,500	4.46
6	Lunglei	4,53,800	10,000	2.20
7	Lawngtlai	2,55,710	7,000	2.74
Total		**21,08,700**	**66,791**	**3.17**

Source: Oil palm cultivation in Mizoram, https://agriculturemizoram.nic.in/pages/oilpalm.html, 2021

Figure 2 shows the oil palm potential area in the districts of Mizoram. Three districts Kolasib, Serchhip, and Mamit have the highest potential for growing oil palm, which is more than the arable area under cereal crops. Other districts have also the potential to cultivate oil palm.

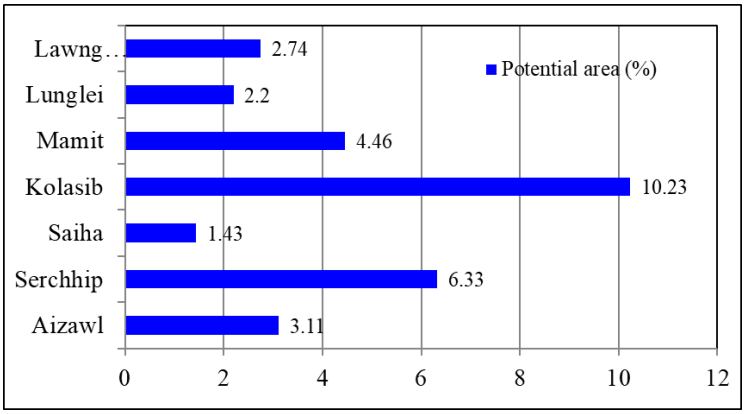


Figure 2: District-wise oil palm potential area (%)

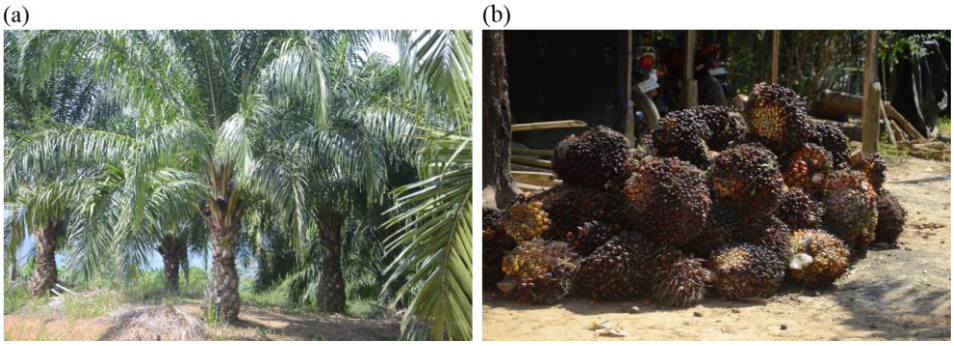


Figure 3: Oil palm plantation and FFBs, photos by Author

In Mizoram, the cultivation of oil palm is only 17 years old. However, its area and production increased substantially. Figure 3 shows oil palm plantations and FFBs.

3.2 Status of Oil Palm Cultivation

Two years of data (2013 and 2021) of six variables were analyzed to understand the status of oil palm cultivation and changes (Table 2). There was an enormous increase in the area covered under oil palm and FFBs sold. Both are important to understand the future potential of oil palm cultivation. A small increase was noticed in the potential area for oil palm and farmers involved in oil palm cultivation. However, 28 villages (12.4%) have stopped practicing oil palm cultivation. The reason farmers leave oil palm cultivation is the inadequate market and low price.

Table 2: Status of Oil Palm Cultivation

S. No.	Variables	Number		Change (%)
		2013	2021	
1.	A potential area for Oil Palm (ha)	61,000	66,791	+9.4
2.	Area covered under Oil Palm (ha)	17,588	26,680	+51.7
3.	Farmers involved in Oil Palm (Numbers)	10800	10,843	+0.4
4.	No. of Districts covered	7	7	+0
5.	No. of Villages covered	225	197	-12.4
6.	FFBs sold (MT)	141	37,273	+26,335

Source: Oil palm cultivation in Mizoram, https://agriculturemizoram.nic.in/pages/oilpalm.html, 2021

The area covered under oil palm increased by more than 50% (Figure 4). Similarly, the potential area for oil palm increased by approximately 10%. A small increase in the number of farmers involved in practicing oil palm cultivation increased. Meanwhile, the number of villages, that are involved in practicing oil palm plantation decreased largely, which is a serious concern for the prospects of oil palm cultivation. The reason was noticed inadequate market facility and low selling price of FFBs.

3.3 Change in the Area under Oil Palm Plantation

The data on changes in the area of oil palm plantations, between 2011 and 2021 were gathered and a percent change was noticed (Table 3). During a decade, the 24,714 ha area increased from 1,966 ha in 2011 and 26,680 ha in 2021. Four districts, Kolasib, Lunglei, Mamit, and Lawngtlai have the highest area under oil palm plantations and all have obtained substantial increases during the period.

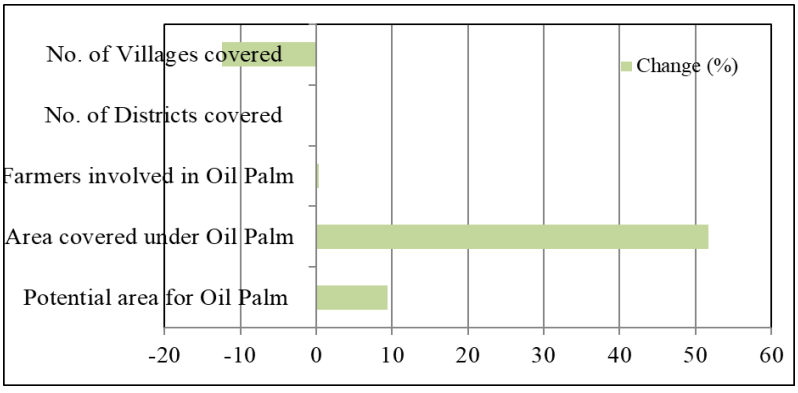


Figure 4: Status of oil palm cultivation in Mizoram (2013-2021)

Table 3: Change in the Area from 2011 to 2021

S. No.	District	Area (ha)		Change (ha)	Change (%)
		2011	2021		
1.	Kolasib	478	6965	+6487	+1357
2.	Mamit	350	5780	+5430	+1551
3.	Aizawl	26	859	+833	+3204
4.	Serchhip	250	2130	+1880	+752
5.	Saiha	-	86	+86	+100
6.	Lunglei	562	6396	+5834	+1038
7.	Lawngtlai	300	4464	+4164	+1388
Total		1966	26680	+24714	+1257

Source: Oil palm cultivation in Mizoram, https://agriculturemizoram.nic.in/pages/oilpalm.html, 2021

Table 4: Farmers with the Highest Oil Palm FFBs Harvest

Name	District	Village	Production (MT)			Income (Lakh Rs.)		
			2013	2021	Change (%)	2013	2021	Change (%)
Ramtinchawma	Mamit	Nalzawl	185.8	273.94	+47.4	8.8	15.1	+71.6
Lalthanzauva	Mamit	Khamrang	99.6	106.57	+7	4.7	5.9	+25.5
Zomuansanga	Kolasib	Khamrang	49.1	163.72	+233	3.3	9	+172

Source: Oil palm cultivation in Mizoram, https://agriculturemizoram.nic.in/pages/oilpalm.html, 2021

3.4 Farmers with Oil Palm FFBs Harvest

Three farmers of Mizoram, who obtained the highest oil palm FFBs harvest in 2013 and 2021, are shown in Table 4. The data show that the production and income from oil palm plantations increased from 2013 to 2021. Further, the increase is very high. It further reveals that the Mamit and Kolasib districts are ideal for oil palm plantations.

4. Case Study

4.1 The Area, Production, and Productivity of Oil Palm Plantation

Table 5 shows the village-wise area (ha), production (kg), and productivity (kg/ha) of oil palm plantations in 2020. The area of oil palm in the villages is substantial, ranging from 9 ha, the lowest, and 37 ha, the highest. The total area was 190 ha. In terms of production, it was 176,747 kg with the highest of 66,000 kg and the lowest of 383 ha. The average productivity was 930 kg/ha with the highest 1834 kg/ha and the lowest 13 kg/ha productivity. Data depicts that three villages have a high potential for the cultivation of oil palm plantations and three villages have moderate potential.

4.2 Comparison of Income from Cereal Crops and Oil Palm Cultivation

Data on the income earned from the cultivation of cereal crops and oil palm was gathered and compared (Table 6). The total income earned from cereals was 8.6 million INR whereas the income earned from oil palm cultivation was 11.6 million INR. It was about 34.9% more income from the cultivation of oil palm than from cereals. Out of the total villages, two villages obtained the highest income from the oil palm plantation and the other three villages received moderate income. It shows that the potential for cultivation of oil palm in Mizoram is high.

Table 5: Area, Production, and Productivity of Oil Palm Plantation

Village	Area (ha)	Production (kg)	Productivity (kg/ha)
Buhchangphai	24	44390	1834
Bukvannei	16	3361	212
Dapchhuah	37	66000	1803
Khamrang	29	383	13
Mualkhang	9	9500	1032
Nalzawl	34	41013	1206
Rawpuichhip	28	6100	216
Rulpuihlim	12	6000	483
Total	190	176747	930

Source: Field survey, 2020

Table 6: Comparison of Income Earned from Cereals and Oil Palm Cultivation (Million INR)

Village	Cereals	Oil palm cultivation	Change (%)
Buhchangphai	1.8	2.1	+16.7
Bukvannei	1.2	1.5	+25
Dapchhuah	0.3	0.4	+33
Khamrang	1.5	2.9	+93
Mualkhang	0.8	0.8	0
Nalzawl	1.1	1.9	+72.7
Rawpuichhip	0.6	0.6	0
Rulpuihlim	1.3	1.4	+7.7
Total	8.6	11.6	+34.9

Source: Field survey, 2020

4.3 People's Perception

People's perception of the cultivation of oil palm was mixed. A majority of farmers had the perception that the economic viability of oil palm cultivation is substantial and its role in livelihood sustainability is significant. However, the market facility is inadequate and therefore, the oil palm growers are not getting sufficient output. They further perceived that the water and soil quality due to oil palm cultivation is deteriorating because of the excessive use of chemicals. Oil palm cultivation needs financial resources initially for clearing the land, construction of water tanks, and pipelines for water supply. It is followed by insecticide, fertilizer, and subsidies in bank loans. Farmers were satisfied with the State Government's financial assistance and many of them wanted to continue oil palm cultivation.

5. Discussion and Conclusions

Mizoram has a primitive economy. Practicing agriculture is the main occupation and the major source of income. Meanwhile, the output from the farmland is not sufficient to feed the growing population (Sati 2019). The main reason is shifting cultivation, which is economically unviable and environmentally unsound. Further, the landscape is fragile and the soil erosion is enormous therefore shifting cultivation is not suitable (Sati 2018). Further, lagging infrastructural facilities, mainly transportation, and market, are the hindrances for the cultivation of oil palm. The price of FFBs is low because only three companies are involved in buying FFBs and they have a monopoly in fixing prices. On the other hand, Mizoram obtains suitable climatic conditions (Sati 2015). The land is suitable for growing fruits, vegetables, and plantation crops mainly oil palm cultivation.

Further, it has tropical and sub-tropical climates, which are suitable for growing oil palm. The case study of eight villages also depicts that the income from oil palm cultivation is higher than the income from cultivating cereals. Data related to the potential area, the current area, production, and income of oil palm cultivation, is substantial. The people's perception of oil palm cultivation is also supportive.

The environmental concern of oil palm plantations is enormous. The conversion of forests into oil plan cultivation adversely affects water and soil quality (Fitzherbert et al., 2008 b). It contains less biomass and decreases biodiversity (Germer and Sauerborn, 2008; Robertson and Schaik, 2001). It is therefore suggested that the environmental sustainability issues are required to be addressed before starting an oil palm plantation (Macdonald et al., 2004; 2009; Gosavi et al., 2004). Oil palm plantations should occur on the existing croplands, grasslands, anthropogenic degraded land, and abandoned jhumlands rather than primary or secondary forests for biodiversity conservation (Koh and Wilcove, 2008).

The present study reveals that the prospect of oil palm plantations in the Mizoram state is high. The jhumlands, which have low output, can be utilized for the cultivation of oil palm (Sati 2015; 2015). Oil palm cultivation needs plenty of water for its growth. Most of the rainwater drains directly through the river channels. Further, due to the hilly terrain, the rainwater does not pour into the ground and therefore water crises are acute mainly during the four months of winter, the dry season. Rainwater harvesting will be a boon for oil palm cultivation. Harnessing suitable climatic conditions for oil palm production will manifest in economic development. The cultivation of oil palm is suitable for controlling soil erosion. The arable land under shifting cultivation can be transferred to the cultivation of oil palm. The State Government should take the appropriate initiative to promote oil palm cultivation. Adequate market facilities for selling FFBs at a profitable price are essential to motivate farmers for oil palm cultivation. Factories for making oil palm products, mainly edible oil, can be set up according to the production in every district. The contract can be given to the other interested companies to maintain the FFBs price. This will generate income for the oil palm growing farmers and will augment employment for educated youth. The cultivation of oil palm initially needs investment and once it is established, it can be managed sustainably. Further, it can enhance the livelihood sustainability of rural people.

REFERENCES

Annual Report, 2021. Department of Agriculture and Farmers Welfare, Ministry of Agriculture, Government of India, New Delhi. Pp. 71.

FAO. 2009. Global Forest Resources Assessment, Progress towards sustainable forest management.

Fitzherbert, E.B., Struebig, M.J., Morel, A., Danielsen, F., Brühl, C.A., Donald, P.F., and Phalan, B., 2008 a&b. How will oil palm expansion affect biodiversity? Trends in Ecology and Evolution, 23 (10), Pp. 538–545.

Germer, J., and Sauerborn, J., 2008. Estimation of the Impact of Oil Palm Plantation Establishment on Green House Balance. Environment, Development and Sustainability, 10, Pp. 697-716. https://doi.org/10.1007/s10668-006-9080-1

Gosavi, M., Patil, K.A., Mittal, S., and Saran, S., 2004. Improvement of properties of black cotton soil subgrade throughsynthetic reinforcement. Institution of Engineers (I) J, 84, Pp. 257- 262.

Koczberski, G., 2007. Loose fruit mamas: creating incentives for smallholder women in oil palm production in Papua New Guinea. World Development, 35 (7), Pp. 1,172–1,185.

Koczberski, G., Curry, G.N., and Gibson, K., 2001. Improving productivity of the smallholder oil palm sector in Papua New Guinea: a socio-economic study of the Hoskins and Popondetta schemes. The Australian National University Department of Human Geography Research School of Asian and Pacific Studies: Canberra.

Koh, L.P., and Wilcove, D.S., 2008. Is oil palm agriculture really destroying tropical biodiversity? Conservation Letters, 1, Pp. 60–64.

Macdonald, M., 2004. Control of cell cycle-dependent degradation of c-Ski proto-oncoprotein by Cdc34. *Oncogene,* 23 (33), Pp. 5643-5653.

Robertson, J., *Schaik,* C.P., *2001.* Dramatic decline in orang-utan numbers in the Leuser Ecosystem, Northern Sumatra, https://doi.org/10.1046/j.1365-3008.2001.00150.x

Sati V.P., 2019. A Socio-Economic Analysis of Livelihood Strategies in Agriculture Dependent Communities of Mizoram, India. In: Saikia A., Thapa P. (eds) Environmental Change in the Himalayan Region. Springer, Cham, Pp. 189-199. DOI https://doi.org/10.1007/978-3-030-03362-0_10, ISBN: 978-3-030-03362-0

Sati, V.P., 2015. Changes in Farming Systems and Livelihood Patterns in Mountainous Region of Mizoram, Eastern Extension of the Himalaya. Indian Journal of Hill Farming, 28 (2), Pp. 111-120. ISSN: 0970-6429 (45700)

Sati, V.P., 2015. Issues and Options of Food Security and Poverty: An Empirical Study of Mizoram, the Eastern Extension of the Himalaya. Journal of Food Security, 3 (4), Pp. 107-114. DOI: 10.12691/jfs-3-4-3; 2372-0115

Sati, V.P., 2017. Prospects of Oil Palm Plantation in Mizoram, India. Journal of Hill Farming, 30 (1), Pp. 139-143.

Sati, V.P., 2019. Economic and Ecological Implications of Shifting Cultivation in Mizoram, India, Springer International Publishers, Switzerland, ISBN 978-3-030-36601-8, P. 160.

Sati, V.P., 2019. Shifting Cultivation in Mizoram, India: An Empirical Study of Its Economic Implications. Journal of Mountain Science, 16 (9), Pp. 2136-2149. https://doi.org/10.1007/s11629-019-5416-9

Sati, V.P., 2020. New Land Use Policy and its Contribution in Sustainable Permanent Agriculture in Mizoram, Indian Journal of Hill Faming, Special Issue, Pp. 113-120.

Sati, V.P., 2020. The Potential of Wet Rice Cultivation in Mizoram, India: A Study of its Self-Sufficiency in Food Grain, Journal of Rice Research,13 (3), Pp. 27-38. ISSN 2319-3670

Sati, V.P., 2022. Assessment of Natural Capital for Sustainable Rural Livelihoods: An Empirical Study of Mizoram, India. Asia-Pacific Journal of Rural Development, SAGE, 32 (1), Pp. 1-19. DOI: 10.1177/10185291221114684; 1018-5291

Sati, V.P., 2022. Mizoram: Land and People. Delhi, Today and Tomorrow, Printers and Publishers.

Sati, V.P., 2022. Reconciling the Issues of Shifting and Permanent Cultivation: An Empirical Study of Mizoram, Eastern Extension of Himalaya, India. Caraka Tani: Journal of Sustainable Agriculture, 37 (1), Pp. 171-184. DOI: http://dx.doi.org/10.20961/carakatani.v37i1.59407, ISSN: 2599 2570

Sati, V.P., 2023. Forest Ecosystem Services and their Valuation in Mizoram, the Eastern Extension of the Himalaya. Eco-feminism and Climate Change, 4 (2), Pp. 44-49. DOI: http://doi.org/10.26480/efcc.02.2023.44.49.

Sati, V.P., and Lalrinpuia, 2015. Altitudinal Zonation of Floral Biodiversity and its Conservation Pattern in Mizoram, Northeast India, In R. B. Singh and P. Prokop (Eds.) Environmental Geography of South Asia, Advances in Geographical and Environmental Sciences, Springer Japan, DOI 10.1007/978-4-431-55741-8_11

Sati, V.P., Vangchhia, L., 2017. Food Security Status in Rural Areas of Mizoram, Northeast India. Journal of Mountain Science, 14 (4), Pp. 795-805. DOI:10.1007/s11629-016-4092-2 (Impact Factor: 1.423); ISSN: 1993-0321

USDA, 2010. Food expenditures by families and individuals as a share of disposable personal income, accessed 8 November 2010 at <http://www.ers.usda.gov/Briefing /CPIFoodAndExpenditures/Data/Expendi tures_tables/table7.htm>.

World Bank, 2010. World databank world development indicators & global development finance database accessed 2010 at <databank.worldbank.org>.