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Are Forest Development Support Policies Can Help to Reduce Poverty for Ethnic Minorities? A Case Study in the Extreme Poor Region of Northwest, Vietnam

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ABSTRACT— Forest production plays crucial role in improving the livelihood of ethnic minorities in Vietnam. This study aims to analyze the correlation between forest development support policies and poverty reduction in ethnic minority households in the extreme poor region. The results of the correlation analysis between the the forest cover and poverty rate in the study site show that the higher the forest cover rate, the lower the poverty rate. Data analysis of 360 households surveyed by Wald test and Binary Logist model and Hierarchical Logist show that if ethnic minority households receive support including contracted and forest care, payment for forest environmental services, support for production forest land increases the probability of households escaping from poverty. These supports have a positive impact on poverty reduction, these are not material supports, they are necessary and their impacts are quite obvious. Support for contracting and taking care of forests, training for agricultural and forestry extension, support for participating in the model tend to increase income a lot. Meanwhile, support for forest plant varieties tends to reduce the income of ethnic minority households. Thus, the research results show that soft support increases household income, in contrast, material supports reduce household income. This shows that the material support is no longer appropriate, local authorities need to change their perception, methods and support solutions in the direction of increasing software support and reducing and eliminating material supports.

KEYWORDS: Poverty reduction, Forest development support, ethnic minorities, Extreme Poor Region, Policy, The poor.

1. INTRODUCTION

Are forests and poverty reduction related or not? Does forest development support policies can help ethnic minority people who are living on/around the forest alleviate the poverty? This questions is posing to many countries around the world including Vietnam. Many studies examining the link between forest development support and poverty reduction have been carried out.

Many studies examining the link between support for forest development and poverty reduction have been carried out. World Bank (2008) have pointed out the importance of forests and natural resources for poverty reduction and livelihood security at both household and community levels. Research also shows that forestry policies support poverty reduction better than other policies supporting livelihoods or poverty reduction alone.

Forests and poor people's livelihoods have a two-way relationship. Forests provide livelihoods for poverty alleviation. Forests and poor people's livelihoods have a two-way relationship. Forests provide livelihoods for poverty alleviation. Many models of afforestation and forest-based livelihoods have helped people in Vietnam escape poverty [23], [21], [14]. In contrast, poverty puts pressure on the exploitation of forest resources, especially natural forests and watershed forests [1]. The relationship between forests and poverty reduction is briefly described in three dimensions [22] as follows: (i) There are important causal relationships between rural livelihood change and drastic changes in forest cover by these two factors occurring in the same geographical location and at the same time; (ii) The lives of the poor in remote rural areas are heavily dependent on the source of environmental goods and services from natural forests; (iii) Although still dependent on forests, some rural people still benefit greatly from forest loss through converting forest land into agricultural land, harvesting and selling timber and other forest products take money as capital.

Forests are divided into three main categories, special-use forests, protection forests and production forests, with clearly defined forest owners and managers of each type. Accordingly, forestry activities and people's livelihoods also depend on the relationship with each of those forest types [13]. The main objective of poverty reduction through forestry is to create jobs from forest protection, afforestation, forest capital development, livelihood improvement, and diversification of income from forests and forestry. FAO (2003) identifies six methods of using forest resources that have the potential to aid poverty reduction which are: (i) Conversion of forests to agricultural production; (ii) Wood; (iii) Non-timber forest products (NTFPs); (iv) Environmental services; (v) Employment; (vi) Indirect benefits. [22] describes the relationship between forests and poverty reduction through the tetrahedral model of human life and forest cover: “Win – Win” means poverty reduction and environmental protection go hand in hand. “Win and lose” means that success in poverty reduction causes forest and biodiversity loss. “Loss – gain” means that people's livelihood security is no longer available because they are not allowed to live near the forest. “Loss – loss” means that both local people and the environment suffer. Thus, forests and poverty reduction in mountainous areas have a compatible relationship and always go hand in hand to achieve sustainability.

According to the most recent statistics, the total forested area in Vietnam is 14.74 million hectares with a forest coverage of 42.02%. According to the purpose of use, the forest is classified into natural forest with an area of 10.17 ha, accounting for 69%, and production forest of 4.57 ha, accounting for 31% [12].

Areas with high poverty rates are more likely to experience extreme poverty, and people's living standards are much lower than the poverty line. It is noteworthy that areas with high poverty rates are concentrated in mountainous, remote and isolated areas, where there is still natural forest with high coverage. Poverty of the population living near the forest is considered one of the important causes of deforestation. The poverty reduction efforts of the Government and organizations implemented in these regions are geared towards improving sustainable forest-based livelihoods.

The Northwest is the region with the highest poverty rate in the country. The Northwest is also a region with a high concentration of natural forests across the country. The current poverty rate of the Northwest region is more than three times higher than the national average poverty rate. The Northwest is considered the "Extreme Poor Region" of the country. The rate of poor households in the Northwest is the highest in the country according to the multidimensional poverty line for the period 2016-2020 with 31.24% (Ministry of Labour, Invalids and Social Affairs, 2017). The assessment results of the World Bank on poverty in Vietnam also show that the Northwest region has the highest poverty rate in the country, in which, mainly ethnic minorities.

In 2017, the National Assembly passed the Vietnam Forestry Law, the Government issued many policies and

programs related to the protection and sustainable development of forests, reducing greenhouse gas (GHG) emissions due to deforestation and forest degradation, sustainable management of forest resources, protection of the environment and natural resources, mitigation and adaptation to climate change. In recent years, the Vietnamese government has implemented many poverty reduction policies. Significant achievements in poverty reduction have been made and recognized internationally. The proportion of poor households (in terms of monetary expenditure) has decreased sharply from 57% in 1990 to 13.5% in 2014 (Ministry of Labor, Invalids and Social Affairs and UNDP, 2018). The poverty rate in 2020 is more than halved compared to 2016, from 9.9% in 2016 to 4.8% in 2020. The proportion of poor households according to the multidimensional poverty line decreased from 9.9% in 2016 to 4.8% in 2020 [4]. However, the poor tends to cluster into poor core zone in mountainous and ethnic minority areas. By region, the Northwest remains the "poor core" of the country, the poorest of the three regions, the Northwest, the Central Highlands and the South West. In terms of ethnic composition, ethnic minority areas are the poverty pockets of the whole country [3], [6]. The poverty reduction rate of ethnic minority households is lower than the overall poverty reduction average. Sustainable poverty reduction in mountainous and ethnic minority areas remains a challenge in the coming years. Therefore, it is nessecary to find out breakthrough solutions and policies to eliminate poverty cores across the country [10].

[11] on "Research on implementation of policies to support agricultural development in poverty reduction programs in the northwest" have shown that, from 2012 to 2020, there are many poverty reduction programs has been implemented in the Northwest region with 48 policy documents at central level and many documents at ministerial and local level, of which the most focus on agricultural support items. The research also shows that there is a close relationship between the poverty rate and the proportion of the population being ethnic minorities. The poverty rate increases to 0.584 if the proportion of the population that is ethnic minorities increases with statistically significant at 97% [2], [11]. Currently, the main livelihoods of ethnic minorities in Vietnam are agriculture and forestry production, of which 16 ethnic minorities have a high rate of workers in agriculture, forestry and fisheries with over 90%. Data analysis shows that there is a certain coincidence between the ethnic groups with a high percentage of poor households and those with a high rate of labor in agriculture, forestry and fisheries [11], [6]. This shows that the extreme poor regions are shrinking among ethnic minorities due to limited production conditions and slow ability to adapt to poverty reduction policies. In addition, the author's doctoral research results have shown that the rate of poverty reduction tends to slow down significantly in the ethnic minority group due to the effects of the decline of indigenous livelihoods sources such as depletion of resources, fragmented production, and weak competitiveness in the process of participating in the market economy. Therefore, in policy making, ethnic minorities should be identified as the top priority group in determining beneficiaries of poverty reduction programs. [11] has made an important contribution to finding the correlation between agricultural development support and poverty reduction, and between the proportion of ethnic minorities and the poverty rate. This study continues to analyze more in depth, finding specific practical evidence for the relationship between enhanced forest-based livelihoods and poverty reduction. The published research results are a useful communication product for the poor themselves, governments at all levels and policy-makers in Vietnam.

From 1991 up to now (especially after the Law on Forest Protection and Development was enacted in 2004), forest protection activities and forest law enforcement have changed positively. Forest areas are increasingly restored. The Northwest region becomes the area with higher forest coverage density than the national average. The increased forest area due to zoning, natural regeneration and afforestation over the years is always higher than the reduced forest area due to legal and illegal reasons. This result is a great effort in the management, protection and development of forests by local goverments, while forest cover in some other provinces of the country is declining. If the forest cover rate is higher, the poverty rate decreases at the

correlation coefficient of –0.56 and statistically significant at 96% [2], [11]. The provinces in the Northwest Region all have large areas of forest and people's livelihoods are closely linked to the benefits from the forest. Therefore, good implementation of the policy on forest protection and proper exploitation of forest resources will contribute to improving poverty. For sustainable poverty reduction, it is necessary to combine poverty reduction policy with livelihoods based on forest management and protection in the localities.

Dien Bien is the province with the highest poverty rate in Vietnam. In 2020, the poverty rate is 29.97%. Poor ethnic minority households account for 37.97% of the ethnic minority households and account for 98.91% the total number of poor households. Muong Cha is a border district in Dien Bien province. The district is one of the 85 poorest districts in the country (according to Decision 275/QD-TTg dated March 7, 2018 of the Prime Minister), with 11/11 communes in category 135 (extremely difficult communes) and the place where more than 90% of ethnic minorities live, of which the rate of poor households accounts for 48.95% [4]. This study finds solutions to reduce poverty based on forests in Muong Cha district have important implications not only for the locality but also as an important reference solution in poverty reduction for the region and the country.

This study aims to analyze and find the correlation between forest development support and poverty reduction in ethnic minority households in poor Muong Cha district, Dien Bien province.

2. MATERIAL AND METHOD

2.1 Data collection

Muong Cha is a mountainous district, the border is located in the north of Dien Bien province, natural area is 118,989.50 ha, bordering with Muong May district, Phong Sa Ly province, People's Democratic Republic Laos with 24.3 km long. The district has 11 communes and 01 town (of which 3 are border communes). The district's population is 48,183 people, of which: Mong ethnic group accounts for 68.73%; Thai ethnic group accounted for 15.28%; Kinh ethnic group accounted for 5.51%; Khang ethnic group accounted for 2.32%; Kho Mu ethnic group accounted for 6.72%; Hoa ethnic (Xa Phang) accounted for 1.23%; The rest are other ethnic groups. The study selected research sites in two communes, Muong Tung and Nam Ne, two locations with diverse types of forest-based livelihoods. In the two selected communes, the study investigated 360 poor and near-poor households whose livelihoods depend on the forest. Data were processed using SPSS and STATA software.

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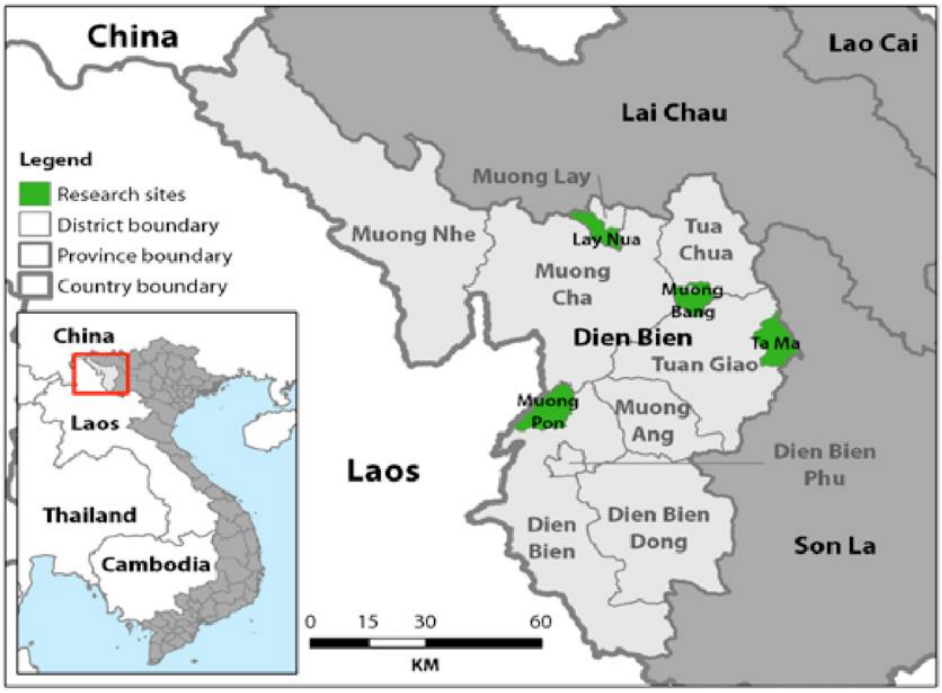

Fig. 1. Study site

2.2 Analysis method

2.2.1 Binary logistic regression model

The study uses the proposed binary logit regression model. by Greene, W. H. (2003) to examine how policies and solutions to support forestry and forest-based livelihoods affect the ability of households to escape poverty in Muong Cha district. The purpose of the model is to determine how forestry supports and forest-based livelihoods affect households' escape from poverty. The research model is set up as follows: **Prob(Y=1|X) =** $\frac{e^z}{1-e^z}$

Of which: Y is the dependent variable in binary form (receiving the value 0 if the household is still poor in 2022 and the value 1 if the household has escaped poverty). X are the respective independent variables in Table 3.1, both are binary variables that take the value of 0 if the household does not receive support and take the value of 1 if the household receives the support with the expectation that both will have a positive effect to escape poverty of households.

Table 1. Independent variables and expectations affect the independent variable on the dependent variable

Variables	No support received	Get support	Expectation
Contract and take care of the forest	0	1	+
Payment for forest environmental services	0	1	+
Support production forest land	0	1	+
Support forest tree varieties	0	1	+
Support training for agricultural and forestry extension	0	1	+
Support to participate in forest-based poverty reduction model	0	1	+
Credit support	0	1	+
Support product consumption	0	1	+

Rice subsidize			

(+ positive influence, in the same direction; - negative influence, in the opposite direction)

To have a deeper understanding the correlation between forest-based poverty reduction support solutions and the change in household income in 2022 compared to 2010, from which recommendations are made comprehensive for poverty reduction in the study area, the ordered logit model has been conducted follows the idea of McKelvey & Zavoina (1975)[1] and Long & Freese (2014)[2]. We divided the change in household income into four categories, which are little decrease, no decrease, little increase, and much increase. These groups therefore follow an order from *little decrease* is the lowest to *much increase* is the highest. Four changing levels are tabulated as follow: 1 if there is a little decreasing in household's income (*little decrease*); 2 if household's income does not change (*no decrease*); 3 if household's income slightly increased (*little increase*); and 4 if the changing is slightly large (*much increase*). The probability of each outcome can be estimated by the following equation (Kramer, 1997[3]; Long & Freese, 2014; Yung Esther et al.[4], 2017):

$$p_{ij} = \Pr(y_j = i) = \Pr(k_{i-1} < x_j\beta + u_j < k_{i+1}) = \frac{1}{1 - \exp(-k_i + x_j\beta)} - \frac{1}{1 + \exp(-k_{i-1} + x_j\beta)}$$

Which p_{ij} is the probability of household j receiving the degree of change in income at category i (i = 1, 2, 3 or 4); x_j is the set of explanatory variables discussed above; k_0 and k_k are $-\infty$ and $+\infty$ respectively, represent the number of possibly level.

3. RESULTS AND DISCUSSIONS

3.1 Access to support policies of ethnic minority households in Muong Cha district

According to types of solutions and supports, the number of people corresponding to the number of support they receive (out of a total of 8 kind of support) is shown in figure 4.1. There is one household that does not receive any support, 21 households only receive 2 types of support. Three households received 8 types of support. Most of the households receive from 3 to 5 types of support, including contract and support for afforestation, payment for forest environmental services, rice subsidy, credit, forestry extension training.

Unit: Households

[1] McKelvey, R.D., and W. Zavoina. 1975 .A statistical model for the analysis of ordinal level dependent variables. Journal of Mathematical Sociology4:103–120

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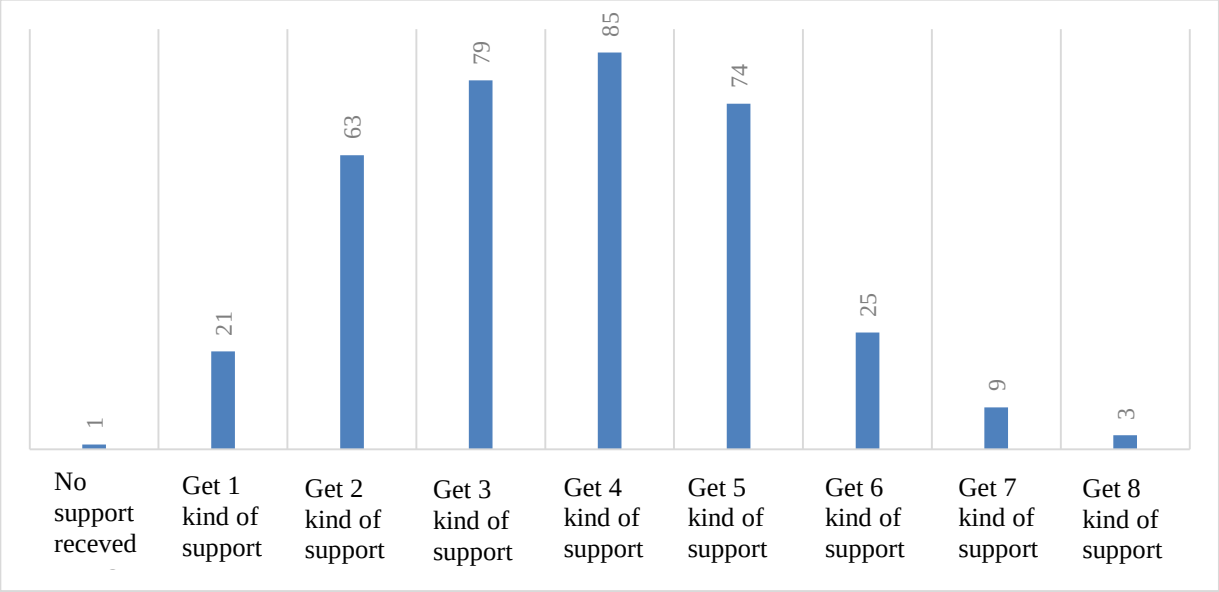

Figure 1: Access to forest-based poverty alleviation support solutions for ethnic minority households
Source: Household survey, 2022

According to the overview of policies and solutions to support poverty reduction and forest-based livelihoods for ethnic minority households, there is an item to support forest product processing for households. However, this content is not implemented locally and households do not receive support for this activity. Households receive the most support in the following groups of solutions: contracting and taking care of forests, training for agricultural and forestry extension, rice support, and credit. The support groups received at an average level include: Payment for forest environmental services, forest land, tree varieties. The groups receiving support with a small number of households include: fertilizer, participating in the forest-based poverty reduction model.

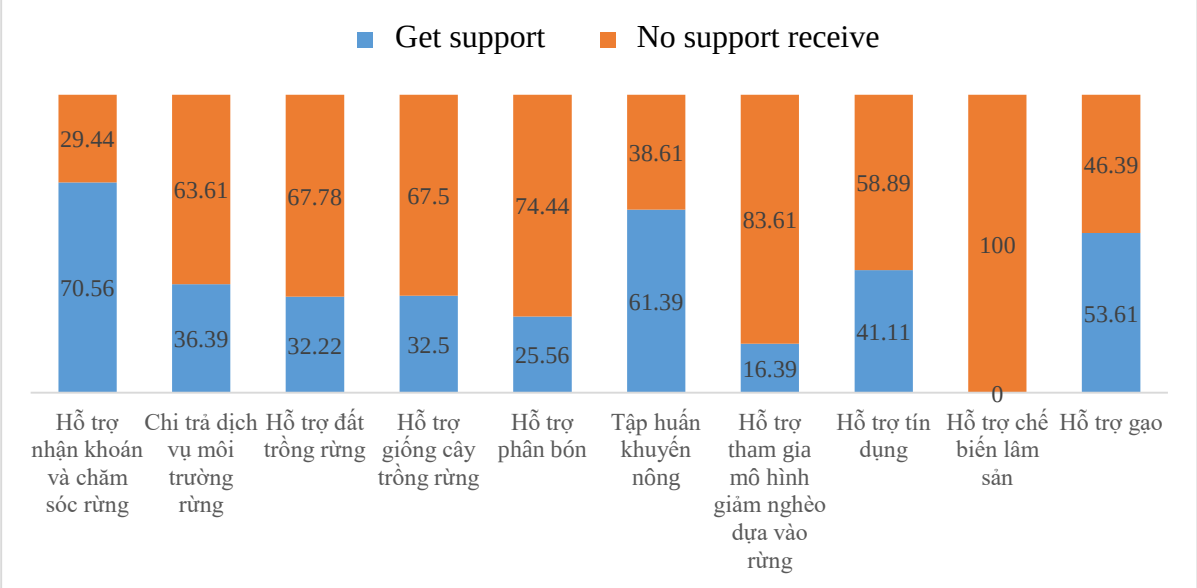

Figure 2: Percentage of ethnic minority households receiving support by types of policies
Source: Household survey, 2022

3.2 The relationship between forests and poverty reduction for ethnic minority households

Forest is one of the strengths of the Northwest region in general and Muong Cha district, Dien Bien province in particular. Thanks to solutions to support poverty reduction and forest-based livelihoods, the forest land area of Muong Cha district in 2019 reached 101,473.05 hectares, of which the area of special-use forest land was 14,171.52 hectares and protection forest 34,867.53 hectares, production forest 52,434 hectares (People's Committee of Dien Bien province, 2019). Forest area is increasing, accordingly, the percentage of forest cover increases. Meanwhile, the poverty rate of Muong Cha district is decreasing.

Table 2: Some indicators on ethnic minority households, forest cover and poverty rate by communes in Muong Cha district in 2020

No.	Indicators	Population density	Percentage of ethnic minorities (%)	Forest cover (%)	The rate of poor households
	Whole district	**29.7**	**94.5**	**41.0**	**48.95**
1	Muong Tung	18	**99**	**55.24**	48.81
2	Huoi Leng	19	**99**	**53.89**	54.17
3	Nam Nen	703	98	39.94	49.34
4	Pa Ham	69	98	33.25	46.56
5	Sa Long	28	99	40.66	55.45
6	Na Sang	32	97	26.85	51.49
7	Ma Thi Ho	22	98	26.7	53.85
8	Muong Muon	23	99	41.64	45.51
9	Muong Cha town	318	49	48.5	8.70
10	Sa Tong	32	99	29.26	62.40
11	Hua Ngai	15	99	49.1	56.20
12	Huoi Mi	18	100	43.42	68.44

Source: Muong Cha District People's Committee, 2021

According to communes and towns in Muong Cha district, Huoi Mi commune is a commune with 100% of the population being ethnic minorities, the remaining communes except Muong Tra town have the percentage of ethnic minorities from 97% to 99%. For the whole district, Muong Cha has 94.5% ethnic minorities. Thus, the percentage of ethnic minorities in Muong Cha district is almost absolute. However, the structure of ethnic minority groups is different among communes. The poverty rate is also highest in the communes with the highest percentage of ethnic minorities. In Huoi Mi commune, there are 68.44% poor households, while the overall poverty rate of the whole district is 48.95%.

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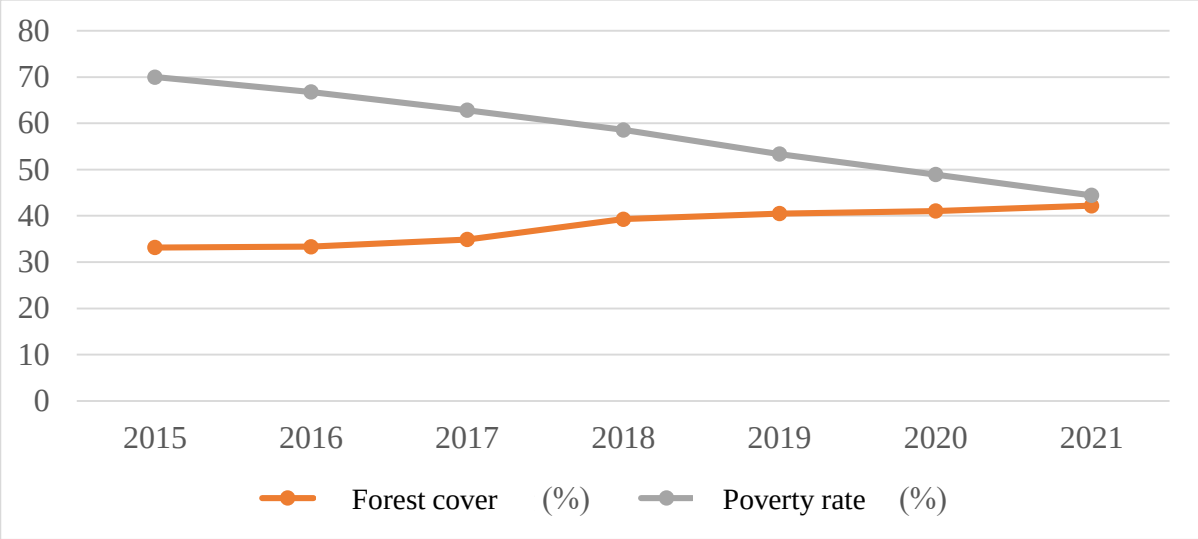

Figure 3: Forest cover and poverty rate in Muong Cha district (2015-2021)
Source: Author's compilation according to reports of Muong Cha District People's Committee, 2015-2022

In the period 2015-2021, the forest cover rate of Muong Cha district increased and the poverty rate decreased significantly. The results of the correlation analysis between the population density, the percentage of the population that are ethnic minorities and the forest cover show that the percentage of the population being ethnic minorities and the percentage of poor households are correlated.

Table 3: Relationship between poverty rate, population density, forest cover rate and percentage of ethnic minority households

Indicators	Pearson Correlation Coefficients		Statistical significance (%)
	Factors affecting	The rate of poor households	
Population density (person/ km^2)	1.0	-0.39	0.209
Percentage of ethnic minority (%)	1.0	+0.91	0.000
Forest cover rate (%)	1.0	-0.9620	0.0001

Source: Analysis from data of the Department of Agriculture of Muong Cha district (2022)

The analysis results show that there is a close relationship between the rate of poor households and the percentage of the population that are ethnic minorities. The poverty rate increases to 0.91% if the percentage of ethnic minority population increases and is statistically significant at 99%. This shows that the "poor pocket" and "poor core" are shrinking among ethnic minorities due to limited production conditions and slow adaptability to poverty reduction policies. In addition, the survey results in Muong Cha have shown that the poverty reduction rate tends to slow down markedly in the ethnic minority group due to the impact of the decline of indigenous livelihoods such as depletion of natural resources and production fragmented, small-scale production, and weak competitiveness in the process of participating in the market economy. Therefore, in policy making, ethnic minority groups need to be identified as the top priority group in determining beneficiaries of support solutions.

The results of the correlation analysis also show that, the higher the forest cover rate, the lower the poverty rate will be at the correlation coefficient of -0.962 and statistically significant at 99%. Therefore, for sustainable poverty reduction, it is necessary to combine poverty reduction policies with local forest protection and management policies. Well-implemented forest protection policies and rational exploitation of forest

resources will contribute to improving poverty.

In terms of average income of surveyed households in 2020, the Thai ethnic group has the highest income with 72.28 million VND. The lowest Mong ethnic group is 39.48 million VND. However, income levels are uneven. There is a huge gap between the highest and lowest income households. The lowest income in Hmong households is 7 million VND. Meanwhile, the income of the highest household reached 192 million VND.

Table 4: Average income of ethnic minority households in 2020

Unit: Million dong

Indicators	Average income	Highest income	Lowest income
Thai	72,28	120	19
HMong	39,48	192	7
Kho Mu	76,54	100	50
Khang	50,00	50	50
Whole groups	65,37	192	7

Source: Household survey, 2022

Comparing the change in household income in 2020 compared to 2010 shows that 88.1% of surveyed households believe that their income has increased, in which, Thai households have the highest income, followed by Kho Mu household. There is 9.2% of surveyed households said that their income was reduced compared to 2010 and fell into Hmong households. Thus, it can be seen that the Hmong ethnic group has the lowest income among the ethnic minority groups and the income tends to decrease.

Table 5: Evaluation on the change in income of ethnic minority households in 2022 compared to 2010

Unit: %

Indicators	Thai	HMong	Kho Mu	Khang	Whole groups
Reduce	0.0	37.9	0.0	0.0	9.2
Unchanged	2.1	6.9	0.9	0.0	2.8
Little increase	53.5	49.4	64.0	100	58.1
Much increase	44.4	5.7	35.1	0.0	30.0

Source: Household survey, 2022

In order to determine the correlation between the poverty exiting status of ethnic minority households and the forest-based support solutions, the study analyzes the dependent variable which is the situation of escaping poverty and not escaping poverty. The independent variables are forestry support activities, forest-based livelihoods including: contracted and forest care, payment for forest environmental services, support for production forest land, support for tree varieties, fertilizer support, agricultural and forestry extension support, model participation support, credit support and rice support.

The analyzed data covers 360 households in 2 communes of Muong Cha district. The study uses Wald test to check whether the independent variables have an effect on the dependent variable or in other words, the variables are significantly correlated with the dependent variable being poor or escaping poverty. The results of the analysis of the logitics model from the survey data of ethnic minority households in Muong Cha district are shown in the following table:

Table 6. Logistic model empirically estimates the correlation between the contents of supporting forestry development, forest livelihoods and the ability of ethnic minority households to escape poverty

Indicators	Quantity	Percentage	Statistical

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	(persons)	(%)	significance level
Contracting and taking care of the forest***	254	70.56	0.000
Payment for forest environmental services***	131	36.69	0.001
Support production forest land**	116	32.22	0.063
Support forest tree varieties	117	32.50	0.797
Fertilizer support	92	25.56	0.861
Support training for agricultural and forestry extension	221	61.39	0.950
Forest-based poverty reduction model	59	16.39	0.254
Credit support	148	41.11	0.293
Rice subsidy	193	53.61	0.416

** significantly correlated with poverty variables and exiting poverty with the 95% confidence level
*** significant correlation with the poverty variable and exiting poverty with the 99% confidence level
Source: Household survey, 2022

Results of analysis of variables: Contracting and taking care of forests, and payment for forest environmental services have sig value < 0.01. Therefore, the variables are significantly correlated with the probability of escaping poverty with 99% confidence. The supporting variable for production forest land has the corresponding sig 0.090 < 0.1. Therefore, this variable is significantly correlated with the probability of escaping poverty with 95% confidence.

The results of running the model to determine the marginal effects of the factors in the binary model show that if the ethnic minority households receive the following support contracted and forest care, payment for forest environmental services, and support for forest land production increases the probability of households escaping poverty by 29.12%, 18.03% and 9.63% respectively when they receive support respectively. These supports have a positive impact on poverty reduction in Muong Cha district, these are not material supports, they are necessary and their impacts are quite obvious.

Table 7. The variable effect of the logistics model determines the factors affecting the probability of households escaping poverty

Indicators	Probability	Robust Std. Err.	z	P>|z|
Contracting and taking care of the forest***	0.2912	0.0545	5.34	0.000
Payment for forest environmental services***	0.1803	0.0490	3.68	0.000
Support production forest land**	0.0963	0.0509	1.89	0.058
Support forest tree varieties	0.0134	0.0522	0.26	0.797
Fertilizer support	-0.0099	0.0567	-0.18	0.861
Support training for agricultural and forestry extension	-0.0032	0.0507	-0.06	0.950
Forest-based poverty reduction model	-0.0780	0.0678	-1.15	0.250
Credit support	-0.0538	0.0508	-1.06	0.290
Rice subsidy	0.0399	0.0490	0.82	0.415

Source: Household survey, 2022

Thus, forest-based support solutions can help improve poverty in ethnic minority households in Muong Cha district.

In order to further assess the correlation between forest-based support solutions and income and poverty status of ethnic minority households in Muong Cha district, the study continues to analyze the correlation between supports and the change in household income in 2022 compared to 2010.

Table 8: Results of the ordered logit regression model analyzing the correlation between forest-based support solutions and the change in income of ethnic minority households in 2022 compared to 2010

Change in household income in 2022 compared to 2010	Coef.	Robust Std. Err.	z	P>z
Contracting and taking care of the forest***	0.8063	0.2879	2.80	0.005
Payment for forest environmental services	0.2570	0.2565	1.00	0.316
Support production forest land	0.2149	0.2581	0.83	0.405
Support forest tree varieties*	-0.4619	0.2701	-1.71	0.087
Fertilizer support	-0.1274	0.0992	-1.28	0.199
Support training for agricultural and forestry extension***	1.2405	0.2607	4.76	0.000
Forest-based poverty reduction model**	0.8483	0.3337	2.54	0.011
Credit support	-0.3982	0.2534	-1.57	0.116
Rice subsidy	0.2154	0.2390	0.90	0.367
Intercept 1	1.4653	0.8001		
Intercept 2	1.8793	0.8067		
Intercept 3	5.4454	0.8708		

* significantly correlated with the variable of income change compared to 2010 with 90% confidence level
** significant correlation with the income change variable compared to 2010 with the 95% confidence level
*** significantly correlated with the variable of income change compared to 2010 with 99% confidence level
Source: Household survey, 2022

When analyzing the correlation between income change and support solutions, it shows that the supporting variable for forest plant varieties is correlated with income change in 2022 compared to 2010 with 90% confidence, forest-based poverty reduction model is correlated with 95% confidence, and support for contracting, forest care, and training for agricultural and forestry extension is significantly correlated with income change compared to 2010 with 99% confidence.

Table 9: The degree of influence of factors in the ordered logit regression model

Change in household income in 2022 compared to 2010	Coef.	Delta-method Std. Err.	z	P>z
Contracting and taking care of the forest				
Little decrease ***	-0.0533	0.0205	-2.60	0.009
No decrease**	-0.0166	0.0079	-2.11	0.035
Little increase ***	-0.0710	0.0258	-2.75	0.006
Much increase***	0.1409	0.0489	2.88	0.004
Support forest tree varieties				
Little decrease	0.0306	0.0189	1.61	0.107
No decrease	0.0095	0.0060	1.57	0.115
Little increase*	0.0407	0.0232	1.75	0.080
Much increase*	-0.0807	0.0462	-1.75	0.081
Training for agricultural and forestry extension				
Little decrease***	-0.0821	0.0215	-3.82	0.000
No decrease***	-0.0256	0.0082	-3.10	0.002
Little increase***	-0.1092	0.0272	-4.01	0.000

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Much increase***	0.2168	0.0437	4.96	0.000
Forest-based poverty reduction model				
Little decrease**	-0.0561	0.0240	-2.34	0.019
No decrease**	-0.0175	0.0087	-2.00	0.046
Little increase**	-0.0746	0.0294	-2.54	0.011
Much increase***	0.1482	0.0570	2.60	0.009

Source: Household survey, 2022

Support for contracting and taking care of forests; agricultural and forestry extension training; the forest-based poverty reduction model tends to increase income with a corresponding probability of 14.09%; 21.68% and 14.82%. Meanwhile, support for forest plant varieties tends to reduce the income of ethnic minority households.

Thus, research results show that soft support such as contracting, forest care, agricultural and forestry extension training, forest-based poverty reduction model increases household income. In contrast, material supports such as tree varieties reduce household income. This shows that the material support is no longer appropriate, local authorities need to change their perception, methods and support solutions in the direction of increasing soft support and reducing and eliminating material support.

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