

# COMMUNITY CHARACTERISTICS AND CONTRIBUTION LEVEL OF AGRO-FORESTRY ACTIVITIES ON INCOME OF HOUSEHOLDS IN BA VI COMMUNE, BA VI, HANOI

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## SUMMARY

Households living in mountainous areas often have very particular characteristics. This household income is often dependent on forest resources. Ba Vi commune, Ba Vi district was the poorest commune in Hanoi city. This paper used correspondence analysis and comparative analysis method to analyze community characteristics of Ba Vi commune, used the multivariate regression model to analyze the contribution of agro-forestry activities to household income in the study area. The results showed that the community was mostly Dao ethnic group, had low education level and the households had well-off income usually did medicine profession. Agro-forestry activities contribute significantly household income in the study area. The results of the analysis show that the order of agro-forestry activities that bring income to households from high to low include: medical plants collection, grazing cattle, timber exploitation, shifting cultivation and intensive cultivation under the forest canopy. Based on the results of research, the paper proposed some solutions to improve household income in the study area.

**Keywords:** Ba Vi commune, community characteristics, correspondence analysis, forestry activities, household income.

## 1. INTRODUCTION

Buffer zones in protected areas and national parks are a home to many indigenous households. The people living in the buffer zone depend on forest resources significantly. Household income might come from timber and non-timber forest products (Tscharrntke T. et al., 2007), or come from cultivation on forestry land (Fisher M., 2004; Sinh L.H. and L.X. Truong, 2017).

Conflicts in the buffer zone arise when: it is a restricted area of agro-forestry productions for conservation purposes, at the same time agro-forestry activities is a major source of income for the indigenous community. They depend heavily on forest resources.

Ba Vi commune, Ba Vi district, Hanoi is a mountainous commune, one of seven communes in the buffer zone of Ba Vi National Park. Ba Vi is considered to be the poorest commune in Hanoi city, with the average income is 8 million VND/person/year (2015) (Hung T., 2015). The life of the community in Ba Vi commune becomes more hardly, because the commune is located in the

area of the national park, people are only allowed to cultivate under the height of 100 meters and be restricted to exploiting forest resources.

Researching community characteristics and identifying the contribution level of agro-forestry activities on household income are really necessary. These are the basis for constructing solutions for increasing income for the households. This paper will focus on 1) analyzing households' characteristics of poor, medium and well-off families; 2) finding important agro-forestry activities influencing the income and 3) proposing some solutions in order to enhance local people's lives in the study area.

## 2. RESEARCH METHODOLOGY

### 2.1. Research model

#### 2.1.1. *Agro-forest production and income of the buffer zone community*

The theory of using resource was proposed by Firey (1999), which recognized human dependence on a resource. Communities lived near protected areas, who depended on forest resources for their livelihoods (Masozera M.K. and J.R.R. Alavalapati, 2004; Mujawamariya,

G. and A.A. Karimov, 2014). For households in these communities, the forest was a source of providing timber and non-timber forest products. It made income for households through purchase and sale of these products (Debabrata, S. and S.R. C., 2012; Royal Botanic Gardens, K., 2010). Thus, agro-forestry production had significant impacts on the income of households, who lived near forests and protected areas.

Logging timber from forests affected household income (Tschardtke T. et al., 2007; Mamo G. et al., 2007; Motiur R.M. et al., 2006; Uberhuaga P. et al., 2012). Extraction of non-timber forest products was considered to affect household income too (Adepoju A.A. and A.S. Salau, 2007; Mahapatra A.K. et al., 2005). NTFPs derived from plants resources, including: seeds, leaves, firewood, flowers, fruits, roots, mushroom, medicinal plants (Chamberlain J. et al., 1998; Ticktin, T., 2004).

Exploitation of NTFPs (including: firewood, mushroom, bamboo, medicinal plants) also affected household income considerably (Tschardtke T. et al., 2007; Mamo G. et al., 2007; Motiur R.M. et al., 2006; Uberhuaga P., 2012; Adepoju A.A. and A.S. Salau, 2007; Adhikari B. et al., 2004; Hegder R. et al., 1996; Suleiman M.S. et al., 2017).

Besides, households cultivated under forest canopy and did shifting cultivation on forestry land for their family demands and for sale. Therefore, these activities also influenced the household income (Fisher M., 2004; Sinh, L.H. and L.X. Truong, 2017).

**2.1.2. Research model**

Based on a theoretical, practical background of previous researches and specific conditions of Ba Ba commune, Ba Vi district, Hanoi, the study identified nine potential factors of forestry activities affecting the household income in the study area (Table 1).

**Table 1. Interpretation of variables in a multivariate regression model**

Symbol	Content	Unit	Expected mark
Times_go_forest	Number of times go to forests	Number of times go to forest/week	+
Timber	Timber exploitation	Get value 1: have exploitation; Get value 0: no exploitation	+
Firewood	Firewood exploitation	Kg/week	+
Medical_plants	Medical plants collection	Kg/year	+
Mushroom	Mushroom collection	Kg/year	+
Bamboo_shoot	Bamboo shoot exploitation	Kg/year	+
Grazing_Cattle	Grazing cattle in the forest	Number of livestock grazing	+
Shifting_cultivation	Shifting cultivation	Value 1: have cultivation under the forest; Value 0: No cultivation under the forest	
Intensive Cultivation	Cultivating under the forest canopy	Value 1: shifting cultivation; Get value 0: No shifting cultivation	+
Household_income	Dependent variable is the household income	Million VND/year/household	

The regression model was defined as follows:

$$\text{Household\_income} = \beta_0 + \beta_1\text{Times\_go\_forest} + \beta_2\text{Timber} + \beta_3\text{Firewood} + \beta_4\text{Medical\_plants} + \beta_5\text{Mushroom} + \beta_6\text{Bamboo\_shoot} + \beta_7\text{Grazing\_Cattle} + \beta_8\text{Shifting\_cultivation} + \beta_9\text{Intensive Cultivation}$$

## **2.2. Data collection**

Data of household characteristics and forestry activities was collected by a questionnaire. The sample size was 80 households. Sampling method is random stratified sampling including 3 villages (Yen Son, Hop Nhat, Hop Son), and household income was classified into poor, medium, well-off.

## **2.3. Data analysis methods**

Stata 14.2 was used to data analysis. Study used descriptive statistics, comparative statistics, and correspondence analysis to analyze community characteristics. In order to determine the contribution level of agro-forestry activities on the household income, the study used the multivariate regression analysis. The results of analysis were the basis for proposing solutions to increase the household income in Ba Vi commune, Ba Vi district, Hanoi city.

## **3. RESULTS AND DISCUSSION**

### **3.1. Community characteristics**

Ba Vi is a poor mountainous commune of Ba Vi district, Hanoi city, located in the buffer zone of Ba Vi National Park. Ba Vi commune is located from 21°7' to 21°15' north latitude, from 105°18' to 105°25' east longitude. The terrain of Ba Vi commune is a medium and low mountainous area, with hills adjacent to the semi-mountainous region, the average slope is from 20° to 25°.

Ba Vi commune has 3 villages: Yen Son, Hop Son and Hop Nhat. By 2017, the population of the commune had 489 households with 2,177 people with 1,200 laborers. 97.7% of the population is Dao ethnic group. The average of population density is 73 people/km<sup>2</sup>.

### **3.1.1. Characteristics of population and labor**

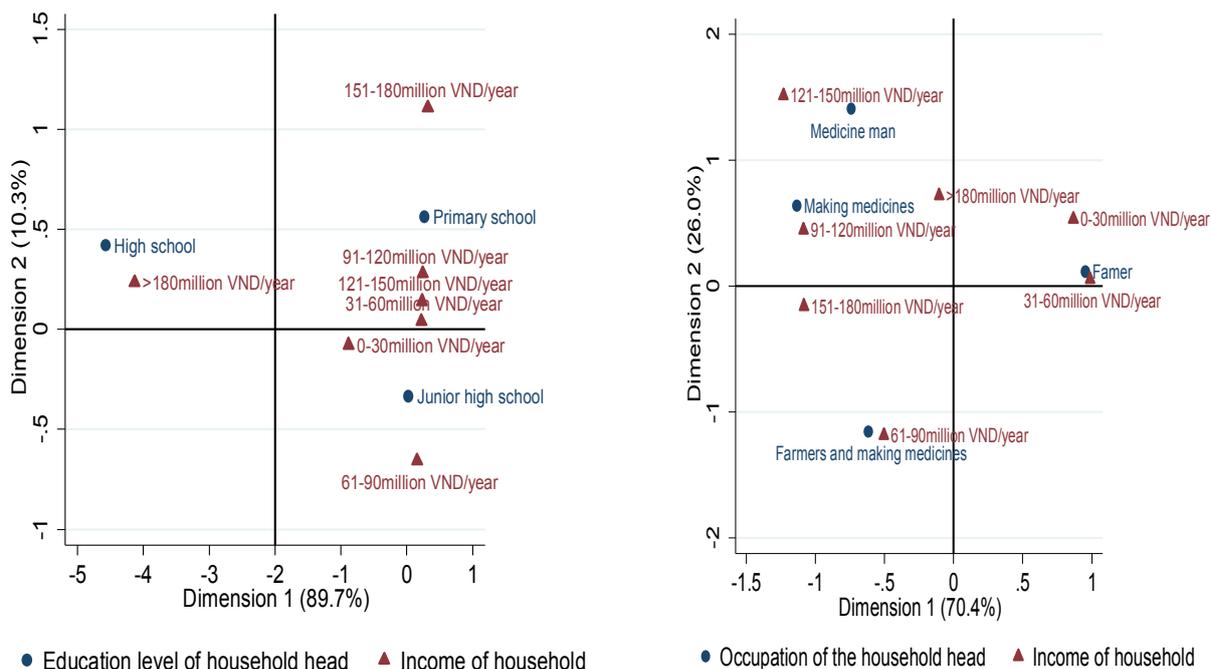
The major population was Dao ethnic group, 90% of total households. This was typical characteristics of Ba Vi commune. Nearly 90% of household head are males. The average age of the household head was 45.9 years old. The average age of household head was quite high, which was very significant in using knowledge and experience for production. There is no difference in the average age of the household head between household groups. The average number of members per household was 4.03 persons/household, and there was no difference between the household groups.

The average education level of the household head was only at the secondary school, with the average year of schooling was 6.23 years, the maximum number of schooling years was 10 years, the minimum was 3 years and it is not significantly different between household groups. However, there was a strong correspondence ( $P = .0081$ ) between the high school groups and the household groups which had average income of more than 180 million VND per year (Figure 1).

47.5% of households were farmers, most of them belong to poor households. The remaining 52.5% of the households worked as making medicines and medicine man. There was a strong correlation ( $P = 0.0000$ ) between the occupation and household income. The farmer household groups corresponded with the household groups which had income from 31 to 60 million VND per year. Farmers and Making medicines groups corresponded with the household groups had income of 63-90 million VND per year.

**Table 2. Characteristics of households by classification variables**

No.	Classification variables	Well-off households		Medium households		Poor households		Total	
		Quantity	%	Quantity	%	Quantity	%	Quantity	%
<b>I.</b>	<b>Sex of the household head</b>								
1	Female	2	8.7	4	16.00	4	12.5	10	12.5
2	male	21	91.3	21	84.00	28	87.5	70	87.5
<b>II</b>	<b>Ethnic</b>								
1	Dao	20	95.2	20	80.00	32	100.0	72	90.0
2	Kinh	3	15.0	5	20.00	0	0.0	8	10.0
<b>III</b>	<b>Occupation of the household head</b>								
1	Farmer	1	4.3	7	28.00	30	93.8	38	47.5
2	Farmers and making medicines	5	21.7	13	52.00	1	3.1	19	23.8
3	Making medicines	14	60.9	5	20.00	0	0.0	19	23.8
4	Medicine man	3	13.0	0	0.00	1	3.1	4	5.0
<b>IV</b>	<b>Exploitation of timber</b>								
1	Yes	19	82.61	14	56.00	8	25.00	41	51.25
2	No	4	17.39	11	44.00	24	75.00	39	48.75
<b>V</b>	<b>Shifting cultivation</b>								
1	Yes	19	633.3	12	48.00	13	40.6	44	55.0
2	No	4	21.1	13	52.00	19	59.4	36	45.0
<b>VI</b>	<b>Intensive Cultivating under the forest canopy</b>								
1	Yes	18	78.3	13	52.00	13	40.6	44	55.0
2	No	5	21.7	12	48.00	19	59.4	36	45.0
<b>VII</b>	<b>Apply techniques soil improvement</b>								
	Yes	21	420.0	14	56.00	9	28.1	44	55.0
	No	2	9.5	11	44.00	23	71.9	36	45.0



**Figure 1. Results of correspondence analysis for education, occupation and income**

The Making medicines groups corresponded with the household groups had income of 91-120 million VND per year. The groups of medicine man had corresponded strongly with the household groups had income from 121 to 150 million VND per year (Figure 1). It could be seen that if the occupation of the household head tends to shift from farmer to making medicines and leech, so the average household income will be increased.

**3.1.2. Land characteristics**

The average land area was about 1.16 ha/household, the largest household was 3.7 ha, the smallest household was 0.01 ha. There was a significant difference in terms of average land area between groups of households (Prob> F = 0.0013). The average land area of the well-off household was 1.56ha/household, that of medium families was 1.23ha/household and for the poor was 0.83ha/household.

Although the average forestry land area between the groups of household was not different, the average agricultural land area was different significantly with Prob > F = 0.0000. There was a correspondence between the groups of agricultural land area and groups of household income (P = 0.0001). Group of households had agricultural land area from 1 to 1.5ha, corresponded with group of households had income of over 180 million VND per year. Group of households had agricultural land area from 0 to 0.5ha, corresponded with group of households had income from 31 to 60 million VND per year (Figure 2).

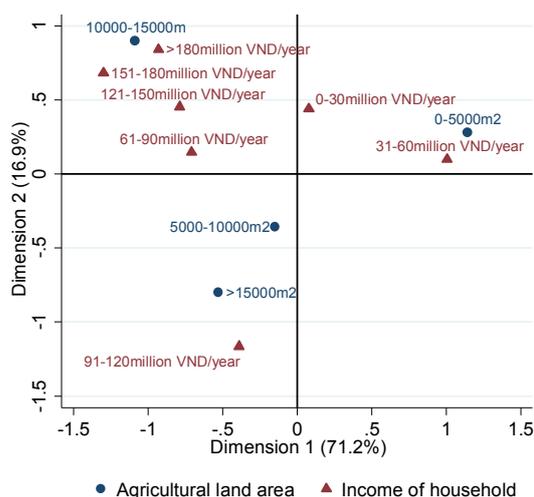
**3.1.3. Characteristics of ago-forestry activities**

Ba Vi Commune is located in the buffer zone of Ba Vi National Park. The households were only allowed to cultivate below the height of 100 m. Besides, it is a relatively steep area. This is not advantageous area for developing agriculture.

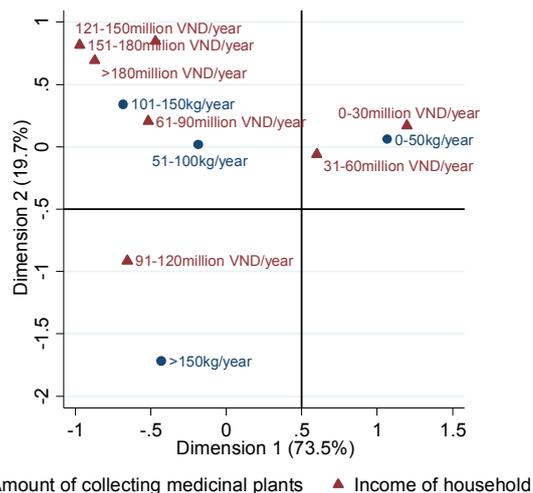
Table 3. Characteristics of investigated households

Continuous variables	Average	Well-off households	Medium households	Poor households	Chi <sup>2</sup> (Kruskal-Wallis test)
Average age of household head (year)	45.9	44.87	43.92	48.19	1.793 <sup>NS</sup>
Average year of schooling of household head (year)	6.23	6	6.28	6.34	0.280 <sup>NS</sup>
Average number of demographic per household (people)	4.03	4.65	3.64	3.88	5.528*
Average land area (ha/household)	1.16	1.56	1.23	0.83	12.827***
Average forestry land area (ha/household)	0.34	0.36	0.34	0.32	0.011 <sup>NS</sup>
Average agriculture land area (ha/household)	0.83	1.197	0.89	0.51	23.027***
Average number of times go to forest (times/week)	3.66	3.96	3.64	3.47	1.299 <sup>NS</sup>
Average amount of exploiting firewood (kg/week)	57.85	68.23	53.67	53.66	2.071 <sup>NS</sup>
Average amount of exploiting bamboo shoot (kg/year)	379.71	548.22	309.32	313.59	5.409*
Average amount of collecting medical plants (kg/year)	79.25	102.52	86.76	56.66	14.837***
Average amount of collecting mushroom (kg/year)	1.49	1.96	1.36	1.27	5.014*
Average number of livestock grazing (livestock)	2.55	3.74	3.2	1.19	18.15***
Average property value (million VND/household)	17.63	25.65	19	10.81	24.148***
Average cost of production (million VND/household)	20.341	37.495	18.832	9.191	25.867***
Average income of household (million VND/household)	76.265	135.909	74.028	35.144	69.667***

Note: NS: Not significant, \*\*\* Prob > F < 0.01, \*\* Prob > F < 0.05, \* Prob > F < 0.10



a) Agricultural land area and income



b) Medicinal plants and income

Figure 2. Results of correspondence analysis between agricultural land area, amount of medicinal plants and income

Therefore, activities generating income for households are mostly agro-forestry activities, including: timber exploitation (on the plantation forest areas), firewood harvesting, bamboo shoot collection, mushroom collection, grazing cattle in the forest, shifting cultivation, intensive cultivating under the forest canopy. The average household income was 76.265 million VND per year, the highest was 217 million/year, the lowest was 22 million/year.

The average number of times go to forest was 3.66 times/week, the highest was 6 times/week and the lowest was 0. There were 55% of the households had shifting cultivation and cultivation under forest canopy. The households, which had timber exploitation, were 51.25% of households.

The average amount of firewood exploitation was 57.85 kg/week, the highest was 131.5 kg/week and the lowest was 0. The Average amount of exploiting bamboo shoot was 379.71 kg/year, the highest was 1800kg/year and the smallest was 0. With sig. < 0.05, there was no difference between amount of exploiting bamboo shoot and groups of household income (poor, medium and well-off households).

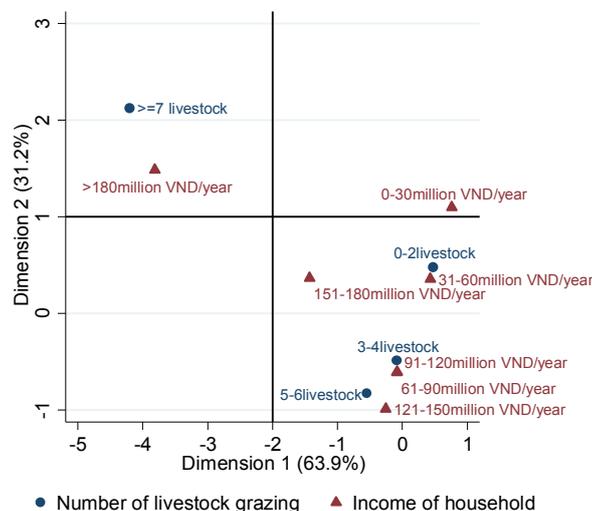
The average amount of collecting medicinal plants was 79.25 kg/year. There was a significant difference in the average amount of collecting medicinal plants between groups of household (sig. < 0.01). Correspondence analysis with sig. < 0.1 (P = 0.0789) showed that: low income households with 0-30 million VND corresponded with groups of household that collected medicinal plants from 0 to 50kg/year; group of households had income from 61 to 90 million VND per year corresponded with groups of household that collected medicinal plants from 0 to 50kg/year (Figure 2).

The mushroom was collected from forests by the households. The average amount of mushroom collection was 1.49 kg/year, the highest was 5 kg/year and the lowest was 0. There was almost no significant difference in average amount of mushroom collection between groups of households.

Households grazed cattle in forests that mainly include: buffaloes, cows, goats and horses. The average number of livestock was 2.55 cattle/household, the highest was 8 animals. There was a significant difference in the average number of livestock grazing between household groups (sig. < 0.01). Correspondence analysis with sig. < 0.01

showed that: groups of households grazed 3 - 4 cattle that correlated very strongly with the groups of income from 61 to 120 million VND/year; the groups grazed 5 - 6 cattle that

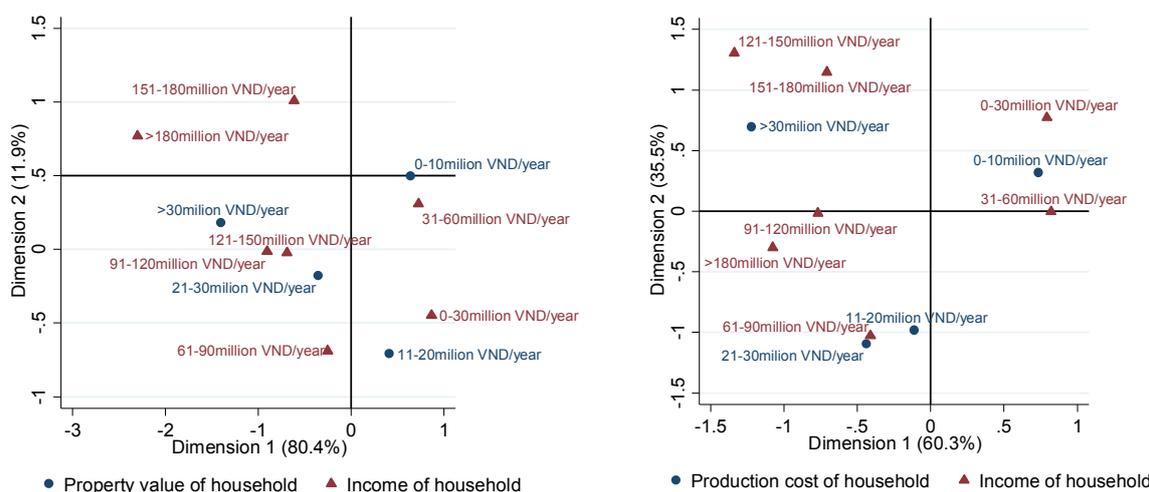
corresponded very strongly with the groups of income from 121 - 150 million/year. It showed that the more livestock grazing, the higher income.



**Figure 3. Results of correspondence analysis between groups of income households and number of livestock grazing**

The average value of property was 17.63 million VND/household. The cost of production activities was 20.34 million VND/household. With sig. < 0.01, it could be stated that both of property value and production cost was different between groups

of households. Groups of households had high value of property that corresponded with groups of high income households, and vice versa. Groups of households had high production cost that correlated strongly with groups of high income households, and vice versa.



**Figure 4. Results of correspondence analysis between groups of household income and property value, production cost of households**

### 3.2. Influencing factors on households' income

The study surveyed by questionnaires. The sample size was 80. The study used STATA 14.2 software for multivariate regression

analysis. From that, the study identified the key factors of agro-forestry activities that affect income of the households in Ba Vi commune, Ba Vi district, Hanoi city.

After testing, the model had a violation of the assumption of constant variances. The study used Robust technique in the Stata software to fix it, the result of model is in table 4.

F of model = 10.89, sig. of F = 0.0000, that indicated that the regression model always existed. The R<sup>2</sup> was 0.5835, meaning 58.35%

of income households in the model was explained by the nine independent variables, while 41.65% of income households was explained by other factors had not been considered in the model. It was possible to conclude that the model was consistent with the actual data.

**Table 4. Model Summary of key factors affecting households' income**

Independent variables	B	t	Sig.	VIF	Beta	Influential order of factor
Constant	-19.640	-1.29	0.201			
Times_go_forest	4.090	1.59 <sup>NS</sup>	0.117	1.04	0.119	6
Timber	20.169	2.03 <sup>**</sup>	0.047	1.50	0.221	3
Firewood	0.109	1.02 <sup>NS</sup>	0.310	1.08	0.078	7
Medical_plants	0.324	3.96 <sup>***</sup>	0.000	1.09	0.335	2
Mushroom	-1.534	-0.54 <sup>NS</sup>	0.591	1.23	-0.043	9
Bamboo_shoot	0.008	0.57 <sup>NS</sup>	0.573	1.10	0.068	8
Grazing_Cattle	7.343	3.92 <sup>***</sup>	0.000	1.26	0.369	1
Shifting_cultivation	16.890	2.51 <sup>*</sup>	0.014	1.12	0.185	5
Intensive_Cultivation	18.167	2.21 <sup>**</sup>	0.030	1.37	0.199	4
Dependent variable: Household_income						
Number of observations	80					
Model summary:						
F	10.89 <sup>***</sup>					
R squared	0.5835					
Durbin-Watson (d)	1.538					
Note: NS: Not significant, *** Prob> F <0.01, ** Prob> F <0.05, * Prob> F <0.10						

Result of VIF test < 10 showed that the regression model does not occur multicollinearity problem. The result of the tested model being deficient independent variable, with F (3.67) = 2.39, Prob > F = 0.0766 < 0.05, it could be concluded that the model had no missed variables. Durbin Watson testing had 1 < “d = 1.538” < 3, it indicated that the model did not have autocorrelation.

From table 4, there were 5 variables that had sig. < 0.05, including: Timber, Medical\_plants, Grazing\_cattle, Shifting\_cultivation and Intensive Cultivation. It could be concluded that

these 5 agro-forestry activities had the most significant contribution to the income of households in the study area. Results showed that these variables had positive correlation with the income of households. That was similar to the initial expectation of the model. Based on the normalized regression coefficient, the study identified ordinal of variables: (1) Grazing cattle in the forest, (2) Medical plants collection, (3) Timber exploitation, (4) Intensive Cultivating under the forest canopy, (5) Shifting cultivation.

### **3.4. Solutions for raising household income from agro-forestry activities in the study area**

#### **3.4.1. Development of grazing cattle**

Research showed that grazing cattle was an important role in household income. There was a strong correspondence between household income and the number of cattle. Grazing in the forest is a traditional agro-forestry activity of the households living in the study area. Cattle are grazed in the forest and have human control. Grazing cattle in the forest made broken trees, death of regeneration trees and shoots, compressed soil, etc. That affects the quality of forest resources. In addition, it might be at risk of disease for cattle, cause of economic losses.

To develop effective breeding, the study proposes: to plan areas of grazing cattle; to provide knowledge for households about feeding cattle and prevention of disease; to be had fodder sources for livestock through development of agro-forestry models or grow grass and fodder plants in the garden, fields, etc.

#### **3.4.2. Development of medicine production**

Ba Vi commune is famous for traditional medicine of Dao ethnic group. The analysis showed that the medicine profession clearly affected the income of the households. In the study area, most of households participate this profession by collecting medical plants in the forest, drying and selling to traders, only a few one make medicines and be leeches. In order to maintain and develop medicine profession and rise income of households, the study proposes some solutions:

- To set up local medical associations: To support each other among households in the production and consumption of traditional medicines.

- To support markets for consuming medicinal plants: understanding channels of consumption of medical products and set links in production and consumption of the products.

- To supply stability supplies by developing models of medicinal plants in the household gardens, under the forest canopy.

#### **3.4.3. Development of intensive cultivating under the forest canopy**

Intensive cultivating under the forest canopy is one of the agro-forestry production activities that generates income for the households. In the study area, the households grow medical plants under the forest, which will bring good incomes. However, spontaneous cultivation, unplanned cultivation and technical restrictions lead to unstable incomes of households. The study found that intensive cultivation of medicinal plants under forest canopy generates income of households effectively. Some measures are proposed:

- To study and develop effective models of agro-forestry in the study area. It helps to ensure the incomes, reduce risks and reduce pressure on forest resources.

- To grow precious medical plants under forest canopy with controlled plants. At the same time, support technology, funds for households.

#### **3.4.4. Development of shifting cultivation**

At present, shifting cultivation of the households makes good income. However, most of shifting cultivation in the study area was monoculture of cassava, maize on sloping land. That greatly affects the quality of forest land and the crop yield. In order to develop shifting cultivation and overcome these problems, the households can grow cassava, maize intercropped with legumes.

## **4. CONCLUSION**

Ba Vi commune, Ba Vi district, Hanoi city is a mountainous commune in the buffer zone of Ba Vi National Park. Analyzing community characteristics of Ba Vi commune showed Ba Vi commune had particular characteristics, including: the community was mostly Dao ethnic, had low education level, education

level of household head corresponded strongly with income of households and the well-off households was those had high property value, high production cost. There was a strong correlation between the occupation of household head and household income. When the occupation of the household head tends to shift from farmer to making medicines and medicine man, the household income increased.

Agro-forestry activities in the study area were diverse and were the main source of income for the households. Results of research showed that agro-forestry activities include medicinal plant collection, grazing cattle, timber exploitation, shifting cultivation and intensive cultivation under the forest canopy, which significantly affected the household income.

Based on the results of the study, the paper proposed solutions to increase household incomes in the study area. The solutions included development of medicine profession, development of grazing cattle under human control in order to limit the impacts to forest resources, development of intensive forest models under forest canopy and effective shifting cultivation.

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# ĐẶC ĐIỂM CỘNG ĐỒNG VÀ MỨC ĐỘ ĐÓNG GÓP CỦA CÁC HOẠT ĐỘNG SẢN XUẤT NÔNG LÂM NGHIỆP TỚI THU NHẬP HỘ GIA ĐÌNH TẠI XÃ BA VÌ, BA VÌ, HÀ NỘI

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## TÓM TẮT

Các hộ gia đình tại miền núi, sống lân cận các khu rừng, thường có những đặc trưng rất riêng. Thu nhập hộ gia đình này thường lệ thuộc vào nguồn tài nguyên rừng. Xã Ba Vì, huyện Ba Vì là xã nghèo nhất thành phố Hà Nội. Bài báo này sử dụng phương pháp phân tích tương đồng, thống kê so sánh nhằm phân tích đặc điểm cộng đồng xã Ba Vì; sử dụng mô hình hồi quy đa biến phân tích mức độ đóng góp của các hoạt động nông lâm nghiệp tới thu nhập hộ gia đình trên địa bàn nghiên cứu. Kết quả cho thấy: cộng đồng tại khu vực nghiên cứu hầu hết là dân tộc Dao, trình độ học vấn thấp, hộ có thu nhập khá thường làm nghề thuốc. Các hoạt động nông lâm nghiệp có đóng góp đáng kể cho thu nhập hộ gia đình. Kết quả phân tích cho thấy thứ tự các hoạt động nông lâm nghiệp mang lại thu nhập cho các hộ gia đình từ cao đến thấp bao gồm: khai thác cây thuốc, chăn thả gia súc, khai thác gỗ, làm nương rẫy và thâm canh dưới tán rừng. Dựa trên kết quả nghiên cứu, bài báo đề xuất một số giải pháp nâng cao thu nhập hộ gia đình trên địa bàn nghiên cứu.

**Từ khóa:** Đặc điểm cộng đồng, hoạt động lâm nghiệp, phân tích tương đồng, thu nhập hộ gia đình, xã Ba Vì.

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