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Assessment Of The Potential Of Land Suitable For Sustainable Agricultural Land Use Types In The Buffer Zone Of Tam Dao National Park

Ta Ngoc Long[1], Phan Dinh Binh[2], Nguyen Duc Nhuan[3], Van Quynh Giang[4]
[1] *(Thai Nguyen University of Agriculture and Forestry, Vietnam)*
[2] *(Thai Nguyen University of Agriculture and Forestry, Vietnam)*
[3] *(Thai Nguyen University of Agriculture and Forestry, Vietnam)*
[4]*(Eötvös Loránd University, Hungary)*

ABSTRACT
Background: *Natural resource reserves in Vietnam such as Tam Dao National Park are being managed by the state with great interest. The conflict between the conservation of land and forest resources of Tam Dao National Park and the need for land use by the people in the buffer zone is increasingly acute. Therefore, it is necessary to determine the potential of agricultural land for the proposal of sustainable land use orientation to both conserve the natural resources of the National Park and improve the living standards of the people sustainably. With that requirement, from 2021 to 2022, a study on the sustainable use of agricultural land in the buffer zone of Tam Dao National Park was carried out.*
Materials and Methods*: The method of conducting this study is to survey and analyze the current land use status of the study area according to current regulations. To assess the land potential of each land parcel, the land quality unit and land use type were selected and evaluated according to the following set of criteria: The degree of suitability according to the characteristics and properties of the land (land circle, land quality unit) for the selected land use type; Determining the economic, social and environmental efficiency of different types of land use; Comparing the characteristics of the land quality unit (detailed to each land parcel) and the land use requirements of the land use type to determine the suitability of that land quality unit for which land use purpose, by degree (high fit, medium fit and low fit).*
Results*: The buffer zone of Tam Dao National Park has 51 quality agricultural and forestry land units with a total area of 20,378.04 ha, accounting for 82.83% of the total natural area. There are 7 common land use types (LUTs) in the whole region, namely Specialized rice, Rice – other crops, Specialized crops, Fruit trees, Perennial industrial plants, Forestry and Medicinal plants. From the results of analyzing the quality of land units, economic, social and environmental efficiency, the LUTs have determined the suitable land potential for agricultural land uses in the buffer zone of Tam Dao National Park.*
Conclusion: *The land for all 7 LUTs of both 2 subregions has TN2 and TN3 potential. In which, land for LUTs Fruit, Tea, Forestry and Medicinal Plants all reached a very potential level (TN3). The remaining LUTs are at medium potential (TN2).*
Keywords: *Land unit; Economic efficiency; Social efficiency; Environmental efficiency; Potential agricultural land, Buffer zone of Tam Dao National Park.*

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I. Introduction

Natural resource reserves in Vietnam such as Tam Dao National Park are being managed by the state with great interest. Tam Dao National Park is located entirely on the Tam Dao mountain range, a large mountain range over 80 km long, 10–15 km wide running in the direction of Northwest - Southeast. Tam Dao National Park is adjacent to the districts of the three provinces of Vinh Phuc, Thai Nguyen and Tuyen Quang. The entire area of Tam Dao district of Vinh Phuc province lies within the buffer zone of Tam Dao National Park *(People's Committee of Tam Dao district, 2021).*

A major obstacle to nature conservation in national parks such as Tam Dao National Park is always under pressure from the communities living in the buffer zone. Because the majority of people in Tam Dao district depend on Tam Dao National Park for their livelihood, the pressure on natural resources in the region is very high. The conflict between forest and land conservation of the National Park and the need for land use of people living in the buffer zone is increasingly severe.

To satisfy human needs for food, agricultural production must go in two directions: Intensive farming to

increase crops, increase crop productivity or expand the agricultural land area. Either way, investigating and researching the land to master the land fund in both quantity and quality is essential.

Therefore, it is very urgent to properly assess the suitable land potential for agricultural land uses in the buffer zone of Tam Dao National Park. From there, propose a sustainable land use orientation to both conserve the natural resources of the National Park and improve the living standards of the people sustainably.

II. Material and Methods

Selecting research sites: On the basis of specific characteristics, the national park area occupies the majority in Tam Dao district, Vinh Phuc province and the objectives of the study, divided into two research subregions as follows:

- Subregion 1: It has the economic, cultural and political centers of the locality. Including 3 towns are Tam Dao, Hop Chau and Dai Dinh.
- Subregion 2: The remaining 6 communes of the buffer zone including Ho Son, Dao Tru, Minh Quang, Tam Quan, Yen Duong and Bo Ly.

Determining a set of criteria for assessing land potential: In order to assess the land potential of each land parcel, the unit of land quality and type of land use was selected and evaluated according to the following set of criteria.

The degree of suitability according to the characteristics of the land (land circle, land quality unit) for the selected land use type: Compare the characteristics of the land quality unit (detailed to each land parcel) and the land use requirements of the land use type to determine the suitability of that land quality unit for which land use purpose, by degree (high fit, medium fit and low fit). In which, a unit of land quality may have different suitability levels depending on the type of land use. Priority is given to the type of land use with the highest degree of suitability.

Economic efficiency: Determined through the indicator of value added (VA - Value Added), the investment efficiency of the land zone and land use type, in which the value-added indicator is determined from variable costs, prices production value:

- Value added (VA) = Value of production (GO) - Intermediary costs (IE).
- Efficiency of investment (HQDT) = Production value (GO)/Intermediate cost (IE).

Economic efficiency is classified into 3 levels: low, medium and high on the basis of uniformly evaluating 2 criteria according to the scoring method: added value and investment efficiency *(Table 01).*

Table 01: Decentralized criteria to evaluate economic efficiency in buffer zones of Tam Dao national park

No	Indicators	Symbol	Hierarchy	Evaluate
1	Value Added (VA)	VA1	< 20 million/ha	Low
		VA2	20 - 40 million/ha	Medium
		VA3	> 40 million/ha	High
2	Investment Efficiency (IE)	IE1	< 1.5 time	Low
		IE2	1.5 - 2 time	Medium
		IE3	> 2 time	High

Note: The classification table is built based on: According to the method of calculating the decentralization of land use efficiency specified in Circular No. 60/2015/TT-BTNMT and according to the actual survey in the buffer zone of Tam Dao National Park.

Social efficiency: Determined through four criteria *(Table 02)*:

- Solve the labor demand, measured by the number of labor/ha.
- Acceptance level of land users.
- The degree of conformity with the socio-economic development strategy and planning.
- The degree of conformity with the industry planning strategy.

Social efficiency is classified into 3 levels: low, medium, and high on the basis of uniformly evaluating 4 indicators according to the scoring method.

Table 02: Decentralized criteria for assessing social efficiency in the buffer zone of Tam Dao national park

No	Indicators	Hierarchy	Evaluate
1	Solve the need labor (LĐ)	< 175 labor/ha/year	Low
		175 – 250 labor/ha/year	Medium
		> 250 labor/ha/year	High
2	Level of acceptance by land users (CN)	< 50 %	Low
		50 - 75 %	Medium
		> 75 %	High
3	The degree of conformity with the socio-economic development strategy and planning (PHCL)	< 75 %	Not suitable
		75 - 90 %	Fit
		> 90 %	Very suitable
4	The degree of conformity with the industry planning strategy (PHN)	< 75 %	Not suitable
		75 – 90 %	Fit
		> 90 %	Very suitable

Note: The classification table is built based on: According to the method of calculating the decentralization of land use efficiency specified in Circular No. 60/2015/TT-BTNMT and according to the actual survey in the buffer zone of Tam Dao National Park.

Environmental efficiency: Determined through 3 criteria *(Table 03):*
- Increasing land cover: Perennial crops and forestry land are calculated as % of cover density; annual crops are calculated as % of months covered/year.
- Maintain soil protection: Determined in % based on the degree of soil degradation in the direction of soil quality changes such as increased acidity, reduced humus content, reduced absorption capacity, and nutrient content. total reduction, soil compaction, and soil erosion resistance (for perennials and forests). The results of the survey and assessment according to environmental criteria on maintaining and protecting the land for land use purposes are classified into levels: affecting the land and causing land degradation, maintaining and protecting the land, and improving the soil well.
- Minimizing soil degradation: Determined based on the degree of soil fertility much, medium or little.

Table 03: Decentralized criteria for assessing environmental efficiency in the buffer zone of Tam Dao national park

No	Indicators	Hierarchy	Evaluate
1	Land cover and forest protection	< 50 % or 6/12 months	Low
		50 – 75 % or 6 - 9/12 months	Medium
		> 75 % or 9/12 months	High
2	Soil protection	> 10% bad	Cause land degradation
		0 % bad	Maintain soil protection
		0 % bad; > 10 % good	Good soil improvement
3	Soil degradation	Heavy soil degradation	Low
		Medium soil degradation	Medium
		Little soil degradation	High

Note: The classification table is built based on: According to the method of calculating the decentralization of land use efficiency specified in Circular No. 60/2015/TT-BTNMT and according to the actual survey in the buffer zone of Tam Dao National Park.

Hierarchy of criteria for assessing land potential: Compare the characteristics of the land quality unit (detailed to each land parcel) and the land use requirements of the land use type to determine the suitability of that land quality unit for which land use purpose, by degree (high fit, medium fit and low fit). In which, a unit of land quality may have different levels of suitability depending on the type of land use, priority is given to the type of land use with the highest degree of suitability and high social efficiency *(Table 04*).

Table 04: Hierarchy of criteria for assessing land potential in the buffer zone of Tam Dao national park

No	Indicators	Symbol	Hierarchy
1	Soil quality unit (DVD)	DVDT	Suitable for low level
		DVDTB	Fits average
		DVDC	High level matching
2	Economic target group (KT)	KT1	Low economic efficiency
		KT2	Average economic efficiency
		KT3	High economic efficiency
3	Social target group (XH)	XH1	Low social efficiency
		XH2	Average social efficiency
		XH3	High social efficiency
4	Environmental target group (MT)	MT1	Low environmental efficiency
		MT2	Average environmental efficiency
		MT3	High environmental efficiency

The suitability of the soil quality unit is classified into 3 levels:
- Highly suitable: The Percentage of criteria are suitable according to levels > 75%
- Moderately suitable: The Percentage of criteria that are suitable according to the level of 50 - 75%.
- Low conformity: The percentage of criteria that are suitable according to levels < 50%.

III. Result

Results of determining the quality of land units

The quality of land units in the buffer zone of Tam Dao National Park in Tam Dao district complies with the provisions of Circular No. 60/2015/TT - BTNMT which is built on the basis of overlapping 6 single-variant maps: map soil type, soil thickness map, slope map, climate subregion map, irrigation regime map and soil fertility map.

Statistical results of the number of soil quality units have determined that the buffer zone of Tam Dao National Park in Tam Dao district has 51 quality units of agricultural and forestry land. Summary data of land units (DVD) by soil quality in the buffer zone of Tam Dao National Park in Table 05 shows that: The total area of 51 land units in the buffer zone of Tam Dao National Park in Tam Dao district is 20,378.04 ha, accounting for 82.83% of the total natural area. The total number of circles on the map is 356.

In Subregion 1, there are 22 land units with 4,948.66 ha and the total number of slices on the map is 67. The large land units are DVD 19, 20 and 51. In Subregion 2, there are 49 land units with 15,429.38 hectares and the total number of slices on the map is 289. Large land units are also DVD 19, 20 and 51.

Table 05: Statistics of land units (DVD) according to the quality of land in the buffer zone of Tam Dao National Park by Subregion

No	DVD	Land characteristics						Subregion 1		Subregion 2	
		Soil type	Slope	Soil layer	Clim-ate	Irriga-tion	Ferti-lity	No of slices	Area (ha)	No of slices	Area (ha)
1	DVD1	G1	SL1	D1	KH1	I3	DP1	1	53.99	3	12.07
2	DVD2	G2	SL1	D1	KH2	I3	DP1	4	166.33	5	439.95
3	DVD3	G2	SL1	D1	KH1	I3	DP1	1	121.17	3	246.88
4	DVD4	G2	SL1	D2	KH1	I3	DP1	4	128,19		
5	DVD5	G2	SL1	D3	KH1	I3	DP1			1	105.74
6	DVD6	G3	SL1	D1	KH1	I3	DP2			1	3.63
7	DVD7	G3	SL1	D1	KH1	I2	DP1	6	81.89	31	552.65
8	DVD8	G3	SL1	D1	KH1	I3	DP2	1	120.45	21	566.14
9	DVD9	G3	SL1	D2	KH1	I2	DP3	1	7.38	2	58.84
10	DVD10	G3	SL3	D2	KH1	I3	DP2	1	2.27	3	161.92
11	DVD11	G3	SL1	D3	KH1	I3	DP2			2	161.83
12	DVD12	G4	SL1	D1	KH1	I3	DP1	17	376.03	19	409.68
13	DVD13	G4	SL1	D2	KH1	I2	DP2			1	24.50
14	DVD14	G4	SL2	D2	KH1	I3	DP2	1	20.89	3	53.02
15	DVD15	G4	SL1	D3	KH1	I3	DP2			5	150.03
16	DVD16	G5	SL1	D1	KH1	I1	DP2			6	125.77
17	DVD17	G5	SL1	D3	KH1	I1	DP2			5	49.67
18	DVD18	G5	SL2	D3	KH1	I1	DP2			10	198.16
19	DVD19	G5	SL4	D3	KH1	I1	DP1	6	1.668.80	12	4,680.89
20	DVD20	G5	SL4	D3	KH1	I1	DP2	2	969.69	8	2,937.47
21	DVD21	G6	SL2	D1	KH1	I2	DP3			4	86.98
22	DVD22	G6	SL2	D1	KH1	I2	DP2			3	25.04
23	DVD23	G6	SL1	D1	KH2	I3	DP3	3	18.94		
24	DVD24	G6	SL1	D1	KH1	I3	DP2			9	132.14
25	DVD25	G6	SL1	D2	KH1	I2	DP2			1	9.21
26	DVD26	G6	SL1	D2	KH1	I3	DP2			12	154.82

No	DVD	Land characteristics						Subregion 1		Subregion 2	
		Soil type	Slope	Soil layer	Clim-ate	Irriga-tion	Ferti-lity	No of slices	Area (ha)	No of slices	Area (ha)
27	DVD27	G6	SL2	D3	KH1	I3	DP2			6	45.35
28	DVD28	G7	SL1	D1	KH2	I1	DP2			1	20.88
29	DVD29	G7	SL1	D1	KH1	I1	DP2			4	211.73
30	DVD30	G7	SL1	D1	KH1	I3	DP2			5	95.24
31	DVD31	G7	SL1	D2	KH2	I1	DP2			4	111.86
32	DVD32	G7	SL1	D2	KH1	I1	DP2			7	214.83
33	DVD33	G7	SL1	D2	KH1	I3	DP3			2	31.75
34	DVD34	G7	SL1	D3	KH2	I1	DP3			1	17.49
35	DVD35	G7	SL1	D1	KH1	I1	DP2	1	10.56	7	182.19
36	DVD36	G7	SL2	D2	KH1	I1	DP3			1	78.72
37	DVD37	G7	SL2	D3	KH1	I1	DP3			1	55.13
38	DVD38	G7	SL3	D2	KH1	I1	DP2	3	99.18	5	425.71
39	DVD39	G7	SL4	D2	KH1	I1	DP3	1	11.36	10	387.79
40	DVD40	G7	SL4	D3	KH1	I1	DP3			5	308.60
41	DVD41	G8	SL1	D1	KH1	I1	DP3	4	68.43	9	133.46
42	DVD42	G8	SL1	D1	KH1	I3	DP2			2	20.23
43	DVD43	G8	SL1	D2	KH2	I1	DP3	1	4.05	1	10.51
44	DVD44	G8	SL1	D2	KH1	I1	DP2			13	150.86
45	DVD45	G8	SL1	D2	KH1	I2	DP3	1	2.88	3	15.67
46	DVD46	G8	SL1	D3	KH1	I1	DP3	1	8.36	7	114.99
47	DVD47	G8	SL1	D3	KH1	I3	DP2			5	29.98
48	DVD48	G8	SL2	D1	KH1	I1	DP3			8	58.46
49	DVD49	G8	SL2	D2	KH1	I1	DP3			10	70.51
50	DVD50	G8	SL3	D2	KH1	I1	DP3	1	156.33	1	12.31
51	DVD51	G9	SL4	D3	KH1	I1	DP3	6	851.49	1	1,278.10
52	*KDG**	*KDG*	*KDG*	*KDG*	*KDG*	*KDG*	*KDG*	*3,091.84*			
Number of slices/Evaluated area								*67*	*4,948.66*	*289*	*15,429.38*
Total natural area									*23,469.88*		*23,469.88*

*Note: * Non-agricultural land*

Results of determining the economic, social and environmental efficiency of agricultural land uses in the buffer zone of Tam Dao national park

Economic, social and environmental performance is the criterion for determining potential land use types. Based on actual land use and decentralization data for each type of land use, the following specific results were obtained.

Economic efficiency of different types of land use

The economic efficiency aggregated data in Table 06 shows that agricultural land in the buffer zone of Tam Dao National Park has 7 common land use types (LUTs), namely Specialized rice, Rice – other crops, Specialized crops, Fruit trees, Perennial industrial plants, Forestry and Medicinal plants. The types of land use for economic efficiency reaching the KT3 level are fruit trees in the land of perennial crops and medicinal plants. The remaining LUTs are economically efficient at KT2. Thus, it can be seen that the type of land use for fruit trees in the land planted with perennial crops and medicinal plants under the forest canopy are the noted LUTs for sustainable agricultural land use of the national park buffer zone.

Table 06: Economic efficiency of agricultural land uses in buffer zone of Tam Dao National Park

Land use type	GO (mi.D/ha)	IE (mi.D/ha)	VA		Invest effects (HQDT)		Economic efficiency (KT)
			Value (mi.D/ha)	Hierarchy	Value (time)	Hierarchy	
Rice	69.35	44.38	24.97	VA2	1.56	HQDT2	KT2
Rice – Other crop	106.52	67.85	38.67	VA2	1.57	HQDT2	KT2
Specialized crops	189.29	147.54	41.75	VA3	1.28	HQDT1	KT2
Fruit trees	67.64	24.29	43.35	VA3	2.79	HQDT3	KT3
Tea	100.56	63.35	37.21	VA2	1.59	HQDT2	KT2
Forestry	12.98	8.15	4.83	VA1	1.59	HQDT2	KT1
Medicinal plants	88.98	42.16	46.82	VA3	2.11	HQDT3	KT3

Social efficiency of different types of land use

Table 07: Social efficiency of agricultural land uses in buffer zone of Tam Dao National Park

Land use type	Labor (LĐ)		Level of acceptance by land users		The degree of conformity with the socio-economic development strategy and planning		The degree of conformity with the industry planning strategy		Social efficiency (XH)
	Value (labor)	Hierar-chy	Value (%)	Hierar-chy	Value (%)	Hierarchy	Value (%)	Hierar-chy	
Rice	194	LĐ2	75	CN2	82	PHCL2	90	PHN3	XH2
Rice – Other crop	219	LĐ2	80	CN3	83	PHCL2	90	PHN3	XH3
Specialized crops	607	LĐ3	80	CN3	97	PHCL3	90	PHN3	XH3
Fruit trees	128	LĐ1	80	CN3	75	PHCL2	90	PHN3	XH2
Tea	411	LĐ3	80	CN3	75	PHCL2	90	PHN3	XH3
Forestry	38	LĐ1	80	CN3	95	PHCL3	95	PHN3	XH3
Medicinal plants	176	LĐ2	80	CN3	95	PHCL3	95	PHN3	XH3

The aggregated social efficiency data in Table 07 shows that: All 7 LUTs are assessed as achieving social efficiency at XH2 and XH3. The LUTs of Rice – other crops, Specialized crops, Perennial industrial plants, Forestry and Medicinal plants have the highest social efficiency at XH3. The remaining LUTs reached XH2. Thus, most of the LUTs of the buffer zone have good effects in maintaining social stability.

Environmental efficiency of different types of land use

The data on environmental performance in Table 08 shows that:

All 7 LUTs in the buffer zone of Tam Dao National Park are rated for environmental performance at MT2 and MT3, only LUT specialized in rice reached MT2 level, and all other LUTs reached MT3 level.Thus, most of the LUTs of the buffer zone are environmentally safe for land use.

Table 08: Environmental efficiency of agricultural land uses in the buffer zone of Tam Dao National Park

Land use type	Land cover and forest protection (TCP)		Soil protection (BVĐ)		Soil degradation (GTH)		Environ-mental efficiency
	Value	Hierarchy	Value	Hierarchy	Value	Hierarchy	
Rice	8 months/year	TCP2	0% bad	BVĐ2	Little	GTH3	MT2
Rice – Other crop	10 months/year	TCP3	0% bad	BVĐ2	Little	GTH3	MT3
Specialized crops	11 months/year	TCP3	0% bad	BVĐ2	Little	GTH3	MT3
Fruit trees	80%	TCP3	0% bad	BVĐ2	Little	GTH3	MT3
Tea	90%	TCP3	0% bad	BVĐ2	Little	GTH3	MT3
Forestry	95%	TCP3	0% bad	BVĐ2	Little	GTH3	MT3
Medicinal plants	95%	TCP3	0% bad	BVĐ2	Little	GTH3	MT3

Results of the assessment of the suitable land potential for sustainable agricultural land uses in the buffer zone of Tam Dao national park

On the basis of data assessing the suitability according to the characteristics of the soil (land circling, land quality units) for the selected land use type, the socio-economic and environmental efficiency of the different types of land; In terms of land use, the study determined the suitable land potential for sustainable agricultural land use in the buffer zone of Tam Dao National Park.

Land potential suitable for sustainable agricultural land uses in Subregion 1

Data on the potential assessment of land types by purpose from land quality, economic, social and environmental efficiency units in Subregion 1 are summarized in Table 09, showing that: Land for all 7 LUTs of Subregion 1 has reached the potential of TN2 and TN3. Land for LUTs Fruit, Tea, Forestry and Medicinal Plants all reached a very potential level (TN3). The remaining LUTs are at medium potential (TN2).

Table 09: Assess the potential of different types of land according to the purpose of effective use of economy, society, and environment in the subregion 1

No	Land use type	Land use efficiency			Potential	Area (ha)	DVD
		Economic	Society	Environ-ment			
1	Rice	KT2	XH2	MT2	TN2	348.14	2,3,4,8,10,12
2	Rice – Other crop	KT2	XH3	MT2	TN2	400.41	
3	Specialized crops	KT2	XH2	MT3	TN2	127.21	1,2,12,45
4	Fruit trees	KT3	XH2	MT3	TN3	322.41	7,9,12,16,23,38,39,41,46
5	Tea	KT2	XH3	MT3	TN3	5.02	
6	Forestry	KT1	XH3	MT3	TN3	3724.58	18,19,20,35,38,43,50,51
7	Medicinal plants*	KT3	XH3	MT3	TN3	16.03	43,50,51

*Note: *Planted under the forest canopy*

Land potential suitable for sustainable agricultural land uses in Subregion 2

The data on the potential assessment of land types according to the purpose of use from economic, social and environmental efficiency in Subregion 2 are summarized in Table 10, showing that: in Subregion 1, all 7 LUTs in this Subregion 2 have TN2 and TN3 potentials. Land for LUTs Fruit, Tea, Forestry and Medicinal Plants all reached a very potential level (TN3). The remaining LUTs are at medium potential (TN2).

Table 10: Assess the potential of different types of land according to the purpose of effective use of economy, society and environment in Subregion 2

No	Land use type	Land use efficiency			Potential	Area (ha)	DVD
		Econo-mic	Society	Environ-ment			
1	Rice	KT2	XH2	MT2	TN2	744.72	1-5,8,10-12,14,15, 24,26,27,30,42
2	Rice – Other crop	KT2	XH3	MT2	TN2	1244.21	
3	Specialized crops	KT2	XH2	MT3	TN2	637.92	8,10-12,14,17,24, 26,27,30,33,42,45
4	Fruit trees	KT3	XH3	MT3	TN3	1666.13	3,7,9,12,13,16-18,20,22, 25,27,29,31,32,37-39,41,43-49
5	Tea	KT2	XH3	MT3	TN3	9.13	
6	Forestry	KT1	XH2	MT3	TN3	10912.02	16-20,28,29,31,32, 34-36,38-41,44,46, 48-51
7	Medicinal plants*	KT3	XH3	MT3	TN3	18.45	19,20,35,36,51

*Note: *Planted under the forest canopy*

IV. Discussion

The statistical results of the number of land quality units have determined that the buffer zone of Tam Dao National Park in Tam Dao district has 51 units of agricultural and forestry land quality with a total area of 20,378.04 ha, accounting for 82.83% of the total natural area. The total number of slices on the map is 356. In Subregion 1, there are 22 land units with 4,948.66 ha and the total number of slices on the map is 67 zones. Land units occupying a large area are DVD 19, 20 and 51. In Subregion 2 there are 49 land units with 15,429.38 ha and the total number of slices on the map is 289. Large land units are also DVD 19, 20 and 51. There are 7 common land use types (LUTs) in the whole region, namely specialized rice, rice-other crops, specialized crops, fruit trees, perennial industrial plants, forest trees and medicinal plants.

The results of the economic efficiency assessment show that the types of land use for economic efficiency reaching KT3 level are fruit trees in the land of perennial crops and medicinal plants. The remaining LUTs such as Specializing in Rice, Rice - other crops, Specializing crops, Perennial Industrial Plants, and Forest Trees have economic efficiency at KT2 level. Thus, it can be seen that the type of land use for fruit trees in the land planted with perennial crops and medicinal plants under the forest canopy are the noted LUTs for sustainable agricultural land use of the national park buffer zone.

The results of the assessment of social efficiency showed that all 7 LUTs achieved social efficiency at XH2 and XH3. The LUTs of Rice - other crops, Specializing crops, Perennial Industrial Plants, Forest Trees and Medicinal Plants have the highest social efficiency at XH3. The remaining LUTs reached XH2. Thus, most of the LUTs of the buffer zone have good effects in maintaining social stability.

The results of the environmental efficiency assessment of different land use show that all 7 LUTs in the buffer zone of Tam Dao national park are rated for environmental efficiency at MT2 and MT3. Only LUT specialized in rice reached MT2 level, and all other LUTs reached MT3 level. Thus, most of the LUTs of the buffer zone are environmentally safe for land use.

V. Conclusion

Land for all 7 LUTs of Subregion 1 has TN2 and TN3 potential. In which, land for LUTs Fruit, Tea, Forestry and Medicinal Plants all reached a very potential level (TN3). The remaining LUTs are at medium potential (TN2). As in Subregion 1, all 7 LUTs in this subregion 2 have TN2 and TN3 potentials. Land for LUTs Fruit, Tea, Forestry and Medicinal Plants all reached a very potential level (TN3). The remaining LUTs are at medium potential (TN2).

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