



**Satoyama Agricultural Development Tool (SADT)
for Collaborative Assessment of Hilltribe Communities in Chiang Mai:
Case Studies of Mueang Ang, Nhong Lom and Pa Kea Noi**

**Devon Ronald Dublin^{1*}, Jarunee Pilumwong², Sumamas Chaiwong²,
Thitima Jantakoson³, Anchan Chompupoung⁴, Noriyuki Tanaka¹**

¹ Center for Sustainability Science, Hokkaido University, Japan

² Highland Research and Development Institute, Thailand

³ Faculty of Agricultural Technology, Songkhla Rajabhat University, Thailand

⁴ Royal Project Foundation, Thailand

* Corresponding author: Email: devdub@yahoo.com

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Abstract

The **Satoyama** Agricultural Development Tool (SADT) is based on five perspectives identified by the International Partnership for the **Satoyama** Initiative (IPSI). To determine its efficiency in indigenous communities, case studies were undertaken in three hilltribe communities: Mueang Ang, Nhong Lom and Pa Kea Noi, located in the province of Chiang Mai, northern Thailand. **Satoyama** analysis was conducted in each village by officers attached to the Royal Project Foundation (RPF) and the Highland Research and Development Institute (HRDI) operating out of the stations of Inthanon and Mae Hae. These were compared with similar analysis done by villagers of each village studied. Results showed uniformity amongst villagers, and amongst officers. No statistical differences were obtained when analysis between officers and villagers were compared, demonstrating that if persons are exposed to the same data and experiences within a given locale, they would produce similar evaluations when using the tool. Further, because villagers are capable of auto-evaluation, it is an indication that the tool should be simplified to facilitate ease of use. We were able to conclude that the SADT allows evaluation of the extent to which the perspectives of *Satoyama* are met in any given community. It is diagnostic in nature and would set the stage for a systematic and scientific approach that should be employed to advance sustainable agricultural development in the community, premised on its local culture and characteristics. The staff attached to the RPF has opted to use the tool as a means of evaluating progress in hilltribe communities affiliated to it.

Keywords: Agriculture; sustainable development; **Satoyama**; Karen; Royal Project Foundation

Introduction

The Royal Project was established in 1969 by His Majesty King Bhumibol Adulyadej for the development of the Thai highland people [1]. Prior to this, about half a million ethnic hill-tribe people lived in scattered settlements in the highland areas of northern Thailand; all except the Karen and Lahu carried out shifting cultivation [2]. Volunteers, government officials and foreign experts collaborated in attempting to educate and raise awareness of the damage and loss caused by forest destruction, and encourage them to settle and farm in one area, and especially to end their opium-growing tradition [3]. Royal Project activities today have increased in scope and sophistication, ranging from grading, packaging, post-harvest treatment, transportation and marketing of both fresh perishable produce as well as value added processing at dedicated Royal Project food processing facilities [4].

Satoyama is a Japanese term for landscapes that comprise a mosaic of different ecosystems including forests, agricultural lands, grassland irrigation ponds and human settlements aimed at promoting viable human nature interaction [5]. As Dublin and Tanaka [6] point out, **Satoyama** is nonexistent without agriculture and as such any developmental model based on **Satoyama** should be based on agriculture. This inseparable connection between **Satoyama** and agriculture should be explored in a structured and scientific way; it is against this background that the SADT was developed and tested in indigenous communities of Gabon, Guyana, Indonesia, Japan and Malaysia by independent researchers and consultants for the Japanese International Cooperation Agency (JICA).

This research is the first attempt to apply the SADT in collaboration with local communities. As agriculture is pivotal to development in the hilltribe communities, this paper analyzes the villages of Mueang Ang, Nhong Lom and Pa Kea Noi on the basis of the SADT developed by

Dublin and Tanaka [7], using data collected between September 2013 and April 2014.

Statistical comparisons are made between evaluations of officers and villagers. Each community is then discussed and compared on the basis of the five principles of **Satoyama**. In conclusion we offer recommendations for the way forward in applying the tool in other villages affiliated to the Royal Project Foundation (RPF) in Thailand and by extension, to indigenous communities globally.

Methodology

Location and communities

Chiang Mai is Thailand's second largest province of Thailand, located in the north of the country (Figure 1). The province is bordered by Chiang Rai to the northeast, Lampang and Lamphun to the south, Tak to the southwest, Mae Hong Son to the west and the Shan State of Myanmar to the north. It is located in the Mae Ping river basin and is on average 300 m above sea level. Surrounded by the high mountain ranges of the Thai highlands, it covers an area of approximately 20,107 km². Chiang Mai has a tropical wet and dry climate tempered by the low latitude and moderate elevation, with warm to hot weather year-round; nighttime temperatures during the dry season can be cool.

The villages of Mueang Ang and Nhong Lom falls under the purview of the Inthanon Research and Development Station, while Pa Kea Noi is served by the Mae Hae Rresearch and Development Station. These villages are populated by the same indigenous group, the Karen- with an estimated 438,450 people, by far the largest of Thailand's ethnic groups [8]. The three villages were also selected because they are located in similar geographic and climatic conditions and receive the same technical advice from officers of the Royal Project. Religions, infrastructure and social services available are also comparable (Table 1).

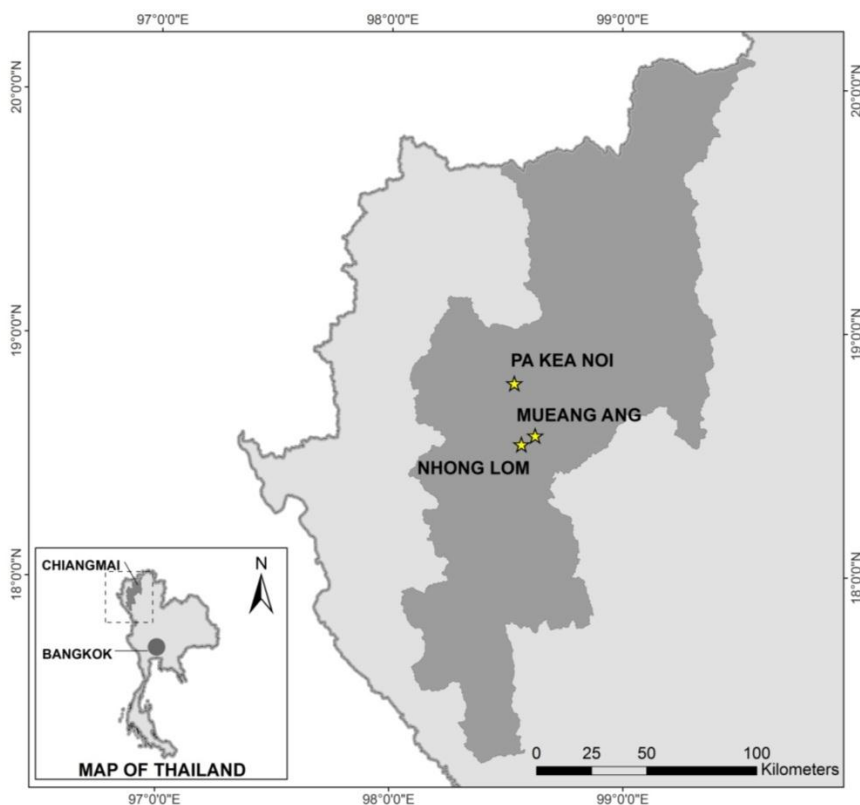


Figure 1 Location of study sites

Table 1 Study site profiles

Parameter	Mueang Ang	Nhong Lom	Pa Kea Noi
Village Size (km ²)	3.20	1.10	0.48
Population	575 (male:278, Female:296)	395 (male:215, Female:180)	274 (male:152, Female:122)
Number of households	145	90	58
Ethnic group in the village	Karen	Karen	Karen
Literacy rate	Primary school	Primary school	Primary school
Main crops grown	Rice, Vegetable (Organic)	Rice, Vegetable, Flower	Rice, Vegetable, Fruit tree
Average income/ household/year (THB)	10,000	27,152	27,169
Main religion of village	Buddhism/Christianity	Buddhism/Christianity	Buddhism/Christianity
Telephone	Yes (Rarely, very poor signal)	Yes	Yes
Water network	Yes	Yes	Yes
Electricity network	No (Solar cell)	Yes	Yes
Garbage disposal network	Yes (Municipal waste collection vehicle)	Yes (Municipal waste collection vehicle)	Yes
Access to education services	Yes	Yes	Yes
Access to health services	Yes	Yes	Yes

Participants

Officers were selected from the RPF and the Highland Research and Development Institute (HRDI) attached to the stations at Inthanon and Mae Hae which are responsible for the villages studied (Table 2a). Some government officers also participated from other government agencies such as the Ministry of Health, Ministry of Education, Ministry of Interior, Ministry of Agriculture and Cooperatives, and the Forestry Department. Village leaders and at least three other villagers were selected per village (Table 2b). Participation was on a voluntary basis.

Data collection and analysis

A Thai version of the SADT jointly prepared by academic staff of the *Faculty of Agricultural Technology*, Songkhla Rajabhat University and officers of the HRDI was utilized by both officers and villagers. The SADT was advocated by Dublin and Tanaka [9] to estimate criteria for the five perspectives, and comprises a questionnaire, supported by a definition of each community classification type and solutions for resolving problems encountered based on the Millennium Development Goals. The five perspectives are: Cyclic use of Natural Resources; Resource Use based on Carrying Capacity and Resilience of Environment; Recognition of the Importance and Value of Local Cultures and Traditions; Collaborative Management of Natural Resources; and Contribution to Local Socio-Economies.

The responses to the questions were based on a Likert scale from one to five with one being the lowest and five being the highest, or vice versa, namely, Strongly Agree; Agree; Neither Agree nor Disagree; Disagree; Strongly Disagree. The value of each perspective was determined by the percentage of points obtained from the total possible points attainable and as a result, they were evaluated as high, medium and low if 80-100%, 60-79% and 0-59% respectively of the total possible

score was achieved. An average of the percentage obtained for the 5 perspectives was then taken to obtain the total **Satoyama** points resulting in the communities being determined as **Satoyama** Like (SL), In Transition (IT), or Non Compliant (NC) if the total **Satoyama** points fell within the ranges of 0.8-1, 0.6-0.79 and 0-0.59, respectively.

Data were then statistically analyzed using Statgraphics Plus Version 5.1 to determine any statistical differences at a confidence level of 95%. Comparisons were made among the officers who evaluated each village, among villagers who evaluated each village, and between the evaluations of officers and villagers. This allowed an estimation of the level of agreement between evaluations of villagers and officers.

Further discussions were held with participants to ascertain the reasons for their responses to the questions comprising the tool. In addition, villagers were questioned in relation to their view of the importance and value of nature, why it was necessary to conserve nature, what responsibility they consider they have towards the conservation of nature, and how they can ensure a balance between their agricultural activities and the natural surroundings of their farms. These discussions were useful in forming conclusions and suggesting a way forward.

Results and discussion

Results of the evaluations of the officers and villagers are shown by village in Tables 3a, b and c.

There were no statistical differences found between the final analysis conducted by individual villagers of Mueang Ang and the final analysis conducted by individual officers when the variance check was done (p -value=0.954). The average of the villagers when compared with the average of the officers for each principle, showed no statistical differences (p -value=0.085).

Table 2a Officers participating in evaluations

	Position	Time worked in village (years)	Villages Evaluated		
			Mueang Ang	Nhong Lom	Pa Kea Noi
1	Agricultural Officer	20	✓		
2	National Park Officer	17	✓	✓	
3	President of Watershed Association	12	✓	✓	
4	Social Worker	1	✓	✓	
5	Social Worker	5	✓	✓	
6	Vice Director, Inthanon Station		✓	✓	
7	Agricultural Extension Officer	6	✓		
8	Social Worker	15	✓	✓	✓
9	Education and Health Officer (aged 54)		✓		
10	Agricultural Researcher	20		✓	
11	Local Government Officer (Previous Village Leader)	6			✓
12	Agricultural Extension Officer	20			✓
13	Environmental Sociologist	10			✓
14	Environmental and Natural Resource Researcher 1	2			✓
15	Environmental and Natural Resource Researcher 2	2			✓
16	Environmental and Natural Resource Researcher 1	3			✓
17	Environmental and Natural Resource Researcher 2	3			✓
18	Teacher	30			✓
19	Medical Doctor	10			✓
20	Forestry Officer	2			✓
21	Social Worker	3			✓
22	Agricultural Extension Officer	21			✓

Table 2b Villagers participating in evaluations

	Position	Villages Evaluated		
		Mueang Ang	Nhong Lom	Pa Kea Noi
1	Villager	✓		
2	Village Leader	✓		
3	Villager	✓		
4	Villager	✓		
5	Village Committee Member	✓		
6	Deputy Leader	✓		
7	Village Leader		✓	
8	Deputy Leader		✓	
9	Past Deputy Leader		✓	
10	Tour Manager		✓	
11	Village Leader			✓
12	Deputy Leader			✓
13	Housewife 1			✓
14	Housewife 2			✓
15	Local Government worker			✓
16	Christian Religious Leader			✓

Similarly, in Nhong Lom when the variance check was done, there were no statistical differences found between the final analysis conducted by individual villagers and the final analysis conducted by individual officers (p-value=0.913). The average of the villagers when compared with the average of the officers for each principle, showed no statistical differences (p-value=0.470).

When the variance check was done, no statistical differences were found between the final analysis conducted by individual villagers of Pa Kea Noi and the final analysis conducted by individual officers when compared per principle (p-value=0.071). However, when the final average of the villagers was compared with the final average of the officers for each principle, statistical differences were found (p-value=0.024).

A further comparison was done between the combined averages of the final evaluation of the officers with that of the villagers. No statistical differences were found in Mueang Ang, Nhong Lom, or Pa Kea Noi (P-value =0.989). However, when using the classification guideline of Dublin and Tanaka (2014b), in the case of Mueang Ang, the villagers classified the village as Satoyama Like while the officers gave a classification of In Transition. The other two villages received a similar classification between officers and villagers of In Transition (Table 4).

The differences between the classification and statistical analysis can be attributed to the fact that classifications are based on specific ranges as set out by Dublin and Tanaka (2014b). Therefore it is possible for two separate persons to come up with the same classification of the village but if an individual score is on the lower level of the range while the other score is on the higher level of the same range then it is possible to find statistical differences when analyzed. On the contrary, if two individuals evaluate the same community and obtain different classifications but if the person which gave the higher classification gave a score on

the lower level of that range while the other who gave the lower classification gave a score which is on the higher level of the range, it is possible that there may not be any statistical differences between them.

Cyclic use of natural resources

There is significant diversity in land use in all three villages, including forest, cropland, irrigation ponds and human settlements. In general, there was evidence of good nitrogen fixation and a low occurrence of soil erosion and soil degradation. This demonstrates the success of the development model established and implemented under the Royal Project (Figure 2). This model is based on land use planning, beginning with a survey of local soil and water availability. Soil which was infertile, too thin or lying on very steep surfaces was allocated to replanting forest, while the more fertile land was allocated to farming. Areas unsuitable for farming were reforested and in the remaining areas, special measures were introduced to help control erosion [10].

His Majesty Bhumibol Adulyadej's initiative has led to a phrase often used by local people involved as 'three types of wood for four users'. These are as follows: 1) wood for fuel to ensure adequate supply for own use; 2) wood for timber to allow for logging only in their own place; and 3) wood for fruit to obtain market produce each year. All three types of wood grown in the watershed area have a direct beneficial effect on the well-being of the communities. The fourth use to benefit the entire country is the conservation of forests and watershed areas [11].

Table 3a Results of Satoyama Evaluation of Mueang Ang based on Villagers and Officers

Criteria	Officers											Villagers					
	O1	O2	O3	O4	O5	O6	O7	O8	O9	O9	V1	V2	V3	V4	V5	V6	
Cyclic use of Natural Resources	PO/PP	45	36	31	41	36	39	41	31	33	39	41	44	41	39	43	
	PP=45																
	%A	100	80	68.89	91.11	80	86.67	91.11	68.89	73.33	86.67	91.11	97.78	91.11	86.67	95.56	
Resource Use based on Carrying Capacity and Resilience of Environment	R	H	H	M	H	H	H	M	M	M	H	H	H	H	H	H	
	PO/PP	24	48	31	55	41	26	42	37	41	41	42	46	45	41	43	
	PP=60																
Recognition of the Importance and Value of Local Cultures and Traditions	%A	40	80	51.67	91.67	68.33	43.33	70	61.67	63.33	68.33	70	76.67	75	68.33	71.67	
	R	L	H	H	M	L	M	M	M	M	M	M	M	M	M	M	
	PO/PP	34	30	24	30	27	33	32	24	35	31	29	29	29	24	33	
Collaborative Management of Natural Resources	PP=35																
	%A	97.14	85.71	68.57	85.71	77.14	94.29	91.43	68.57	100	88.57	82.86	82.86	82.86	68.57	94.29	
	R	H	H	M	H	M	H	M	M	H	H	H	H	H	M	H	
Contribution to Local Socio-Economies	PO/PP	25	20	15	23	24	23	23	19	23	22	22	25	25	21	23	
	PP=25																
	%A	100	80	60	92	96	92	93	76	92	88	88	100	100	84	92	
Final Evaluation	R	H	H	M	H	H	H	M	M	H	H	H	H	H	H	H	
	PO/PP	35	26	21	26	29	34	26	23	26	29	31	20	33	25	21	
	PP=35																
Total	%A	100	74.26	60	74.29	82.86	97.14	74.29	65.71	74.29	82.96	88.57	57.14	94.29	71.43	60	
	R	H	M	M	M	H	H	M	M	M	H	H	L	H	M	M	
	%A	87.43	80	61.83	86.96	80.87	82.69	83.77	68.17	81.59	82.89	84.11	82.89	88.65	75.8	82.7	
Final Evaluation	SP	0.87	0.8	0.62	0.87	0.81	0.83	0.84	0.68	0.82	0.83	0.84	0.83	0.89	0.76	0.83	
	SL	SL	SL	IT	SL	SL	SL	SL	IT	SL	SL	SL	SL	SL	IT	SL	
	SL	SL	IT	SL	SL	SL	SL	IT	SL	SL	SL	SL	SL	SL	IT	SL	

Key: – O – Officer, V – Villager, PO/PP – Point Obtained of Possible points, %A – Percent of Answer Points obtained, R – Rating, IT – In Transition, SL – Satoyama Like, H – High, L – Low, M – Medium, SP – Satoyama Points

Table 3b Results of Satoyama Evaluation of Nthong Lom based on Villagers and Officers

Criteria	Officers										Villagers			
	O1	O2	O3	O4	O5	O6	O7	V1	V2	V3	V4			
Cyclic use of Natural Resources	PO/PP	32	33	44	25	29	33	31	31	31	37	35		
	PP=45													
Resource Use based on Carrying Capacity and Resilience of Environment	%A	71.11	73.33	97.78	55.56	66.67	73.33	55.56	68.89	68.89	82.22	77.78		
	R	M	M	H	L	M	M	L	M	M	H	M		
Recognition of the Importance and Value of Local Cultures and Traditions	PO/PP	46	27	25	54	48	24	46	49	49	25	44		
	PP=60													
Collaborative Management of Natural Resources	%A	76.67	45	41.67	90	80	40	76.67	81.67	81.67	41.67	73.33		
	R	M	L	L	H	H	L	M	H	H	L	M		
Contribution to Local Socio-Economies	PO/PP	28	23	34	26	30	34	25	30	29	24	30		
	PP=35													
Final Evaluation	%A	80	65.71	97.14	74.29	85.71	97.14	71.43	85.71	82.86	68.57	85.71		
	R	H	M	H	M	H	H	M	H	H	M	H		
Total	PO/PP	20	18	20	17	22	22	17	24	24	21	22		
	PP=25													
Final Evaluation	%A	80	72	80	68	88	88	68	96	96	84	88		
	R	H	M	H	M	H	H	M	H	H	H	H		
Final Evaluation	PO/PP	26	15	35	26	29	29	23	29	29	27	29		
	PP=35													
Final Evaluation	%A	74.29	42.86	100	74.29	82.86	82.86	65.71	82.86	82.86	74.29	82.86		
	R	M	L	H	M	H	H	M	H	H	M	H		
Final Evaluation	%A	76.41	59.78	87.32	72.43	80.65	76.27	67.47	83.03	82.45	70.15	81.54		
	SP	0.76	0.6	0.87	0.72	0.81	0.76	0.67	0.83	0.82	0.7	0.82		
Final Evaluation	IT	IT	IT	IT	IT	IT	IT	IT	IT	IT	IT	IT		
	SL	SL	SL	SL	SL	SL	SL	SL	SL	SL	SL	SL		

Key: - O - Officer, V - Villager, PO/PP - Point Obtained of Possible points, %A - Percent of AnswerPoints obtained, R - Rating, IT - In Transition, SL - Satoyama Like, H - High, L - Low, M - Medium, SP - Satoyama Points

Table 3c Results of Satoyama Evaluation of Pa Kea Noi based on Villagers and Officers

Criteria	Officers															Villagers					
	O1	O2	O3	O4	O5	O6	O7	O8	O9	O10	O11	O12	O13	O14	V1	V2	V3	V4	V5	V6	
Cyclic use of Natural Resources	PO/PP	34	33	32	38	35	33	28	31	21	28	34	33	30	34	34	37	31	37	37	
	PP=45																				
%A	R	75.56	73.33	71.11	84.44	77.78	73.33	62.22	68.89	46.67	62.22	75.56	73.33	66.67	75.56	75.56	82.22	68.89	82.22	82.22	
	M	M	M	M	H	M	M	M	M	L	M	M	M	M	M	M	H	M	H	H	
Resource Use based on Carrying Capacity and Resilience of Environment	PO/PP	40	49	26	43	26	22	36	24	37	37	22	44	38	35	31	40	38	37	35	
	PP=60																				
%A	R	66.67	81.67	43.33	71.67	43.33	36.67	60	40	62	62	36.67	73.33	63.33	58.33	51.67	66.67	63.33	61.67	58.33	
	M	H	H	L	M	L	L	M	L	M	M	L	M	M	L	L	M	M	M	L	
Recognition of the Importance and Value of Local Cultures and Traditions	PO/PP	34	31	32	31	27	25	28	27	29	34	25	27	20	32	32	22	25	29	29	
	PP=35																				
%A	R	97.14	88.57	91.43	88.57	77.14	71.43	80	77.14	82.86	97.14	71.43	100	77.14	57.14	91.43	62.86	71.43	82.86	82.86	
	M	H	H	H	H	M	M	H	M	H	H	M	H	M	L	H	M	M	H	H	
Collaborative Management of Natural Resources	PO/PP	24	23	22	20	21	16	20	21	20	25	18	21	22	17	21	16	21	19	23	
	PP=25																				
%A	R	96	92	88	80	84	64	80	84	80	100	72	84	88	84	64	84	76	92	92	
	M	H	H	H	H	H	M	H	H	H	H	M	H	H	M	H	M	H	M	H	
Contribution to Local Socio-Economies	PO/PP	31	30	26	24	30	18	27	25	20	21	24	30	21	23	27	26	28	27	26	
	PP=35																				
%A	R	88.57	85.71	74.29	68.57	85.71	51.43	77.14	71.43	57.14	60	68.57	85.71	60	65.71	77.14	74.29	80	77.14	74.29	
	M	H	H	M	M	H	L	M	M	L	M	M	H	M	M	M	M	H	M	M	
%A	R	84.79	84.26	74.08	75.98	74.93	60.26	74.1	66.96	67.18	73.1	67.18	76.39	74.36	64.17	77.29	71.96	74	71.93	79.18	
	M	0.85	0.84	0.74	0.76	0.75	0.62	0.74	0.67	0.67	0.73	0.67	0.76	0.74	0.64	0.77	0.72	0.74	0.72	0.8	
Final Evaluation	SL	SL	IT	IT	IT	IT	IT	IT	IT	IT	IT	IT	IT	IT	IT	IT	IT	IT	IT	IT	
	SL	SL	IT	IT	IT	IT	IT	IT	IT	IT	IT	IT	IT	IT	IT	IT	IT	IT	IT	IT	

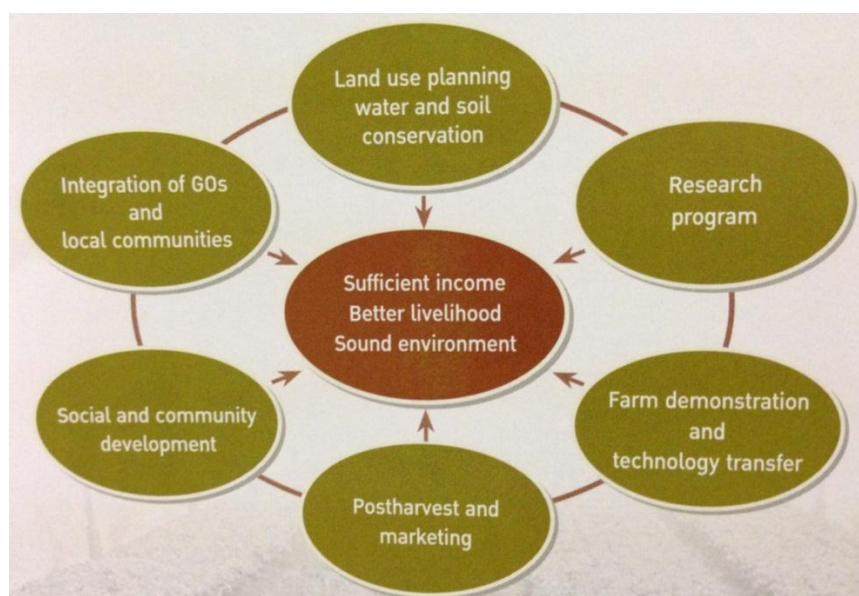
Key: – O – Officer, V – Villager, PO/PP – Point Obtained of Possible points, %A – Percent of Answer Points obtained, R – Rating, IT – In Transition, SL – Satoyama Like, H – High, L – Low, M – Medium, SP – Satoyama Points

Table 4 Results of *Satoyama* evaluation of the communities studied

Community	<i>Mueang Ang</i>				<i>Nhong Lom</i>				<i>Pa Kea Noi</i>			
	SP		R		SP		R		SP		R	
	O	V	O	V	O	V	O	V	O	V	O	V
Cyclic use of Natural Resources	0.82	0.91	H	H	0.70	0.74	M	M	0.70	0.78	M	H
Resource Use based on Carrying Capacity and Resilience of Environment	0.64	0.72	M	M	0.64	0.70	M	M	0.57	0.60	L	L
Recognition of the Importance and Value of Local Cultures and Traditions	0.85	0.83	H	H	0.82	0.81	H	H	0.83	0.80	H	H
Collaborative Management of Natural Resources	0.87	0.92	H	H	0.81	0.91	H	H	0.83	0.82	H	H
Contribution to Local Socio-Economies	0.78	0.76	M	M	0.75	0.81	M	H	0.71	0.77	M	M
Final Evaluation	0.79	0.83	IT	SL	0.74	0.79	IT	IT	0.73	0.75	IT	IT

Key: O - Officer, V - Villager, R - Rating, SP - **Satoyama** Points, IT - In Transition, SL - **Satoyama** Like, H - High, L - Low, M - Medium

Note: Figures in this table are based on an average of all analysis conducted by villagers and officers

**Figure 2** Royal Project Development Process

In the villages studied, keystone species were generally maintained. In the village of Mueang Ang (the only village to be rated High in this category by both villagers and officers), medicinal plants are used for home remedies as well as for biopesticides. Traditional ways of harvesting allows for continued growth of these plants, which seldom need replanting. One such tree used widely as a biopesticide in these villages is Neem (*Azadirachta indica* A. Juss), where the leaves and seeds are used, minimizing or even eliminating the need for chemical

insecticide use. However, although villagers are supposed to use agrochemicals based on the advice of extension officers, there is still evidence of misuse, which gives rise to the possibility of leaching into water courses.

Resource use based on carrying capacity and resilience of environment

In spite of the fact that the villages are not specifically demarcated, partly due to being located in areas under special National Park rules, sufficient land remains under the control

of each village to provide adequately for the population. In general, no obvious evidence of water, air and soil pollution was found and there is adequate waste disposal in the villages. Water supplies to the villages are also adequate. In Nhong Lom, the village sets up small dams which reduces river flow, thus facilitating fish spawning and providing a reservoir in the dry season for the villagers.

Largely due to the rules under which the villages were originally set up there is adequate forest conservation and protection. In Nhong Lom, regeneration of forests occurred by default as it was impossible to further extend the cultivated area. Biodiversity is continuously increasing as a result. The main tree species used for house construction in Nhong Lom was the Jahmbee Bah (*Michelia baillonii*), although this more recently been replaced by the Kesiya Pine (*Pinus kesiya*) due to its availability. In Pa Kea Noi, which was rated Low in this category by both villager and officers, villagers mentioned that they notice the disappearance of certain species and reiterated that while rules are good, there is always the chance of persons breaking it due to lapses in enforcement and monitoring.

There is no evidence of overfishing, over-hunting or overgrazing. However, in Mueang Ang, orchids are under threat due to outsiders coming and collecting them to be sold. The village itself does not commercialize these orchids in any way.

There is no disaster preparedness plan that is specifically set up by the villages but support is given by the government in the event of natural disasters such as flash flooding and landslides. The frequency and severity of such events is further exacerbated where improper forestry management is practiced, as Chaiwong [12] pointed out in research conducted in hill-tribe communities in Nan province under similar geographic conditions as the three villages studied.

Recognition of the importance and value of local cultures and traditions

In this category, the evaluation by both villagers and officers in all three villages studied was 'High'. In general, the villages do not possess cultural landscapes and archeological sites. While cuisine, rituals, ceremonies, skills, knowledge, art and craft exists, they are not specific to the villages studied but to the Karen ethnic group as a whole. The local language is adequately preserved although villagers speak Thai with a variation specific to the North of Thailand.

The Village Housewives Association operates in all the villages, and aims to provide support at festivals, particularly in decorations and culinary activities. They help to keep the culture of knitting, weaving and traditional arts and crafts alive by passing down skills and know-how to younger women. While the association is only made up of married women, there is another association within the villages which is made up of unmarried women who change associations when their marital status changes.

Pa De Por- a tradition where the umbilical cord of newborn babies is hung on a tree to establish a mutual connection between them and nature- is widely observed (Figure 3). When this is done, it is prohibited for anyone to cut down that tree. Traditionally, the Indian laburnum (*Cassia fistula* L.) was used. However, as a result of the improvement of healthcare in the hill-tribe communities, women started giving birth in modern hospitals rather than at home. Thus, many of them could not collect the umbilical cord when discharged from the hospital. This contributed to a reduction in populations of that species of trees due to the decline in the tradition that prohibited its cutting. Subsequently, the tradition was revitalized but due in part to the reduction in the tree traditionally used, it has been replaced by the Purple orchid tree (*Bauhinia purpurea*). This tree was selected because it can be used for food since both young leaves and flowers are edible.



Figure 3 Pa De Po

In addition, the **Lue Ta** (Figure 4)- a river ceremony that is also extended to cultivated plots such as rice fields- purports to cast a spell on anyone that disturbs it by breaking the rules

set up with its establishment. This allows for a spiritual type of regulation which sees villagers doing the right thing to facilitate conservation of nature. This coincides with Sasaoka and Laumonier [13] who found similar observances in indigenous groups in Central Seram in Indonesia.

Both traditions of **Pa De Por** and **Lue Ta** are considered potential tourist attractions that could be incorporated into agro-tourism and ecotourism. Homestays are considered as an additional source of income to supplement the main income from agriculture. In the case of Nhong Lom, there is a homestay organization that is fully owned and managed by the villagers which results in a range of 5-10% of the profits obtained channeled towards environmental conservation. The guides employed all come from the village and are certified by the relevant authorities after completing a training course offered by the national park. Most of the guides speak French since most of the homestayors so far are French.



Figure 4 Lue Ta located at a rice field

Collaborative management of natural resources

In all the villages studied, the evaluation in this category was High by both villagers and officers and there is a well laid out organizational structure with clear roles for all players. Village meetings are regularly held to obtain inputs from the wider community and allow for transparency in the decision making process. In general, a good spirit of camaraderie and dialogue was observed among villagers.

Although no women sit on the village management committee, their voices are heard and further enhanced by the united front which the Village Housewives Association provides. In our investigations, women expressed satisfaction with the fact that their issues are adequately addressed. In fact as can be seen in Table 2b, two housewives of Pa Kea Noi participated in the evaluation of their village.

The village leader of Mueang Ang has attended REDD++ meetings in Cambodia and has since implemented many of those concepts in the forest conservation program of his village, even without receiving any compensation. This demonstrates what can happen when village exchanges occur and when villagers and their leaders are exposed to other management practices.

Contribution to local socio-economies

Social work was initiated by the Royal Project. Among the objectives were to improve and support children living in the Royal Project area so that they can obtain a good education, including reading and writing in Thai. The children and teachers were provided with quality text books, thus introducing new knowledge to them and improving their ability to read and inculcate a love for school. Parents were also encouraged to support sending their children to school and basic knowledge was imparted on how to be a good Thai citizen. This included the appreciation of religion,

culture, economy, family planning and personal health. Groups and associations at village level were formed and modern toilets provided [14].

As a result, infant mortality, life expectancy and literacy rate have all improved. Crime has decreased as well, largely due to the fact that opium addiction is no longer a problem as it was many years ago. While alcohol is widely consumed socially, alcoholism is not a problem.

Because agriculture is the main source of income and other types of jobs are directly or indirectly linked to it, most villagers are employed within their own villages. As Pilumwong [15] points out, the highland restoration and the successful introduction of high income crops resulted in increased standards of living in the hilltribe communities. However, many of the crops they grow, such as lettuce, leek and beet, are today produced for the market and are not traditionally consumed by the villagers.

Conclusions

In keeping with the spirit of **Satoyama**, the discussions held with villagers revealed that nature is important for their life, since it provides important goods and services. As a result, villagers felt a compelling need to conserve it for future generations since no one else will do it for them.

Fire breaking, observance of agreed rules, and allowing natural regeneration of the forests all form part of a combined strategy to protect nature. The observation of the rules laid down for nature conservation is seen as a demonstration of community-level commitment to protection of nature. Villagers believe that people become sick as a result of violating the **Lue Ta** by doing bad things in the forest and therefore it is their duty to conserve nature.

Zoning based on land use allows for a balance between agriculture and the surrounding natural environment.

Several non-governmental organizations (NGOs) are involved in the villages studied and

this lends support to the work started by the RPF and HRDI, thus contributing to a higher level of commitment to the principles of **Satoyama**, based mainly on environmental and forestry conservation. Both Nhong Lom and Mueang Ang, located within the Doi Inthanon National Park since it was established 42 years ago, are further governed by specific rules which also facilitate **Satoyama**, such as activities that enhance the homestay potential of these villages due to their already well-promoted touristic locations in the park.

Because the RPF is strictly departmentalized with everyone focused on specific tasks and specialties, it is difficult for individuals to conduct the **Satoyama** analysis unless they consult with several departments. One suggestion (with which the authors agree) is to establish a multi-disciplinary group tasked with evaluating the communities. Multidisciplinary groups have already started working in some selected communities with good success; the concept is to be expanded to other villages.

The striking similarity found between evaluations conducted by both villagers and officers points to a common understanding between stakeholders in relation to the problems, needs and solutions that needs to be considered for the continued sustainable development of the respective villages.

Feedback from users of the SADT so far (n=41) indicates that 90.24% consider it user-friendly; 92.68% are familiar with the terms used in the SADT and are willing to use and/or modify it for their professional life; 63.41% found the information required to answer the questions easy to acquire indicating that data availability is crucial; and 85.37% believed that persons who worked in a community for an extended period of time were more capable of using the SADT effectively.

Notes

The SADT is available in 4 languages:

- Thai - Dublin, Devon (2014): เครื่องมือที่ใช้ในการศึกษาการพัฒนาการเกษตรตามแนวทาง “Satoyama”. figshare. <http://dx.doi.org/10.6084/m9.figshare.1121568>
- Spanish - Dublin, Devon (2014): *Heramienta de Desarrollo Agrícola Satoyama*. figshare. <http://dx.doi.org/10.6084/m9.figshare.1121569>
- Japanese - Dublin, Devon (2014): 里山農業開発ツール. figshare. <http://dx.doi.org/10.6084/m9.figshare.1121570>
- English - Dublin, Devon (2014): *Satoyama Agricultural Development Tool*. figshare.
- <http://dx.doi.org/10.6084/m9.figshare.1121571>

References

- [1] National Identity Office (2000) The Royal Development Projects, in: *King Bhumibol Strength of the Land*, Secretariat of the Prime Minister, Thailand. pp. 281-366
- [2] Highland Research and Development Institute (2007) *The Peach and the Poppy: The story of Thailand's Royal Project*. Royal Project Foundation, Chiang Mai, Thailand
- [3] Rajani, B. (2008) *The King and the Royal Project*, 2nd Edition, Allied Printers. Bangkok, Thailand. pp. 23 (in Thai)
- [4] Rajani, B. (1998a), *The Royal Project*, in: *Highland Ecosystem Management, Proceedings of the International Symposium on Highland Ecosystem Management*. Royal Angkhang Agricultural Station. Royal Project Foundation, Chiang Mai, Thailand. pp. 9-11
- [5] Duraiappah, A. and Nakamura, K. (2012) *The Japan Satoyama Satoumi Assessment: Objectives, focus and approach*.

- pp. 1-16 in *Satoyama-Satoumi Ecosystems and Human Well-Being, Socio-Ecological Production Landscapes of Japan*. Edited by Duraiappah, A. Nakamura, K. Takeuchi, K. Watanabe, M. and Nishi, M. United Nations University Press, Japan
- [6] Dublin, Devon and Noriyuki Tanaka (2014a) Indigenous Agricultural Development for Sustainability and “Satoyama”, *Geography, Environment, Sustainability* 02 (07): 86-95 Available at: http://int.rgo.ru/wp-content/uploads/2014/06/gi214_web.pdf
- [7] Dublin, D. and Noriyuki, T. (2014b) The Origin and Meaning of Satoyama: A Peoples Perspective from citizens of Suzu City, Japan, International Multi-disciplinary Research Foundation (IMRF), Ratna Prasad Multidisciplinary Research and Educational Society, Andhra Pradesh, India. *Life Sciences International Research Journal* 01 (01): 86-89
- [8] Social Development Center (2008) Hill-tribe, Available from: <http://www.mhsdc.org/interest1.htm>
- [9] Dublin, D. and Noriyuki, T. (2014c) Satoyama Agricultural Development Tool: A method for Evaluating, Guiding and Achieving Sustainable Indigenous and Rural Communities, *NeBIO Research Journal* 5 (5): 1 Available at: <http://www.nebio.info/> 2014/10/nebio-october-2014.html
- [10] Royal Project Foundation (2012) Thailand's Royal Project, Chiang Mai, Thailand
- [11] Rajani, B. (1998b) Highland Development in Thailand: A case study by the Royal Project Foundation, in: *Highland Ecosystem Management, Proceedings of the International Symposium on Highland Ecosystem Management*. Royal Angkhang Agricultural Station. Royal Project Foundation, Chiang Mai, Thailand. pp. 12-16
- [12] Chaiwong, S., Boonyawat, S., Udomchoke, V. and Pookngam, S. (2010) Analysis on Flood Induced Rainfall Characteristics in the Upper Nan Watershed, The Proceeding of Kasetsart University Annual Conference 48th Report: Natural Resources and Environment Section. Bangkok, Thailand. pp.123-131
- [13] Sasaoka, M and Laumonier, Y. (2012) Suitability of Local Resource Management Practices Based on Supernatural Enforcement Mechanisms in the Local Social-cultural Context, *Ecology and Society* 17(4): 6. <http://dx.doi.org/10.5751/ES-05124-170406>
- [14] Sri Mongkon, T. (1993) Education and Social Development, The Royal Project and Highland Improvement Royal Project 5th Meeting, The Committee of the Royal Project Meeting. pp. 53-62 (in Thai)
- [15] Pilumwong, J., Wittayapraparat, A., Poachareon, K., Pannet, P., Raorat, K. and Arayangkool, T(2009) Restoration of Food Resources and Biodiversity in the Highland Community. Proceeding of Highland Research and Development in Thailand, 40th Anniversary of Royal Project Foundation. pp.105 -110.