

# A Guide to Environmental Indicators at the Rural Community Level: Case in Northeast Region Thailand

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**Abstract:-** The purpose of this study was to investigate the perception of environmental indicators of a community of farmers in their own words. This study was carried out in 3 rural communities of a northeast region of Thailand, with data collected from 98 villagers and 15 key informants. Techniques for the collection of data were group interviews and in-depth interviews, and content analysis including a triangulation technique was used for comparing data. The results found the meaning of “environment” between villager and academician is similar, and that as an environmental component the villagers can be classified into 4 levels, which are: household, community, national, and international. The environmental indicators consist of 26 indicators from 5 environmental components in the community. However, this study is part of a process to further motivation and environmental awareness in the community of villagers, and for setting development guidelines for the resolution of environmental problem in communities for the future.

**Keywords:-** Environment indicators, Rural community, Northeast Thailand, Villager perception.

## I. INTRODUCTION

The environmental indicators developed for use as a standard for predicting how successful improvements in the quality of the environment, such as in the ASEAN Working Group on Environmentally Sustainable Cities, cover 3 dimensions: clean air, clean water, and clean and green land (Ministry of Natural Resources and Environment, 2015). The environmental indicators are a scale of environmental evaluation control standards. For example in the report of the Regional Environment Office 4 (2014) there was a target set of environmental indicators scored out of 100. These were divided into: (1) water quality, calculated as a percentage of water quality, which can be improved in critical areas, and has a score of 40; (2) Law enforcement, calculated as a percentage of pollutant sources targeted, as covered by section 30 in Act of extension and protection a nation environment in 1992, has a score of 30, (3) Waste management, calculated as a percentage of local government targets of community waste management in standard policy, has a score of 30. However, the Organisation for Economic Co-operation and Development

(2008) classifies environment indicators as 10 factors: climate change, atmosphere, air quality, waste, sources of fresh water, fresh water quality, forestry resources, aquatic animal resources, energy sources and diversity.

The environmental indicators are tools for evaluation community resources and aim to improve quality. They cover aspects of the physical environment, law, social and the economic environment (Cheadle, et. al., 1992). These are specific indicators of environment in the community because the community is intimately connected to natural resources and members of the community are primary users of natural resources. However, studies on the topic of environmental indicators and impact tend to focus on environmental issues over a broad and wide scale, but in the community there is a micro-scale covered by environmental indicators. Many activities in the community cause environmental problems, for example farm land is often prepared by burning fields for the purpose of clearing weeds and controlling disease, but the activity has the effect of causing smoke pollution and decreasing air quality; or farmers who use pesticides on their farm, where the pesticides become a contaminant in rivers. The environmental problem in the report of Sangpakdee, et al. (2014) explains further that farmers are associated with impacts of pesticides to farmers health and to the environment. Nevertheless, the farmer chooses to use pesticides because they're prioritizing the economic success of their household over the environment (Jantaraworachat, et. al., 2015; Kroeksakul & Srichaiwong, 2018). From this it can be determined that more access to and understanding of environmental indicators will help to achieve sustainable communities and natural resource management (Nancy, 2009). However, early in the year 2019, Thailand developed serious air pollution from PM.2.5 such as dust, which has had the effect of causing people to realize the environmental problems which created that situation, and made Thai people talk about environment more. In fact a primary cause in many cases of dust air pollution is farmers burning straw in paddy fields or burning for clearing fields before planting new crops, which is a phenomena intimately connected to the rural community.

Therefore, many activities in rural communities have influences on the environment, and so it will be important to understand whether the farmers' perception of these matters is problematic, and how do they cope with environment problems. These questions are central to our research, and the objectives for study about the perception of the environment, and the perception of environmental indicators in the community for determining environmental quality. One of the primary goals of the study is to use the information as a database to develop environment planning in the community, for analysis of environmental problems and for producing guidelines for environmental conservation in our communities in the future.

## II. METHODOLOGY

### ➤ *The study site*

Conditions of the villager study in Northeast Thailand: 3 villages distributed in the 3 provinces of Roi-et, Chaiyaphum and Khon Kean.

The village (V.1) in Chaiyaphum is situated in Limit Zone 48Q 186085.56mE and 1838826.37mN. The community is situated on flat land in an upland region, most villagers work in the agriculture sector, such as on rubber plantations, in sugar fields, paddy fields, orchards etc.

The village (V.2) in Khon Kean province, is a settlement in Limit Zone 48Q 268791.44mE and 1776542.89mN. The village area is irrigated, around the village are paddy fields, the major occupation of village householders is agricultural work and as employees in industrial sectors.

The village (V.3) in Roi-et province is in the area of Tung Kula Rong Hai, in Limit Zone 48P 344427.24mE and 1726157.98mN. These are flat lands in a low land area, surrounding the village

### ➤ *Villager informants*

In the study data was collected from 98 villagers 15 key informants. Village V1. had 29 villagers and 6 key informants, V.2 had 34 villagers and 5 key informants, and V3. had 35 villagers and 4 key informants.

### ➤ *Collecting data*

This study collected data by 2 techniques: 1) villager group interview, using topics focused on villager perception, as well as the general feeling of villagers, and 2) in-depth interview, using senior villagers and key informants including a village headman for considering the dynamics and history of the village.

### ➤ *Tools for collecting data*

This study used topics as the main tools for collecting data, with a focus on villager perception and feeling of environmental issues facing the community, and word-cards to support data grouping and ranking.

### ➤ *Data analysis*

The study used content analysis for classifying and grouping data, and for interpreting the content of the collected information, before cross-checking data from the villagers again. However, data analysis using a triangulation technique allowed us to compare data between data from villagers, key informant and from surveying.

## III. RESULT AND DISCUSSION

### ➤ *Villager environmental perception*

The data were collected by group interview to define the word "Environment", by asking the questions "What is the environment?" and "What is the meaning of the word environment?". This information, which records how the villagers understand the concept of the environment, is presented in Table 1.

The perception villagers have in northeast Thailand can be compared with a more academician definition with "environment" as a multiple-aspect concept, covering conditions surrounding humans at a given point in space and time such as ecology, policy, behavior etc., (Shamim, 2016; Hammond, et. al., 1955). Similarly, a report of Katsoulakos et. al. (2016) to explain the definition of environment, says meaning lies in natural resources in terms of economics, education, socially and culturally, and the impact of humans using a natural resource as part of human activity. The meaning of environment also has a component regarding geography between living things and non-living thing (Pawson & Christensen, 2017), so much of this has an impact on humans, and it should be considered alongside with the relationship of humans with the natural community as it was in the past, in order to describe the processes of change that affect that relationship (Donald, 2009).

The data defining the environment of a village by an academician has a mention geography, and natural resources and cover the beliefs such as festivals, the social customs, economic markers such as occupations, and a dimension can be seen in everything surrounding the village community; employment and their first-hand observations such as temperature when compared with previous times, etc.

Community	Definition
V1	<p>“Environment” is everything around ourselves and it can indirectly and directly effect to yourself in body and mind.</p> <p>Positive: The products of the environment activity such as soil can result in good quality agriculture, or abundance of rain contributing to rice production, or the forest around communities being a natural food resource of villagers, etc.</p> <p>Negative: Some phenomena effecting the villagers’ livelihood such as drought and flooding, etc.</p>
V2	The environment surrounds ourselves, in things such as soil, water, wind, temperature etc., and it has an influence on agriculture, and the livelihood of the village. However, environment is part of our culture and the beliefs of the village such as <i>Don Phu Ta</i> who is respected in a ceremony every year, or <i>Pee Ta Hak</i> who is a spirit who protects production in paddy fields, etc.
V3	Land, wind, water, sunlight, etc., which surrounds ourselves. These things we use for our lives and to earn a living. The environment is a condition of the quality of life villagers have in the community, such as if a forest is fertile there will be a lot of natural food and good weather, etc.

Table 1:- The environment as defined by the villager's perception

➤ *Environmental component*

The concept of environmental component for villagers can be classified into 4 levels which are: the international level which will be concerned with climate, weather, or pollutions such as smoke, etc.; National level which are public issues such as public forests, biodiversity, economics, etc.; Community level is related to the natural resources in the community, such as soil fertility, species of plant and animal, water resources, environmental impact of farms etc.; and the household scale which covers the household occupations, neighbors etc., so the content present in **Table2**.

Community	Components	Level of Component			
		HH.	Com.	Nat.	Inter.
V1	1. It is close to our in village			✓	
	2. We’re touching or felling, such as rain, wind, sun light etc.	✓	✓		
	3. Soil fertility, and contamination from pesticides		✓		
	4. Species of plant and animal			✓	
	5. The forest around the village		✓	✓	
	6. Dust from field burning and transportation		✓	✓	✓
	7. Sound	✓	✓		
	8. Ecology in the community	✓	✓		
V2	1. Everything in the community	✓	✓		
	2. The ecology in farming around a community, such as paddy fields, gardens, farm ponds, etc.	✓	✓		
	3. Everything related to occupation		✓	✓	
	4. Disaster such as drought, inundation.		✓	✓	✓
	5. Weather such as cool, hot, high humidity, etc.			✓	✓
	6. Household and family	✓			
V3	1. Soil, wind, air, water, trees, forests, etc. in the village and surrounding a community		✓	✓	
	2. A fish species in paddy field, pond and river		✓	✓	

Community	Components	Level of Component			
		HH.	Com.	Nat.	Inter.
	3. Activity of neighbors, such as burning garbage or playing loud music, etc.	✓	✓		
	4. The culture in the community	✓	✓	✓	
	5. Public areas and public forests or community forests		✓	✓	
	6. Soil conditions for agriculture		✓	✓	
	7. Climate change such as El Nino and La Nina, or drought and flooding			✓	✓

**Remark:** HH: Household Level, Com.: Community, Nat.: National, and Inter.: International

Table 2:- The component of the environment in a community

However, the environmental component has Canadian International Development Agency (2005) classify the environment into 2 groups which are: 1) The biophysical environment which has components: a) Types of environment such as ones containing natural resources, grassland, savanna *etc.*, b) Landscapes such as rivers, villages, farms *etc.*, c) Climates and weather, d) Biodiversity or endemic plants and animals, and 2) Human environment which has as components: Settlements, agriculture, life quality, safety, population density, sanitary, social structure, culture value, livelihood and economics. However, in Limpinantana (2000) it is explained that the environmental component of farmers lives is defined by the farmer's livelihood such as a river farmer who will use aquaculture, fishing, agriculture, or soil, so it is related to the yield of agricultural production, and so all components of the environment of farmers depend on the availability of resources which the farmer uses. Nevertheless, the environmental concept to villagers stems from their knowledge and their experience, and the totality of this is related under an environment hierarchy, with an ecology scale. The environmental component of villagers' lives is presented in **Figure 1**.

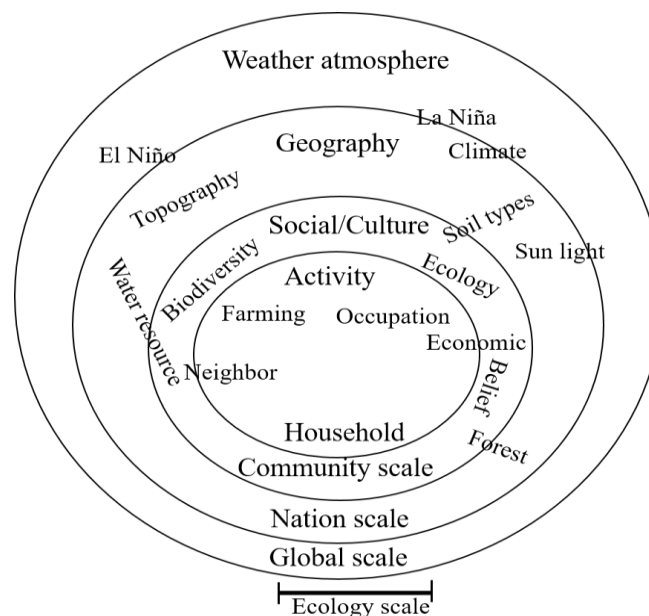


Fig 1:- The environmental component of villagers' lives.

➤ *Environmental perception in the village community*

The environmental perception of community villagers is a combination of environment and community, and it is defined by:

- More than 1 people living in an area or territory
- Has a relation between villagers and the environmental area such as agriculture, aquaculture *etc.* in community boundary
- A natural resource or ecology system within the community boundary

- Has activity which villagers can use to support themselves
- Has diversity of plant, animal, beliefs, occupation *etc.*
- Has economic value such as natural food, fire wood, *etc.*
- Has a public and private area
- Has agreement or rule of the community

However, the environment of the community covers ecology systems which effect the livelihood of villagers in the community, such as rice production, or orchards, etc., (Borishudi, 2015), and it should be considered a component which has influences to village health (Conant & Fadem, 2008). Therefore, the environmental community is an ecology system in community boundary, and has villager use of natural resources for supporting their livelihood and occupation for the maintenance of themselves and family, and so covers to social and culture of the community.

➤ *The perception of environmental indicators in the villager community*

When describing the environmental components for developing indicators in communities and their villages, there are 5 environmental components which should be considered, which are: 1) Soil; which has agriculture

production and health impacts, and has 9 indicators which are: soil type, soil color, soil pH., soil moisture, nutrient content, presence of pesticide contaminants, earthworms, plant soil cover and microorganisms, 2) Water, which has 5 indicators which are smell, aquatic animals, water color, presence of pesticide contaminants, water pH., 3) Air; air quality has 3 indicators which are: farmers’ use of pesticides, paddy burning, and dust, 4) Social; has topics of waste management, festival/culture, public areas and sound, so as a component it has 6 indicators which are: participation, place for waste management, festival, utilization in public area, economic value and volume level, and 5) Household has 2 topics which are biodiversity and waste management, so has 3 indicators which are backyard gardens, farming ecology and garbage management. All the contents of all environmental indicators in the community are presented in **Table 3**.

Environment Component	Topic	Content	Indicate of villager idea	Indicators by academicians dimension	Sources information
Soil	Quality	The soil is very important for agriculture sectors and is a primary villager occupation in the community. However, the type of soil depends on geography and geo-local settlement. The definition of soil quality by villagers will be focused on soil's physical properties such as: soil type, pH or if soil has a dark color, is considered to be good soil etc.	Soil types	The soil structure and macrospores, and total organic carbon.	USDA,2015; McGarry, 2006
			Soil color	Soil color can be diagnostic to organic matter, or present to soil morphology.	Owen & Rutledge, 2005; McGarry, 2006
			Soil pH.	Soil pH	USDA,2015; Costantini, <i>et. al.</i> , 2016
			Soil moisture	Infiltration, available water capacity.	USDA,2015; Cardoso, <i>et. al.</i> ,2013
			Nutrients content (N, P, K)	Particulate organic matter, potentially mineralizable nitrogen, C and N, mineral nutrients is mean high fertility (high nutrient).	USDA,2015; Cardoso, <i>et. al.</i> ,2013
	Health	Soil fertility suitable for agriculture, or favourable to microorganism, in soil cover there are many living things such as insects, which can be predator or prey, and bacteria which help digestion organic matter.	Not pesticides contaminate	Soil not toxic; a pesticide contaminant is an environmental effect possibly transferring to plant and animal and also human.	Hammond, <i>et. al.</i> , 1955; Merrington, 2006
			Earthworm and earthworm cattle	Earthworms digest organic matter in soil.	USDA,2015
			Grass or weeds or various species in soil.	Soil biodiversity, present in soil are nutrients used by plants.	Breure,2004
			Microorganisms	Microorganisms in soil indicate soil fertility.	Breure,2004; Costantini, <i>et. al.</i> , 2016
Water	Quality	In the water quality	Smell; the water	The smell is one	WHO, 1997

		suitable for use in animal raising, agriculture, aquaculture, and use for water supply to the community.	smell is not fetid.	topic to consider as part of a combination test. However, the water surface is good quality and should not smell.	
			In water are aquatic animals.	There is a report with Thai ricefish as an indicator of environmental pollution in water, and the water animals being present to is an assurance of water health	Ngamniyom, 2012; WHO, 2017
			The water color are clear or turbid slightly.	The water color is cover to TDL., and water color can be a sign of mineral or organic substance in the water. However, it should be possible to detect color above 15 true color units (TCU) in a glass of water.	WHO, 2016; WHO, 2017
			No pesticide contaminants.	The information of pesticides in the list of WHO guidelines of chemicals such as DDT., Endrin etc., solution in water drinking.	WHO, 2016
			Water pH. neutral	Water pH. range about 6.5 - 8 optimal for surface freshwater.	WHO, 2016; WHO, 2017
Air	Quality	The pesticide use in agriculture sectors gives possibility to be exposed to the environment like air, water resources, or absorption in soil or human by inhalation.	Farmer not use pesticide	The pesticides make possible exposure in the environment and spread in air via wind.	Kubiak, <i>et. al.</i> ,2008
		Dust is a problem in the community and the origin of dust has 2 causes: 1) transportation due to the type of local road some areas make from soil no asphalt or concrete cover, 2) agriculture practices such as paddy burning.	No smoke form paddy burning Dust in air.	Dust is air pollution with the AQI scale as an indicator for Thailand. However, the dust quantity in the air varies from season to season.	Pollution Control Department,2019; Yan, <i>et. al.</i> ,2019
Social	Waste Management	The relation or connection between local government and	Participation	The local intuition responds to villager activity for	Valentin & Spangenberg, 2000;

		villagers working together, the village can produce waste and household waste is an origin of waste product.		conservation natural resources, and the participation of development in community gives the possibility to improve life quality of villagers in the community.	Streimikiene, 2015; Dizdaroglu, 2017
			Garbage in public places is lessened by a designated dumping are.	The waste management should be governed by a local institute for management because it is difficult to correctly manage.	OECD., 2008
	Festival/culture	Spiritual events which involve to the environment such as; <ul style="list-style-type: none"> <li>▪ <i>Pee Ta Hak</i> the villager salute to paddy fields.</li> <li>▪ <i>Boon Bung Fai</i> (rocket festival) where villagers plead for spirits to make rainy.</li> <li>▪ <i>Poo Ta in Don Poo Ta</i> usually is a forest zone in public area near the village which will be saluted every year,                         <ul style="list-style-type: none"> <li>▪ etc.</li> </ul> </li> </ul>	Villager inherit to a festival/culture.	The folk customs transferred from villager beliefs and awarenesses of the value of culture, and the traditional festival, often relate to natural resources in the community, and are transmitted due to activities on which the community depends.	Rosenström & Mickwitz,2004; Hislop, 1971
	Public area	Public areas cover public forests, public land, streams or canals etc., the villager can use benefits from natural resources, for example villagers can find natural foods from forests or fish from canals, rivers or public ponds etc.	Utilization in public area	Basic environmental conflict resolution and collaborative problem solving are vital in engagement and participation for management of natural resources in public areas. However, the concept of conservation should be considered as a natural resource utilization and therefore managed together.	Dietz & Stern, 2008; Kroeksakul, (2018)
			Economic value	In villages with nearby forest, they can make money form natural products totalling about 600 USD per year.	Srichaiwong, <i>et. al.</i> , 2014
	Sound	Sound is important because the volume level has an effect to	Volume level	Noise is a major environmental issue because of the effect	Can, 2015; European Environment

		villagers, such as the sound of motorcycles, festivals or parties at night, etc.		to human health (and mind); almost all the indicators will present to areas nearby roads, railways, airports, industry areas.	Agency, 2016
Household	Biodiversity	Household biodiversity is important in rural communities because if present there may be sources of food, which can supplement households and help villagers save the food cost of their family.	Backyard garden and plant species quantity in household areas.	The indicators cover eco-services and improve green areas in the community; the activity remains important to household food security, and the backyard garden is a small classroom of ecology systems for the household.	Teitel-Payne, et. al., 2016; Teillard, <i>et. al.</i> , 2016
		The villager practices in farms such as intensive agriculture, cash crops, multi cropping etc., the practices of villager-related agriculture patterns and land use.	Farm practices/agriculture patterns and farming ecology	The farming ecology covers the relation of resources in farming and farmer activity, and considering the yield of product, soil nutrient return, etc. However, farming pattern awareness such as soil, water and environment conservation.	Latruffe, et. al., 2016; OECD, 2001; Waney, et. al., 2014
	Waste management	Garbage management in household part time village use, burning or landfill.	Garbage management	The garbage management of households separates waste between waste which can be recycled and non-recyclable materials, with a tendency of waste in household decreasing.	Ristic, 2005; OECD, 2008

Table 3:- The environmental indicators of villager perception.

**IV. CONCLUSION AND RECOMMENDATION**

The study found many villagers understand the meaning of the environment, and they understand the environmental situation at present; similarly they're aware of the environment as a community because it's a topic which is close to themselves. The information about the environmental component of community villagers shows awareness to natural components and ecology surrounding themselves, such as neighbors, occupation, etc., which effect a direct and indirect impact to villagers physical and mental well-being. However, the environmental indicators of villager perception have 5 components, which cover 26 indicators to develop from villager perception, from this study of a rural community in a Northeast region of Thailand. However, this study is part of a process of motivation for environmental awareness in communities of

villagers, for the purpose of developing guidelines for resolving environmental problems in communities in the future. In the study it was found to channel to support data of environmental impact to the community because the villagers have basic knowledge of the environment and environmental problems, if the academicians or government officer is to suggest a technique and technology to monitor the environment in local scale, it's aim must be to efficiently protect and monitor the environment.

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