

# Environmental literacy in interpreting endangered sustainability Case studies from Thailand and the Sudan

Minna Hares<sup>a,\*</sup>, Anu Eskonheimo<sup>a,2</sup>, Timo Myllyntaus<sup>b</sup>, Olavi Luukkanen<sup>a</sup>

<sup>a</sup> Viikki Tropical Resources Institute, P.O. Box 27, 00014 Helsinki University, Finland

<sup>b</sup> School of History, 20014 University of Turku, Finland

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## Abstract

This paper examines how people explain reasons and impacts of environmental change in the low-rain savanna of the central Sudan and mountainous forest lands of northern Thailand. The explanations are analyzed by using the concept of environmental literacy, which refers to the people's ability to grasp the environment and its interactions. The paper aims to study people's conceptions of the environment, which compose one factor in directing their behavior. For the study, rural inhabitants in the State of North Kordofan, the Sudan, and the Chiang Mai Province in Thailand were interviewed.

It was noted that an individual's capability to understand the environment is alone insufficient to address environmental problems because the efficient alleviation of the problems requires collective actions at all levels, and because of factors beyond an individual's control. However, the results supported the assumption that the local people have knowledge of their environment that may help in developing sustainable environmental management practices. The main advantages of using the environmental literacy concept are argued to be its dynamic and synthetic essence, its link to sustainable behavior, and wide applicability in various contexts within heterogeneous communities.

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## 1. Introduction

Rural people's livelihood in Asia and Africa is often directly dependent on natural conditions. Changes in these conditions require humans to update their environmental knowledge and adapt their behavior. In fact, people's interaction with their environment, visual monitoring, and communication with other people provide them constantly updated information of environmental changes (e.g. Spencer, 2004; Becker and Ghimire, 2003).

Research on environmental knowledge and strategies to cope with environmental changes may provide valu-

able information to address environmental problems. For instance, studies in eastern and western Africa have shown that rural people have adapted to environmental and social changes with various strategies (Tiffen et al., 1994; Mortimore and Adams, 2001). However, adaptation can fail, for example, when people migrate or are relocated to a different environment where their agricultural practices are unsustainable (Hurst, 1990; Sunderlin and Resosudarmo, 1996). Thus, varying ecological and social circumstances in different areas affect people and, consequently, their environmental perceptions, management practices, and livelihood strategies.

This paper aims to demonstrate differences and similarities in local people's environmental thinking and behavior in two ecologically and socially divergent areas. The article focuses on two case studies on two

\* Corresponding author.

E-mail address: [minna.hares@helsinki.fi](mailto:minna.hares@helsinki.fi) (M. Hares).

<sup>1</sup> Fieldwork in Thailand was conducted by Minna Hares.

<sup>2</sup> Fieldwork in the Sudan was carried out by Anu Eskonheimo.

continents, cases from the Sudan and Thailand. Both of these examined similar research questions: (1) How did the rural people perceive and describe environmental changes? (2) How did they comprehend the reasons behind the changes? (3) What kind of actions had local people suggested and taken to tackle the environmental changes and problems in their home area?

The studies were conducted with the support of the environmental literacy concept. This concept is not new, for the origin of the term dates back at least to the end of the 1960s when it was used in pedagogical research (Hsu and Roth, 1998). In environmental education, an important objective has been the promotion of environmental literacy with an idea that environmentally literate citizens would be able to behave in a responsible manner, respecting the environment. In this context, the term has been mainly associated with scientific knowledge about nature and its processes. As a whole, environmental literacy has various definitions, but commonly it has been described as comprising environmental knowledge (a central ingredient), awareness and concern (David, 1974; Orr, 1992; Brennan, 1994; Bowers, 1996; Hsu and Roth, 1998). Recently, also respect and morality referring to the sustainable use of natural resources have been included in the definition (Basile and White, 2000; King, 2000).

Orr (1992) has used the term ecological literacy to refer to people's conceptions of the environment. He considered development of ecological literacy, based on education, as a tool for sustainable life in the post-modern world. Thus, the content of Orr's ecological literacy concept seems to be rather similar to that associated with environmental literacy. In this article, the term environmental literacy is, however, used as a broader concept than as an educational term and thus, the term is redefined. Our aim is to develop a flexible and dynamic concept that is applicable globally in dissimilar environments and refers to different types of environmental knowledge. The new definition of environmental literacy aims also to encourage a holistic research approach. This approach regards knowledge of the physical environment as an important research topic, but it also emphasizes the need to study the overall circumstances at large. These social and ecological circumstances are believed to affect human behavior directly, and through environmental literacy.

Rural people's expertise in their surroundings and local practices have been hoped to assist in solving environmental problems. With a revised environmental literacy concept, the purpose is to develop a tool that will help to bring out and combine various perceptions and facilitate the challenging task of understanding the complexity of various viewpoints. We hope this will benefit the difficult task of identifying and implementing sustainable solutions for environmental problems.

## 2. Environmental literacy defined

Here, we define environmental literacy as people's perceptions of their physical environment. It refers to a holistic understanding, which is the result of a process synthesizing all sources of information a person may have. Environmental literacy is built up of personal learning processes, which are affected by socio-economic, political, cultural, historical, and ecological circumstances. In addition, individual features, such as age and intelligence, also affect environmental literacy and behavior. Thus, environmental literacy is subjective and individual although it is closely linked to a broader framework at local, national and global levels. People belong to various groups that have an effect on how the environment is interpreted, for instance, through traditions, beliefs and values. Therefore, environmental literacy can also be studied as a characteristic of a certain group. A group, such as village or work community, may have common environmental ideas which can be a focus of research: for example, a study of influences of formal education on environmental perceptions of pupils at the same grade level may concentrate on environmental literacy of a group with common characteristics of age and education.

It seems that no one is completely illiterate of his or her surroundings but people's ability to process and analyze information varies. Environmental literacy includes the elements of perceiving, decoding, and also using information from the environment. It consists, in addition to reading, the ability to "write" on the environment, that is to sustainably use, conserve, maintain and co-exist with the environment. In other words, environmental literacy is not only a set of conceptions in people's minds, but also something that is manifested in people's environmental behavior. Unsound actions, however, leading to unsustainable situations may take place due to insufficient knowledge, difficulty of interpretation, or distorted perception of the environment. This can happen not only at an individual level but also at societal and cultural levels (cf. Orr, 1992; Prakash, 1995).

Environmental behavior is also affected by other factors along with environmental literacy. Because of these other factors people may end up in environmental problems despite their environmental literacy. Hsu and Roth (1998), for example, in their research on environmental literacy of secondary school teachers in Taiwan, came to the conclusion that the environmental literacy variables<sup>3</sup> they used could explain only about 35% of the

<sup>3</sup> Ten variables were used: responsible environmental behavior, environmental sensitivity, environmental attitudes, environmental responsibility, locus of control, intention to act, perceived knowledge of environmental action strategies, perceived skill in using environmental action strategies, perceived knowledge of ecology and environmental science, and perceived knowledge of environmental problems and issues (Hsu and Roth, 1998).

variance in responsible environmental behavior. These other influencing factors can be political, cultural, economic or social. Furthermore, people do not always behave in the way generally regarded as optimal or expedient. For instance, in order to secure their immediate livelihood, people may feel obliged to harm their environment even if they know the negative long-term consequences of their actions. On the other hand, people may end up with perfectly sustainable solutions even though they lack the knowledge considered scientifically correct. They may draw conclusions on the basis of their beliefs or traditional practices, for instance, but this process can also guide them to appropriate strategies.

It is also possible that individuals are aware of environmental problems, but they lack knowledge of or commitment to collective action. Sustainable collective action to conserve, protect, and rehabilitate the environment may require extensive participation from various stakeholders. In common property land, collective action may pose a particular challenge, for the stakeholders may have conflicting views on how the common resources should be used (Adams et al., 2003).

Power is also one of the significant factors influencing how people think and act. The perceptions of environmental problems may differ between communities with different access to power. In administration, the preference of the views of certain groups may affect the decisions made. An interesting question thus is: whose way of reading and manipulating nature becomes dominant and to what extent does power modify these activities (see Banuri and Marglin, 1993; Dove, 2000; Siebers, 2004). Research on environmental literacy could encourage the empowerment of people. Identifying environmental literacy of minority groups and those living in peripheral areas can improve the status of these groups in environmental policy formulation.

### 3. Concepts in comparison

Researchers studying people's conceptions of the environment have used numerous concepts as tools of abstraction: ethnoscience, indigenous, local, and traditional knowledge with various modifications have been commonly used particularly in the fields of environmental sciences and development studies (e.g. Fleming, 1992; Warren et al., 1995; Blaikie et al., 1997; Berkes et al., 2000; Zurayk et al., 2001). Debate over the appropriateness of these terms has, however, occurred. Thus, attempts to redefine them have emerged, in particular to better describe the hybrid nature of knowledge systems meaning that they are modified by influences from various other knowledge systems; traditional knowledge, for instance, has influences from scientific knowledge. Adrian Martin (2003) describes local knowledge as "the product of a dynamic hybridization with the wider

world". In spite of the new definitions, one could think that the words indigenous and traditional are actually misnomers in the context of hybrid knowledge. In addition, the term ethnoscience, for example, has been redefined but a connotation of an ethnic group still easily exists. Although efforts for redefinitions are made, earlier definitions are rather well-established and still are widely used and form the basis for this critical review.

The term traditional knowledge has normally included an assumption that knowledge is passed on from generation to another and is thus accumulative (Berkes, 1993). In today's world, however, people's conceptions of their environments are rarely affected only by this type of accumulated knowledge for constantly undergoing changes in societies, cultures, and nature modify people's perceptions of their environment. Acknowledgement of this dynamism is important for environmental literacy because it is all the time reconstructed and modified along with new experiences and information; environmental literacy needs to adapt to altering circumstances in order to remain viable. There are several factors in which changes may challenge the utility of former literacy. These may include demographic changes; disasters and other extreme events (e.g. war); commercialization and economic shocks; and shifts in environmental conditions such as climate change or pollution (Blaikie et al., 1997).

Another commonly used term is indigenous knowledge. It has often been used in a basically similar way as traditional knowledge to refer to collectively accumulated knowledge that indigenous people possess owing to their long historical interaction with a particular type of environment. Similarly, the term traditional knowledge tends to refer to the accumulation of knowledge of a certain locality in the course of time and is often connected to indigenous people. Furthermore, definitions of who are actually indigenous to a certain region may vary (Colchester, 2002; McIntosh, 2002). Both indigenous and traditional knowledge may, moreover, be associated with sustainable co-existence with nature, which is not necessarily the case. The concept of environmental literacy avoids this kind of automatic association.

Local knowledge is also among the most frequently used expressions; it is typically viewed as a result of continuous and intensive contact with a surrounding environment. If not defined otherwise, local knowledge is associated with the inhabitants of a particular area. However, the exact area that the word local refers to often remains unclear, and perhaps the main difficulty is how to define local people and on what grounds (e.g. Forbes, 1999). For instance, if a person born in an area works most of the year outside it, can he or she still be considered as a local? Furthermore, local knowledge easily includes an assumption that all people who live close to nature are well familiar with the

physical environment, such as soil or plants, although, for instance, the means of livelihood significantly affects the type of knowledge different individuals may have. Generally, it is unclear how local knowledge is related to supra-local or universal knowledge.

All these terms—local, traditional and indigenous knowledge—which are sometimes used as more or less synonyms, are often seen as being opposed to (global) science (see e.g. Ellen and Harris, 2000; Becker and Ghimire, 2003). Environmental literacy avoids this connotation, and it also has wider applicability than a mere description of different knowledge systems. Although the hybridization of knowledge systems is acknowledged in some recent definitions, the words local, traditional and indigenous can easily have connotations of being specialized, localized, and different from science. This commonly includes the idea that they are acquired through observation and experiences and transmitted orally (Ellen and Harris, 2000). In general, accumulated knowledge is viewed as stored linguistically, in vocabulary, proverbs, and stories, and transmitted orally from one generation to another. Environmental literacy acknowledges that language is significant in transmitting environmental literacy, as are also practice and imitation. It also recognizes the importance of culture in modifying knowledge systems; social reflection and discussion can lead to the creation of various ways to conceptualize and explain phenomena in the environment.

Any term, however, has its problems. Environmental literacy also has its historical burden: because of its pedagogical background, it is easily connected to the comparison of environmental perceptions with scientific knowledge, the inherent idea being that scientific knowledge is superior, more accurate. To avoid this, environmental literacy has here been differentiated from the meaning used in environmental education, although the links to behavior and sustainability are also included in our redefinition.

#### 4. Cognitive approaches

Some psychological and geographical approaches have considered the link between human environmental thinking and behavior. These approaches have concentrated on an individualistic view: how a person perceives and acts in the environment. Having its roots in psychological research, environmental psychology emerged in the 1960s. Environmental psychologists focused their attention on behavior settings within a defined time and place and patterns of behavior coordinated by physical environments (Craik, 1977). Later, this idea was further elaborated to have broader applicability.

Geographers, among other scholars, have elaborated the terms environmental perception and cognition, which largely derive from ideas of environmental psy-

chology (Norton, 2000). Environmental perception refers to the experience of places, and studies the processes and factors that affect people's impression of the environment. In addition to visual observation, it includes an idea of environmental awareness (Craik, 1977). The concept of environmental cognition was linked more closely to the tradition of geography by bringing in an understanding of topographic representations (Norton, 2000). Both of these terms, though, have been further developed from these definitions. In addition, the term of regional perception has been used to describe how people rank places according to given criteria, employment opportunities, for example (Haggett, 2001).

Cognitive or mental maps have been used in geographical research since the late 1960s to study environmental perceptions, images of an area that a person had visited or lived in and that are in relation to a person's world view. The subjectivity of these maps is emphasized, as is the approach from both an individual and cultural point of view (Norton, 2000). A mental map can be defined as an individual's or group's notion of a place or region illustrated in a sketch map (Haggett, 2001). The focus of this type of research has often been on spatial orientation and a sense of direction; this emphasis differs from the environmental literacy approach. Nevertheless, mapping is a useful method also in examining environmental literacy.

Activities that are critical for the environment often appear in uncertain situations or natural environments that are hard to predict. Perceptions of natural hazards have, thus, been investigated. Peter Haggett (2001), for instance, presented an example of human reactions to floods and listed four different responses to this irregular hazard. The conclusion he drew was that we should focus on human-environment relations of particular groups instead of searching for universal patterns. Haggett (2001) further stressed the importance of images as they guide action, since decisions are made based on images that are transitory by nature. Cultural geography inspired by environmental psychology includes the idea that human activities are based on the mental image of the environment, which further refers to a notion that actions are often taken in situations of uncertainty (Norton, 2000).

One risk of a cognitional view of environmental knowledge is that it might restrict descriptions to mere set of conceptions in people's minds, a way of thinking similar to that of cognitive anthropology. However, the idea of describing culture as conceptions that guide human behavior has been viewed as simplistic and static because this kind of approach fails to acknowledge that culture is constantly being created and developed (Ingold, 2000). Similarly, to believe that environmental literacy precedes and guides environmental behavior would simplify the dynamic reality—environmental



literacy continues to develop as people interact with the environment and with each other.

### 5. Overarching concept for empirical research

Environmental literacy is something everyone has—people in rural communities, as well as researchers, for example. This makes the concept flexible and universal. Previously, dichotomizing scientific or western knowledge and indigenous, traditional or local knowledge has been widely debated (e.g. Howes and Chambers, 1979; Johnson, 1992; Thompson and Scoones, 1994; Blaikie et al., 1997; Sillitoe, 1998; Nygren, 1999). A view that these knowledge systems should not be represented in epistemological opposition to each other is more common nowadays than a contrasting view (Martin, 2003). Here, it is hoped that the universal aspect of the term environmental literacy further supports this approach.

The discussion of dichotomies seems to be difficult to avoid if scientific knowledge is regarded as generalisable. When referring to the dichotomizing discussion, it actually seems to have two sides: On the one hand, “western science” is sometimes seen as superior, while other knowledge systems are devaluated. On the other hand, in some cases, it is assumed to be self-evident that local or indigenous people live in harmony with nature and manage its resources wisely (Murdoch and Clark, 1994; McCay, 2001). Both of these views have been criticized (e.g. Thompson and Scoones, 1994; Luukkanen, 2001). Typically, words like indigenous, traditional or local knowledge are used to affirm authenticity (Forbes, 1999), which contains a danger of romanticizing, or even re-establishing the metaphor of the noble savage, of which these terms have been criticized (e.g. Browder, 1995). Thus, although scientific knowledge used to be considered a reference point for environmental literacy, we also include other types of knowledge. However, the significance of scientific knowledge as a framework to which local knowledge systems can be compared is undeniable. In fact, we believe that approaching reality from different points of views and combining them is a fruitful approach.

### 6. Evaluating environmental literacy

Being an individual attribute, environmental literacy can be criticized as emphasizing the individual perspective even though collectiveness, as stressed in this definition, is important both in the formulation of environmental literacy and in affecting activities. Environmental literacy may also be criticized for lacking wider applicability due to difficulties in generalizing its information in practical applications on a large scale. The generalization of research results is difficult not only

because of the variety of ecological, socio-economic and cultural conditions but also because of individual characteristics. However, according to Forsyth (1996), researchers increasingly utilize local knowledge in indicating environmental degradation (see also e.g. Lykke, 2000). It must, nevertheless, be admitted that not only the diversity of information but also varying conditions make it difficult to create effective and sustainable management strategies applicable over large areas. By and large, however, studies of environmental literacy, although not generalisable as such, can be applied when designing strategies to address environmental problems.

Because environmental literacy is based on individual perception, it helps to avoid the problem involved in the term local knowledge, for example, which can be criticized as being inaccurate by definition and failing to provide a tool discriminating enough for the investigation of individual differences and the diverse factors affecting people’s interpretations of their environment. Furthermore, because everyone possesses environmental literacy, mythologizing of the knowledge of any certain group can be prevented. On the other hand, environmental literacy may be regarded as lacking the means to highlight the cultural dimension when discussing the interaction between ecological disturbance and loss of knowledge.

Environmental literacy is linked with environmental behavior; it contains the ability to “write”—interact and use the environment. This can be witnessed in people’s behavior and its consequences. The literacy of environmentally sound practices does not, however, automatically result in sustainable activities either at an individual or community level. As Blaikie and Brookfield (1987) emphasize, individuals are actors who decide how to act in changing situations, but the options for their behavior are regulated by society and the ecological environment. The prevailing circumstances also determine whether or how sustainable environmental collective action is manifested in practice.

The main advantages of the term environmental literacy over concepts such as indigenous or traditional knowledge are as follows: Firstly, it is applicable within heterogeneous groups. Secondly, it is dynamic because it is a result of a process. Thirdly, it is a synthesis and has no inbuilt idea of a dichotomy between scientific and other forms of knowledge and consequently no valuation between different types of knowledge. Moreover, it is manifested in sustainable environmental behavior if conditions are favorable.

As a whole, the definition of environmental literacy refers to no specific environment or locality, lacks the determination of a type of information or how it has been acquired, and excludes no one. It can be studied in rural or urban settings in industrialized or less-industrialized countries. The concept refers to no specific group, ethnic background or residence although it is

developed in social interaction and the role of communities is significant. Environmental literacy is an eclectic mixture containing elements from both scientific and non-scientific knowledge. It can be acquired from direct personal interaction with the environment as well as from various other sources such as relatives and friends, or through education or mass media. Moreover, the study of environmental literacy includes methodological challenges, which we review in the next section.

## 7. Methodological considerations and methods used in the case studies

The research of environmental literacy is a challenging task for various reasons. Firstly, as the main sources of information are verbal expressions and actions of people, several factors may have an effect on what people actually tell the researcher; it is a challenging task to interpret the real meanings. For example, in the case of government campaigns, people may express opinions that they think they are expected to express. Secondly, it may be difficult to verbally describe environmental literacy that develops in everyday life. People are not necessarily conscious of the thinking underlying their actions. These limitations of interviews can be compensated by observation, participation in people's daily activities, and informal discussions. Thirdly, to examine and communicate with people in foreign cultures and environments adds to the challenge, even when a researcher obtains information from literal and other sources. In the case studies of this article, interviews were conducted with the help of interpreters, which further affected the collected data. Fourthly, research needs to concentrate on how people "read" their environment, for instance, how they describe changes, and also on practices, the ability to "write"; we need to study not only the ability to identify problems but also skills involved in environmental protection and rehabilitation. Fifthly, a holistic approach is needed to study literacy of environmental changes in order to reveal the influencing factors. For instance, sometimes people with knowledge and skills have invested no time and effort to enhancing the environment. To understand the reasons behind this, a researcher needs to examine the overall circumstances, including complicated issues such as poverty.

The two case studies in two different areas in Thailand and the Sudan aim to demonstrate that the concept of environmental literacy can be used globally even though the concept is context specific and various views exist also within the communities. Environmental literacy at an individual level is demonstrated by the case of an uplander from Northern Thailand. Otherwise, the focus is on environmental literacy at the village level.

This community based approach aims to illustrate that environmental literacy is at the same time shared and different among the members of the community. In Thailand, several villages were studied, whereas in the Sudan only one village was under study.

The qualitative approach was used in both cases. The primary method was individual interviews with open-ended questions, besides which some thematic focus group interviews were carried out. The role of group interviews was to provide complementary material such as additional information about the use of natural resources and the interactions and power relations in the communities. In addition to interviews, observation (for instance of tree cover or people's activities) was used as a complementary method.

## 8. Case study in the Sudan: villagers' conceptions of environmental changes

The case study in the Sudan concentrated on exploring how inhabitants of a farming village in a dry region described changes in their demanding ecological living environment and why they believed that the changes had occurred. Moreover, farmers' views of the possible environmental rehabilitation of their fragile home area were researched. The village under study was situated in the centre of Sudan, in North Kordofan State, as depicted in Fig. 1.

The Sudan lies in the northern part of Africa, and with approximately 2.5 million square kilometers it is the largest country on the continent in terms of territory (Allan, 1995). Most of the Sudan is covered by dry regions (UNEP, 1997) such as the research area, which is a semi-arid region that has suffered from droughts (Olsson, 1985; Helldén, 1991). To what extent the region has been subjected to negative environmental changes (to desertification or land degradation in particular) has been discussed by the government, international development organizations and researchers. These parties have also expressed slightly different views on the role of local people in contributing to the environmental changes in the area. The government and the development organizations have stressed desertification as an important problem in the area, assuming that both climate and human impact such as overgrazing and cutting vegetation have contributed to the problem (Lamprey, 1988; Helldén, 1991). Some researchers from the University of Lund in Sweden have questioned these assumptions and studied desertification in the area with the help of satellite imagery and field studies. They have stressed that the vegetation cover in the area mainly increases and decreases depending on rainfall, not because of the human impact (Olsson, 1985; Helldén, 1991). Some other researchers from Lund and Khartoum in the Sudan have, however, assumed that people degrade

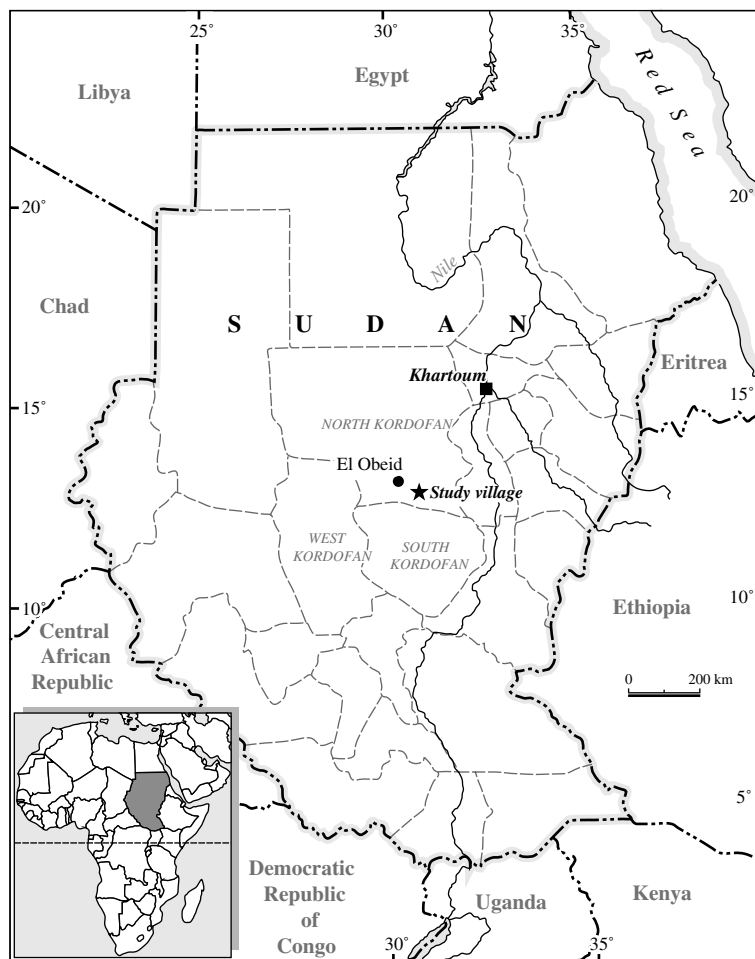


Fig. 1. Map of the Sudan with the research area.

the environment in the area locally, for instance, by too intense farming methods (Khogali, 1991; Olsson and Rapp, 1991). Thus diverse environmental literacy of the changes in the area exists without any clear agreement of the scale of occurrence or the reasons behind the changes.

The farmers of the study represented a village situated approximately 130 km east of the capital of the state El Obeid. According to the leader of the village, *sheikh*, approximately 500 people, mostly from the Arabic-speaking Gawamaa ethnic group, lived in the village of 102 households. For this study, 40 villagers were individually interviewed. They were selected randomly, but at the same time assuring that the interviewed group would be diverse by nature, representing both sexes and variety of ages, levels of education and socio-economic status. The study was conducted in October, November and December 2002.

The natural vegetation of the research area has been classified as woodland savannah dominated by *Acacia* species (El-Dukheri, 1997; Ballal, 2002). The environment in the study village consisted of sandy paths and

fenced homesteads with round thatched wooden huts often with adjacent neem trees (*Azadirachta indica*). The surroundings of the village were characterized by both the natural vegetation and agricultural fields. Around the village the majority of the interviewed farmers practiced a shifting cultivation system in their agricultural plots. In this system, a piece of land was cultivated until the yields dropped to a certain level, after which the farmers shifted their agricultural production to another piece of land. The new land was prepared for cultivation by clearing and burning it. The most common tree species of the area, called *hashab* (*Acacia senegal*) played an important role in this system. *Hashab* was mostly grown on fallow lands, in plots separate from the other agricultural crops. The farmers cultivated land of various sizes, and also the cultivation and fallow periods varied. Moreover, some farmers were obliged to rent their land each year and had no fallow period at all. The main cultivated crops were sorghum (*Sorghum bicolor*), pearl millet (*Pennisetum typhoides*), karkadeh (*Hibiscus sabdariffa*), sesame (*Sesamum indicum*), and groundnut (*Arachis hypogaea*).

The soil in the research area is mostly sandy soil, locally called *qoz* (El-Dukheri, 1997). Water has been an important limiting factor of agricultural production. The region has suffered from scarcity of water during the 20th century, which has been characterized by rather limited and highly variable rainfall (Olsson, 1985; Meteorological Department, 2002). The 1990s was, however, characterized by rather high precipitation for the average mean annual rainfall of the decade reached 380 mm in El Obeid (Meteorological Department, 2002). At the same time, even in such years, high daily temperatures lead to intensive evaporation. The sandy soil causes additional problems due to its coarse texture and poor water holding capacity (El-Dukheri, 1997).

### 8.1. Literacy of the environmental changes and their causes

The environmental literacy of the farmers in the study village had been affected by various sources of information. The single most important source had been older family and community members, and farmers' close interaction with their environment. Personal experience and traditional knowledge were, however, also mixed with the information from other sources. Farmers had received environmental information from the government, from at least one international development organization, schools, and people outside the village.

To examine farmers' literacy of environmental changes, it was first asked from the 40 farmers whether their environment had changed during their lifetime and if so, what kinds of changes had taken place. They commonly reacted to these inquiries by describing that their environment had changed for the worse. Many farmers, however, described only one change, which was usually reduced productivity of their agricultural lands.

Moreover, the majority of the men and approximately 40% of the women described changes in vegetation cover. In most of these interviews farmers simply stated that there used to be more trees in the area. In three interviews farmers also mentioned that the grass cover had diminished over the years. Three farmers also stated that the quality of the trees had degraded and that they were now "less green" than before, indicating that the trees produce fewer leaves. Finally, two farmers also mentioned that there were fewer domestic animals in the area than before, describing how the last extremely severe drought in the 1980s had caused serious livestock losses.

After the farmers had described the environmental changes, the reasons behind the negative changes were discussed with all of them. The main cause behind the changes was a subject of wide consensus, for in all of the interviews lack of rain was stressed. On the individual level, environmental literacy included differences in viewpoint on rainfall patterns and their significance to the environment. While most farmers claimed that the

rain had diminished gradually over the years, some individual farmers stressed that particularly the severe drought that occurred in the area in the 1980s had degraded their environment.

Farmers did not stress their own role as agents that had affected their environment. In fact, less than a third of the interviews mentioned human impact at all. Moreover, although the majority of the farmers said that the amount of trees had reduced, only six of them cited cutting trees as a cause of this diminished number. In two of these interviews, it was not disclosed who the cutters were and why the trees had been cut. In other interviews, the farmers presented themselves as cutters either in connection with land clearing for farming purposes or with cutting trees for firewood and the charcoal trade. The firewood trade was explained by poverty since the farmers stressed that poor people were obliged to trade wood in order to survive.

As a whole, people rarely mentioned cutting firewood for their own domestic use as an activity that would harm the environment. When some farmers were asked separately whether they thought that cutting of domestic firewood affects the environment, most of them agreed. In addition, some farmers said that they only use dead wood or old trees in order to minimize the environmental impact of their activities. Since this might not always be possible, it raises a question of power—what kind of ideas did the farmers feel that they were expected to express? The villagers have been affected by forestry extension and awareness activities by the government and mainly in the 1980s by an international development organization. Thus, it is difficult to judge whether these answers reflected people's true sentiments, for they might have felt obliged to express views they felt were the "proper answer" to the researcher. Nevertheless, during the study it was observed that while the woodfuel traders commonly cut most of the tree (including stem), the farmer women normally cut individual branches from a part of a tree. Thus, the environmental impact of the firewood and charcoal trade on an individual tree was clearly more severe than the impact of domestic firewood cutting.

Although the reduced productivity of agricultural land had earlier been described as the main environmental problem, people seemed to be perceived as having a rather limited role in connection with this phenomenon. In fact, only four farmers said that farmers had negatively affected their environment by harmful farming methods such as shortened fallow periods and uncontrolled use of fire. A farmer also mentioned that animals had particularly affected the environment. Furthermore, one farmer also mentioned an economic cause describing that the low price of gum-arabic, a staple export product of the Sudan, has encouraged cutting *hashab* trees in the fallow land in order to have more land available for agriculture.



Table 1

Environmental literacy of the farmers interviewed ( $n = 40$ ; 22 women and 18 men) on indicators of, and reasons for negative changes in the environment

Indicators of environmental changes	Number of interviewees			Reasons for negative changes	Number of interviewees		
	Women	Men	Total		Women	Men	Total
Land produces less	18	15	33	Lack of rain	21	18	39
Reduced vegetation	9	15	24	Tree cutting	4	2	6
Trees are less green	1	2	3	Reduced fallow periods	0	2	2
Fewer animals	0	2	2	Mismanagement of fire	1	1	2
				Animals feed on grasses	0	2	2
				Low price of gum-arabic	0	1	1

Table 1 illustrates how clearly the rain was seen as a central factor affecting the environment. The only person interviewed who did not mention it was a farmer woman who was new in the area through marriage and was therefore not able to discuss the rainfall patterns in the area over the years.

The farmers that interacted with their environment regularly had detailed environmental literacy of their environment and had also monitored its changes. Therefore, it seems unlikely that most people would believe that their livelihood activities of firewood collection and agricultural production had not affected the environment at all. To what extent the farmers believed these activities to affect their environment remained, however, unclear. In any case, the farmers perceived the illegal cutting of trees for the firewood and charcoal trade as more harmful activities than domestic firewood cutting.

### 8.2. Environmental literacy of the activities to address the negative changes

Both the women and men in the study conducted diverse agricultural tasks, having commonly planted trees in their farming systems and on their homesteads. Thus, the villagers were not only likely to have literacy of their environment as such, but also skills to address the environmental changes with activities such as planting trees. However, when forty farmers were asked whether they

thought local people could address the negative environmental changes, only six farmers mentioned, as indicated in Table 2, that planting trees could be useful in order to rehabilitate their environment. All of these farmers viewed tree planting as something each farmer household could do on the particular land they managed. Planting trees on common property land was not suggested at all.

At the same time, most farmers claimed that there was nothing people could do to address the changes, since changes in agricultural crops and in natural vegetation had been regulated only by rain. Those farmers that suggested activities to address the environmental changes normally described one activity, which was either planting trees, protecting trees from cutting or an improved farming technique. Most farmers practiced a farming system in which they not only shifted agricultural production to a former fallow area after the land under cultivation had been exhausted, but also rotated the crops inside the agricultural plots each year to increase the productivity.

Although the significance of human activities in environmental rehabilitation was quite commonly doubted, three farmers gave longer answers than the others, describing several human activities that could benefit the environment. Two of these farmers were teachers at the village school.

The above described environmental literacy leads to a difficult question, namely, which factors in local

Table 2

Environmental literacy of the farmers interviewed ( $n = 40$ ; 22 women and 18 men) on means to address negative environmental changes

Views of the means to address negative environmental changes	Number of interviewees		
	Women	Men	Total
People are unable to address changes	16	10	26
Planting of trees should be done	3	3	6
Protection of trees from cutting is needed	2	2	4
Fertilizers are needed for agricultural land	2	2	4
Sufficiently long fallow time is needed	1	2	3
Fire control on croplands should be improved	1	1	2
Protection of trees from animals is useful	0	1	1
Awareness should be improved	0	1	1

circumstances have contributed to these views of humans as relatively powerless to address environmental rehabilitation. These factors seemed to be both ecological and social. The farmers emphasized mainly ecological factors, stating that since they were unable to affect the rainfall fluctuations in any way, they could not really address the environmental problems. At the same time, in other parts of the interviews many farmers disclosed that they used a shorter fallow period than before. The reasons behind this behavior seemed to be social, since some farmers mentioned that households' agricultural plots were becoming smaller due to inheritance and it was difficult to make livelihood with only small agricultural plots. Moreover, some households owned no agricultural land, but rented a plot each year from other farmers. These farmers used no fallow period at all. Thus, it seems that poverty and population growth contribute to the intensification of farming methods and ultimately, both rainfall fluctuations and intensified land use practices affect the agricultural land.

The farmers had made such decisions about land use that seemed to have, at least to some extent, degraded their precious agricultural land as well as the woody vegetation. It would, however, have been difficult to behave otherwise for people have limited livelihood options available since education and career possibilities are limited. These circumstances may contribute to fatalistic thinking. As a result, people in the village continue to follow largely traditional livelihood strategies, hoping and praying rain from God. Furthermore, most of the families in the village earn extra income by sending their men to work outside village for several months a year, normally to Khartoum, the capital of the Sudan. Seasonal migration has occurred in the area for decades, but it has been on the increase since the last extremely severe droughts of the late 1960s and early 1970s and particularly since the severe drought of 1984/1985 (Myers et al., 1995). In addition to droughts, the degradation of cropland is probably the main ecological factor contributing to migration.

In sum, people were well aware of negative environmental changes in their area. They had also rehabilitated their environment by planting trees in farming systems and on their homesteads, but their main motive of planting was not environmental rehabilitation. Although some farmers suggested planting of trees for environmental rehabilitation, it was more common to view trees as valuable for other reasons, such as shade or firewood. The farmers that suggested planting to rehabilitate the environment, regarded the planting as an activity farmers could do in their private lands, not on common property land. Thus, villagers' environmental literacy did not seem to include ideas of collective action in common property land to protect and rehabilitate their environment.

## 9. Case study in northern Thailand: views on deforestation

The case study of northern Thailand examines local environmental literacy in regard to forests and their management.<sup>4</sup> Here the focus is on people's views of deforestation, its causes and consequences. The fieldwork for this research was conducted during January–March and October–November 2002 in the Chiang Mai Province in six villages (Fig. 2.). Five of these villages were situated in the Mae Chaem District and one in the Chomthong District. Four villages in Mae Chaem and one in Chomthong consisted of ethnic minorities in the uplands; in addition, a lowland Thai village was studied. The villages were selected primarily on the basis of ethnic group and forest area. The condition of the forest that surrounded the villages varied. Moreover, one village was located in the Doi Inthanon National Park area, and three of the villages were situated in the vicinity of a planned national park.

The villagers' conceptions of deforestation and forest conservation were investigated in six villages and within four ethnic groups: the Karen, Hmong, Lua and Thai. Group interviews were carried out to complement the individual and key informant interviews. Altogether seventy interviews (of which sixty are used for this paper) were conducted in the villages with the help of interpreters. Interviewees represented both sexes equally, and people of various ages. The households' income level, particularly in the upland villages, was low compared to the national average. The main source of income for the respondents was agriculture but the field size was small, on average only 10 rais (about 1.6 ha).

Mountainous topography and several ethnic minority groups living mainly in the uplands are characteristic of the northern part of Thailand. The ethnic minorities have nowadays a more significant role in forest management and conservation than before. This is a result of the logging ban of 1989, which prohibited all commercial activities in natural forests, and thus made the forest dwellers the main users and managers of the forest resources (Poffenberger, 2000). The logging ban was framed to restrain deforestation, which had been rapid particularly since the 1960s. At present, forests cover 29% of Thailand's land area (FAO, 2003); the most forested region of the country is its northern part where roughly half of the land area is classified as forest (44%: RFD, 1997; 57%: RFD, 2001). The main forest types in the north according to the Royal Forest Department classification are the dry dipterocarp, tropical evergreen, and mixed deciduous forest (RFD, 1997). The natural conditions of northern Thailand are characterized by a monsoonal climate with distinct dry and rainy

<sup>4</sup> Management is here understood in a broad sense covering also use and conservation. By and large, it refers to actions purposefully taken or not taken in the forest.

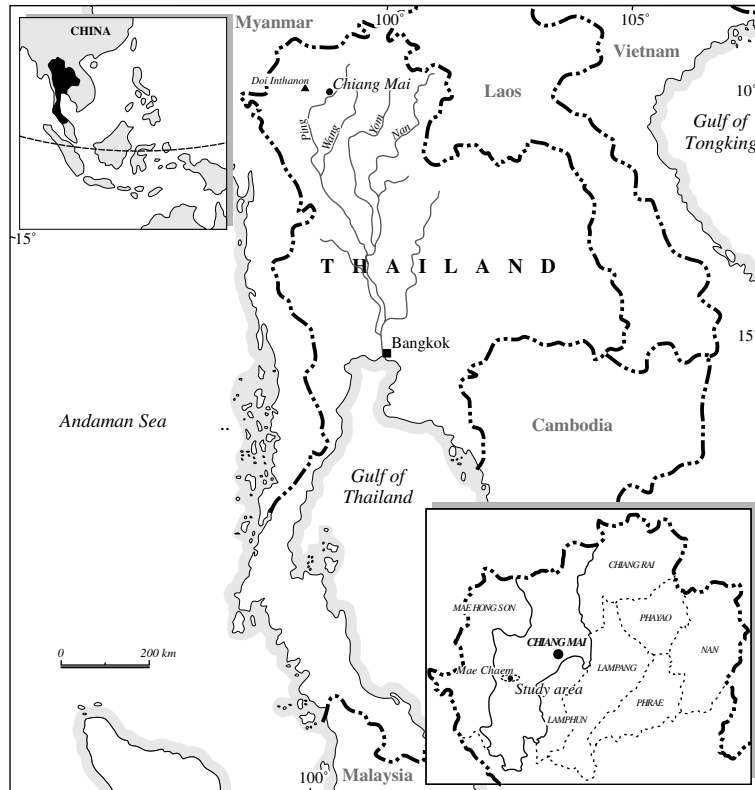


Fig. 2. Map of Thailand and location of the study area in Chiang Mai Province.

seasons. Average annual precipitation is approximately 1200 mm, but variation in rainfall occurs within the region due to mountainous topography.

The area under study is mostly upland, and lowlands constitute only 10% of the area (ICRAF, 2001b). Forest covers an extensive area; in Mae Chaem, 70% of the land is classified as forest (Mae Chaem District Office, 2001). A relatively high percentage of land falls under the category of forest also in Chomthong, and a considerable share of that is preserved forest in the Ob Luang—Doi Inthanon National Park. All in all, large areas in both districts are classified as protected, and, therefore, in many places all forms of land-use are prohibited. This restricted land-use due to conservation, steep slopes with limited arable land, and population growth are central to increasing the pressure on land resources. Despite the large area of preserved forest and the national logging ban on natural forests, deforestation and environmental degradation still exist (Kaosa-ard and Wijukprasert, 2000). It is estimated that the forest cover in Mae Chaem has diminished by eight percent during the past 10 years (ICRAF, 2001b).

In Mae Chaem, 45% of the population lives within the protected forest and another 7% in planned reserves (ICRAF, 2001a). Ethnic minorities comprise 72% of the population of Mae Chaem, where the Karen form the largest group, and the Hmong, Lua and Lisu make up the rest of the ethnic minority population. The minority

groups tend to inhabit the uplands, whereas the Thais typically occupy the lowlands. The Hmong tend to live at high elevations (1000–1600 m above sea level), the Karen and the Lua at middle elevations (600–1000 m), and the Thais in the lowland areas (300–600 m) (ICRAF, 2001a).

### 9.1. Consequences of forest loss and locally suggested solutions

An environmental concern in the study area, caused mainly by agricultural expansion and to some extent illegal logging, is deforestation. It occurs today on a smaller scale than some decades ago, primarily due to the government's strict conservation policy and control. The questions under examination were: How did the local people explain the reasons and consequences of deforestation and forest degradation, and what suggestions did they make to counteract these problems?

The majority of the interviewees indicated that nowadays the study area no longer had deforestation, at least on a large scale. Related to this, one-fourth of the interviewees identified no present day environmental problem. Nevertheless, many respondents expressed concerns, mostly related to the forests and water, the latter of which was viewed as the most important service the forest provides.

When these concerns were voiced, agriculture was perceived as the main reason for deforestation both in the past and today. Rotational slash-and-burn cultivation used to be viewed as a significant cause of forest loss. The expansion of farmland, also linked to increasing demand for land due to population growth, was regarded as a primary reason for the present deforestation. In addition, logging was seen as another cause of forest destruction, particularly in the past when commercial logging was still legal. Illegal logging is, however, to some extent a problem. Some villagers considered cutting trees even for household construction as a cause of forest loss.

In general, the villagers were well aware of negative impacts of deforestation. Only a few people from one village, located inside the Doi Inthanon National Park in the middle of a relatively undisturbed hill evergreen forest, stated that they had seen no effects and could not imagine a situation in which no forest existed. Based on the interviews, the most crucial effect of the disappearance of forests was shortage of water. Several people in each of the villages studied had observed a decreased supply of utilizable water. The interviewees used, for example, the runoff in an adjacent stream or river as an indicator of this phenomenon. In some cases, people also noted the threat of floods as one consequence of deforestation. Another consequence of deforestation described was a change in local weather conditions: decreased rainfall and higher temperatures.

People commonly expressed the worry that they would be incapable of living in non-forested areas because they would have difficulties in agricultural production and could no longer obtain forest products. Another concern included fires, which the interviewees said occur more frequently when the forest is degraded. Some lowlanders, however, did not consider burning of the forest as deforestation. Human activity was viewed as the main cause of forest fires. A few respondents regarded fires as already a problem of the past because the state of the forests in the area had improved due to the actions taken both by governmental and non-governmental organizations to prevent fires. Despite this, fires can be seen on many hillsides at the end of the dry season.

A typical response to the question on how to stop deforestation was that the forests need to be conserved; actually a fair number of many people could not think of any other solution aside from conservation. In addition to conservation, people suggested that already degraded and deforested areas should be reforested. Furthermore, education, fire prevention, and management efforts, such as clear division between usable and conservation forest, as well as between forest and agricultural land, were considered central in conservation. It was also indicated that conservation measures taken

during the past two decades had been effective: The number of trees in surrounding areas has increased, and the state of the environment has improved. Rules and control, set both by the government and the villagers, were regarded as important means of protecting the forest, and successful in stopping deforestation. Other solutions for environmental problems included changes in farming systems, enhanced flow of information, as well as better cooperation at all levels. In particular, the significance of local collaboration within and between communities was emphasized.

Other factors besides environmental literacy also have a considerable influence on people's behavior and practices, and sometimes they provide a better explanation for actions taken than the ability to interpret the signs of nature. As the interviews imply, the most significant of these factors in this study area seemed to be economic circumstances, population growth, which increases demand for agricultural land, and government policies regarding land-use and the forests. Moreover, in some villages forest fire was classified as an outside factor affecting the surrounding environment but not being controllable by the villagers themselves; upland dwellers sometimes accused the lowland Thais, and even government officials, for burning the adjacent hillsides despite the efforts of the villagers.

In the study area, the government's forest conservation policy has had a significant effect on the natural resource management and land-use of the communities, primarily due to its two goals: an aim to establish new protected areas, and efforts to forge a change in uplanders' agricultural systems. The officials have actively worked to stop rotational slash-and-burn cultivation to conserve the forests. In addition, the Royal Project has promoted the cultivation of cash crops on permanent farms as a source of income to replace the growing of opium poppy in the uplands. The local inhabitants have had to adapt to the changes in agricultural systems, for instance, by changing over from traditional systems to chemical-based farming. This change has taken place despite limited agricultural extension services in the use of the chemicals in many remote upland villages, and despite people's concerns over the health, environmental and economic effects of chemical use.

Environmental literacy seemed to have been constructed of information from several sources, of which the oral ones were the most important. People had commonly learned about the environment from their parents, older people and other villagers. Village meetings also had a role in distributing information but primarily only among men. Training within forestry and agricultural projects, as well as formal education were noted as sources of environmental information but the role of mass media appeared minor. A special characteristic in Thailand is the role of the Buddhist temples in providing teaching about nature.



### 9.2. A Karen woman's view: living in the forest requires conservation

To illustrate the individual aspect of environmental literacy, an example of an individual villager is presented. The purpose in selecting this example was not to seek the best representativeness, which would have been very difficult to determine, but simply to demonstrate one typical case. Thus, a case of a middle-aged Karen woman is reviewed here. This woman lives in a Karen village where people have shifted their agricultural practice from rotational cultivation to a permanent one. Most of the villagers were engaged in agriculture, while weaving and work as a wage laborer provided additional income. People in the village were Buddhists but they had held on to their traditional beliefs as well.

A 40-year-old Karen woman, referred to here as Ms J., whose main occupation was farming and who had no formal education, knew her environment well. She was a migrant from the neighboring Mae Hong Son province but had already lived in the village for 17 years. She had moved to the village to get married, and her husband was actively working to develop the village and promote environmental conservation. As the other villagers, Ms J. stopped rotational slash-and-burn cultivation about 10 years ago. Moreover, despite health problems, she had participated in reforestation activities arranged both by governmental and non-governmental organizations. In addition, she had planted elephant grass to prevent soil erosion on slopes adjacent to the village.

The forest was very important to Ms J., and she stated that people in the village could not live without it. To her, the natural forest was a habitat for many wild animals, such as tigers that kill oxen and gibbons; she added, however, that many wild animals no longer existed in the surrounding area. The importance of the forest was indicated in religious rituals as well. Ms J., as many other villagers, sacrificed to the spirit of the origin of water, which was believed to be very holy and powerful. Buddhist ceremonies were performed in the forest as well; one important ritual in upper watersheds and other areas where forest protection is regarded as particularly significant was to ordain a tree as a monk. Thus, religious traditions played an important role in the village, and that probably had an effect on environmental literacy as well. For example, some villagers believed that the spirit of the mountain, who was angry for some reason, caused the exceptionally severe floods in 2002.

Ms J. regarded deforestation as still a problem in the village area because the cultivated area was expanding. She explained that one reason for this is the need for money for fertilizers, which now have to be used because fields are smaller than before, and no field rotation can be practiced owing to stricter rules of forest protection. She added that if the area were left unburned, trees

could grow, but the lowlanders burned the hillsides near the village. A common reason for burning was a species of mushroom, which was believed to be found only if the area was burned. Ms J. explained that the water level decreases when the forest is burned. As a consequence, wild fowl, for example, are now less common because fire destroys their eggs, which they lay in winter when the humidity is suitable. The main problem with burning, however, was seen to be the decreasing availability of water. People faced a problem: They needed to use agricultural chemicals in their fields if burning was forbidden. In sum, Ms J.'s opinion was that "if you stay in the forest, you must preserve it".

### 9.3. Environmental literacy of the villagers

The view of the local people that, after the national logging ban, agriculture is the most significant single cause of deforestation is widely accepted. It is also recognized that illegal logging is still a problem, at least to some extent. The consequences of deforestation as the villagers perceive them include changes in water balance and microclimate, and the consequent effects on agricultural production and the availability of collectable non-domesticated products. These forest dwellers had recognized the importance of environmentally sound systems of land-use, which often became evident in the traditional ideas of conservation. The current protective government policy was commonly seen as a welcome method of forest management although the capability of local people to manage their forests was usually emphasized.

It can be concluded that generally the people in the area studied had a clear view on deforestation, and they recognized the significance of the forest to their lives. This understanding was not only a result of personal experience but also of education and training (organized, for example, as a part of government and NGO projects), and learning from relatives or other villagers. Cultural impacts on environmental literacy were most clearly seen in religious traditions, which in the villages indicated people's respect for forests and nature.

## 10. Discussion on the results—what was learned?

In Thailand and the Sudan, interviewees acknowledged and assessed the environmental changes in their home area. The same result has been obtained also in several other studies of rural people's environmental perceptions (e.g. Chokor and Odermeh, 1994; Bollig and Schulte, 1999). This environmental literacy alone might, however, be insufficient for alleviating environmental problems such as deforestation. Since protection and rehabilitation of the degraded environment require collective action, awareness of this action should be

included in environmental literacy. Furthermore, collective action can be realized on the condition that people are convinced of the benefits and they have knowledge and skills for the required tasks. The results implied a difference in perceiving the possibilities of collective action: in the Sudan, people felt skeptical towards it, whereas in Thailand it was stressed as being crucial.

Perceptions of the reasons for and suggested actions to address environmental problems somewhat differed in the research areas in Thailand and the Sudan. The insights in Thailand commonly included an indication that the environmental problems were derived from the activities of the local residents, such as the conversion of forest to agricultural land. Furthermore, the interviewees could generally mention at least one measure that people could carry out to promote environmental rehabilitation. In the Sudan, however, environmentally unsound human activities were regarded as a minor factor in causing degradation problems. Most of the farmers interviewed held the view that no human activities could really address environmental degradation.

People's views about their own role in addressing environmental changes were commonly optimistic in Thailand's case whereas they were much more doubtful in the Sudan case. In both cases, however, the interviewees seemed to possess the skills to respond to environmental changes, for instance by planting trees or changing agricultural practices. In Thailand's case, the problem was to conclude whether the optimistic views really reflected people's true literacy or whether they gave the answers that they thought were expected. The Thai case illustrates how the power aspect is connected to environmental literacy. To some extent this also concerns the Sudan case, because the government's and the development organisation's forestry and awareness-raising activities have also affected the villagers. However, awareness activities have been less intense in the Sudan than in Thailand. The case of the Sudanese farmers who were doubtful about their possibilities for contributing to the alleviation of environmental problems, presents an example in which many individuals seem to have the skills to protect and rehabilitate the environment but commonly lack confidence that investing time and effort to environmental work would significantly help.

The reasons behind the differences in the ways people perceived causes of and solutions to environmental problems in the research areas of Thailand and the Sudan were complex, including ecological and social factors. One important aspect was that although the natural environment in the research area in Thailand was degraded in many places, the environmental capacity was not as limited as in the Sudan. Generally speaking, human activities seemed to have contributed to environmental degradation in both areas although the droughts in the Sudan had had serious environmental impacts as well.

Outside projects give another perspective. The government of Thailand attempted to control deforestation by tight regulations and various forestry and agricultural projects, which were also implemented in the research area with the assistance of local inhabitants. In contrast, in the Sudan, a country affected by a civil war, withdrawal of international projects and scarce resources allocated to environmental rehabilitation by the government had left people with less support than in Thailand. On the other hand, although the socio-economic status of the people interviewed varied, the informants of both cases could generally be considered as having a relatively low socio-economic status. However, the villagers in Thailand seemed to have a rather optimistic view of the future, whereas most of the people studied in the Sudan appeared not to believe that their home area could be significantly developed with common activities.

The Sudan case also illustrates how the research on local people's environmental literacy provides a necessary contribution to the discussion of the significance of environmental problems. The research area has been the subject of a debate by scientists and developers on how significantly it is affected by negative environmental changes. Interviewees commonly perceived that the environment was degraded, which impeded their livelihood.

The two case studies seem to support the argument that environmental literacy affects citizen behavior or, further, environmentally responsible behavior and finally sustainable development—although here the effect of other factors, such as poverty, population growth and pressure on land resources, is emphasized. Personal observations and experiences, learning from parents and other relatives, as well as communication with other community members are central in evolving an understanding of the surrounding environment. Formal and other kinds of education and training, given, for instance, within agricultural and forestry projects, also have a distinct role in building environmental knowledge. Although mass media provides a considerable potential for constructing environmental literacy, in the case study areas it was still a minor source of information.

## 11. Conclusions

The redefined concept of environmental literacy has here been reviewed and compared with other similar concepts, and illustrated by two case studies. The concept aims at wide applicability using a holistic approach. Dynamism through the need for adapting to changes in the environment, applicability, which is restricted by no environmental setting or group characteristics, and synthesis of information from various sources were all

considered important in the definition of environmental literacy. In the case studies, we looked at people's understanding of their environment in a broader socio-economic, historical, and cultural context than the sole examination of specified knowledge regarding, for instance, identification or classification of species or soils. In addition, an attempt was made to provide insight into the local views of environmental problems in these areas (see also Niemeijer and Mazzucato, 2003).

We admit that environmental literacy is inevitably context-specific and affected, as is environmental behavior, by other factors such as power relations. However, we also believe that people's coping strategies may have a broader applicability in solving environmental problems, and that combining environmental literacy from two or more, even different, areas may result in innovative solutions. Combining different actors' environmental literacy can be fruitful in providing a critical view of prevailing conceptions and for creating new ideas (cf. King, 2000). Even if broad applicability is lacking, the study of environmental literacy has at least local significance. Understanding people's individual and shared conceptions and their interpretation of processes, as well as the reasons behind practices, is essential in assessing and devising sustainable management systems relevant to the local context. In sum, it may well contribute to designing suitable collective actions in different circumstances, which often is the key for environmental development.

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