

Nguyen, T.H. and Ross, A. 2017. Barriers and opportunities for the involvement of indigenous knowledge in water resources management in the Gam River Basin in north-east Vietnam. *Water Alternatives* 10(1): 134-159



Barriers and Opportunities for the Involvement of Indigenous Knowledge in Water Resources Management in the Gam River Basin in North-East Vietnam

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ABSTRACT: Water resources management today has shifted from a purely technical response to one that involves multiple stakeholders to allow for cross-cultural and cross-issue discussion and cooperative management. However, the integration of indigenous knowledge and local people into mainstream natural resources management is still restricted due to epistemological and institutional obstacles. This research explores the differences in perceptions of the nature of water resources, and their consequent management, existing between local people and the government in the Gam River Basin of Vietnam, concentrating on the views of the majority Tay and Dao peoples. We focus on how knowledge differences can be communicated and how water management can integrate different ways of knowing. We identify barriers to, and opportunities for, the involvement of indigenous knowledge and local people in water resources management at the research site. We argue that local needs and aspirations in relation to the use and management of water resources do indeed have a role in the modern world, contrary to the views of many scientists and government officers. Therefore, indigenous knowledge needs to be considered in water resources management schemes, to achieve the effective and sustainable use of water in areas such as the Gam River Basin.

KEYWORDS: Indigenous knowledge, traditional ecological knowledge, water management, ethnic people, Gam River Basin, Vietnam

INTRODUCTION

Improving access to water supply and associated services is important for human health and well-being and is crucial to the development of a country or region (Gunawansa et al., 2013). However, due to the rapid growth in international trade and the increasing demand for food, energy, goods and services, the problems of both scarcity and quality of water are increasing and there are now problems in relation to water management at regional and global scales (Falkenmark, 1990; Dellapenna et al., 2013; Gupta and Pahl-Wostl, 2013). Today, water resources management (WRM) has changed from a purely technical response to one that involves multi-stakeholder inputs, including those from civil society organisations (CSOs)¹ and indigenous people (Critchley et al., 1994; Menon et al., 2007; Pahl-Wostl et al., 2007; der Porten and de Loë, 2013).

¹ CSOs include organisations such as international and local NGOs, and mass organisations. International organisations such as World Bank (WB), Asian Development Bank (ADB), and United Nations (UN) are not CSOs.

There are many different forms of water management depending on economic, cultural, traditional and political norms as well as policy and legislative frameworks. One of the key elements in present-day management involves the creation of an institutional and administrative framework fostering and encouraging the involvement of people with different interests and allowing cross-cultural and cross-issue discussion, and cooperation and coordination of management actions (Rogers and Hall, 2003; Crevello, 2004).

In water management schemes in Vietnam in general, and in the Gam River Basin (GRB) in particular, local people continue to be largely ignored. Yet local people are keen to be part of the decision-making process (People and Nature Reconciliation [PanNature], 2006). Nevertheless, the government water management bureaucracy has a range of policies and principles based on science and ideology that leave little room for indigenous knowledge (IK) and local desires within these science-dominated policies (IUCN, 2009; PanNature, 2006).

In this article, we examine the interest of the majority Tay and Dao peoples in the GRB and their aspirations to be invited to the water management decision-making table. We investigate the nature of the barriers to local involvement, and particularly the incorporation of local knowledge, in decision-making in the GRB specifically, and examine the consequences for water management in Vietnam generally. We demonstrate that there is considerable potential for integrated water management in the GRB, but a lack of communication about the different ways of knowing is a significant barrier to shared knowledge and resources management engagement.

Research methods

Our research is a qualitative examination of the participation of local people and their knowledge in natural resources management (NRM) in general and WRM particularly in the GRB in northern Vietnam. The research is primarily a desktop study with a limited number of interviews (Table 1): the interviewees were four government officials responsible for water resources management in the Department of Natural Resources and Environment and Department of Agriculture and Rural Development at provincial and district levels; and with four Tay or Dao village leaders, who have a good command of their locality based on customary law, and who are high-ranked members of their villages. Interviewees were selected from those actively involved in water-related projects conducted by a wide range of organisations; they were introduced to us by NGOs and experts who have worked in the field of water resources management (WRM) in the basin over many years. The interviews were undertaken to provide empirical corroboration, or refutation, of more theoretical arguments about the role of IK in WRM gained from literature reviews. All interviews were conducted in the period from 15 March to 15 April, 2015.

Critical evaluation of the data collected from the interviews is used, in combination with the information from secondary sources, to investigate the range of policies and procedures adopted by water management personnel to investigate the opportunities and challenges to IK involvement in water management decision-making in the GRB.

Background

The Lo-Gam River Basin is in the upstream area of the Red-Thai Binh River Basin in northern Vietnam (Figure 1). Originating from the Yunnan Province in China, the Lo-Gam River Basin includes four main rivers: the Lo, Gam, Chay and Pho Day. The GRB is the largest sub-river system in the Lo-Gam River Basin (Ministry of Natural Resources and Environment [MONRE], 2009).

Table 1. List of interviewees.

Interviewee (code)	Position	Description
VILL001	Village leader	Lives in a village in the upper reaches of GRB. He belongs to the Tay group in Bao Lam District.
VILL002	Village leader	His village is in the middle reaches of the GRB; he has participated in some projects conducted by NGOs. He belongs to the Tay group in Bac Me District.
VILL003	Village leader	A leader of a village in the upper reaches of the GRB and belongs to the Dao group in Nguyen Binh District.
VILL004	Village leader	His village lies in the lower reaches of the basin, close to where the Tuyen Quang hydropower station is located. He participates actively in various NGO projects, particularly in villager research on water-related management. He belongs to the Kinh group in Na Hang District.
GOV001	Government official at district level	Works in the DARD in Na Hang District where the hydropower station is located. He comes from a district of lower Lo-Gam River Basin.
GOV002	Government official at district level	Works in the Spell out (DONRE) in Bac Me District in the middle reaches of the basin, and is actively involved in a project conducted by an NGO. He was born in the basin and understands local customs and culture.
GOV003	Government official at provincial level	She is responsible for managing water resources in upstream areas of the basin at the provincial level. She was born in the Cao Bang Province in the basin.
GOV004	Government official at provincial level	Her responsibility is water management in the downstream area of the basin at the provincial level in the Tuyen Quang Province.

There are 757,000 people living in 186 communes along the Gam River (Ministry of Agriculture and Rural Development, 2013). The majority of these populations live in rural areas. There are 14 different ethnic groups in the basin, including Kinh, Tày, Nùng, Hmông, Dao, Sán Chay, Sán Diu, Lô Lô, Cờ Lao, Bồ Y, Pà Thên, La Chí, Phù Lá, Pu Piéo (Table 2). The four groups that account for the majority of the population in the basin are the Tay, Hmong, Dao and Kinh (WARECOD, 2014).

The Hmong people, who have been in Vietnam for about 300 years, often live in high areas far from the river (Vuong, 2016). By contrast, Tay people, who have lived in Vietnam for over 1000 years (VOV4, n.d.), live in valleys and mountain foothills along the rivers (Cao Bang Portal, 2013; VOV5, 2015). A major part of resident areas along the Gam River in provinces of Cao Bang, Bac Kan, Tuyen Quang are villages of Tay people. Dao people, who have been in Vietnam since the thirteenth century (Global Wandering, n.d.), live in higher areas than the Tay people. However, their villages are still close to the river and streams. Kinh people mainly live in the towns of the Na Hang, Chiem Hoa and Yen Son districts. In this research, our focus is with those peoples who are most closely associated with the rivers and streams of the GBR: principally, the Tay and Dao people.

The Gam River and its resources play an important role in the lives and livelihoods of local people, particularly those living in riverine communities. Large volumes of water are used for agriculture and agroforestry. The river is also important for fishing and aquaculture. Rivers, streams and waterfalls are

the main sources of water for domestic uses such as drinking, cooking, washing and swimming (WARECOD, 2014). Nationally, the GRB is important for a range of development projects, particularly hydropower dams and reservoirs.

Figure 1. The Gam River Basin in Vietnam (WARECOD, 2014).

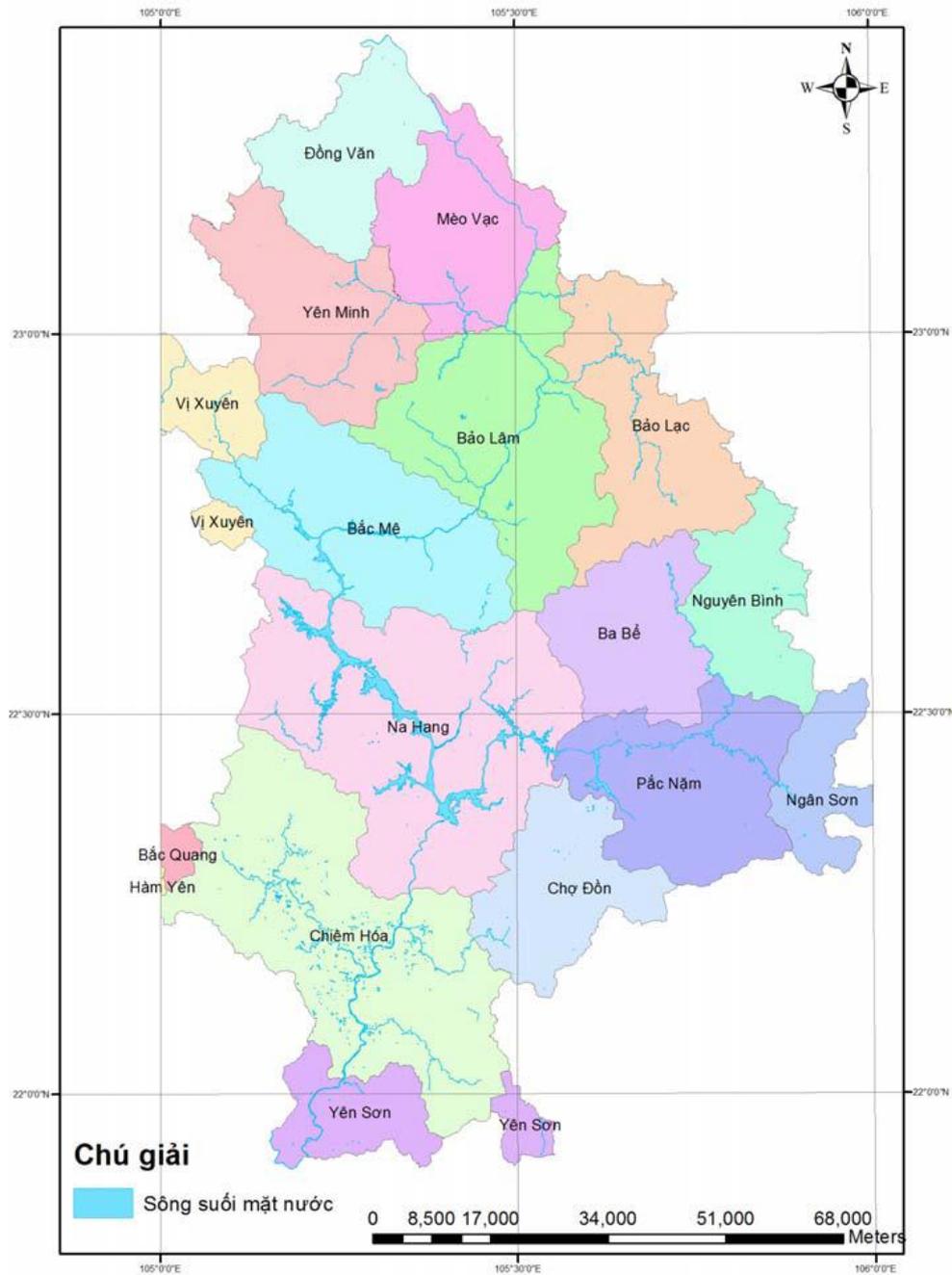


Table 2. The proportion of ethnic groups in the various districts in the GRB.

Province	District	Population	Names of ethnic groups	Tay people (%)	Hmong people (%)	Dao people (%)	Nung people (%)	Kinh people (%)	San Chay people (%)	Other (%)
Tuyen Quang	Na Hang	60,532	Tay, Dao, Kinh, Hmong, Hoa, Nung, other	55.2	7.5	25.7	0.50	10.1		0.10
	Yen Son	159,668	Kinh, Tay, Dao, Hmong, Nung, Thai, Muong, Kho Me, Hoa, San Chay, San Diu, other	13.2	4.5	13.9	2.4	54.1	10.7	1.2
	Lam Binh	29,983	Tay, Dao, Hmong, Kinh, Nung, San Chay, San Diu, Hoa, Pa Then, other	59.7	6.8	27.4	0.03	4.1	0.1	1.8
Cao Bang	Bao Lam	56,399	Hmong, Tay, Dao, Nung, Kinh, San Chay, other	21.4	48.6	8.5	10.1	1.3	8.1	1.9
	Bao Lac	50,210	Tay, Dao, Hmong, Nung, Kinh, San Chi, Lo Lo	26	15.9	25.2	23.3	2.0		7.6
	Nguyen Binh	39,644	Dao, Tay, Hmong, Nung, Kinh, San Chay, other	24.5	6.7	54.2	8.81	4.97	0.03	0.76
Ha Giang	Yen Minh	78,725	Hmong, Dao, Tay, Kinh, Nung, Giay, La Chi, Hoa-Han, Pa Then, Co Lao, Lo Lo, Bo Y, Pu Peo, Muong, San Chay, other	13.3	54.5	14.7	5.04	4.10	0.05	8.36
	Dong Van	65,421	Hmong, Tay, Dao, Kinh, Nung, Giay, Hoa Han, Co Lao, Lo Lo, Bo y, La Chi, Pa Then, Pu Peo, Muong, Thai, Cao Lan	2.1	87.3	0.8	0.4	3.5	0.0	5.8
	Meo Vac	71,297	Hmong, Dao, Tay, Nung, Kinh, San Chay, other	3.1	77.2	5.6	2.1	3.6	0.1	8.4
	Vi Xuyen	96,996	Hmong, Tay, Dao, Kinh, Nung, Giay, La Chi, Hoa-Han, Pa Then, Co Lao, Lo Lo, Bo Y, Pu La, Pu Peo, Muong, San Chay, San Diu, other	36.3	12.2	22.9	6.9	16.5	0.1	5.1
	Bac Me	48,597	Tay, Dao, Hmong, Kinh, Nung, Giay, La Chi, Hoa-Han, Bo Y, Pu Peo, Muong, San Chay, Thai, San Diu, other	32.3	23.9	36.6	0.8	5.8	0.1	0.6

Sources: Adapted from district statistic reports of Na Hang, Yen Son, Bao Lam, Bao Lac, Nguyen Binh, Yen Minh, Dong Van, Meo Vac, Vi Xuyen and Bac Me 2010; district statistic report of Lam Binh 2011 (Lam Binh District was established in early 2011 and includes parts of Na Hang and Chiem Hoa districts).

Given these multiple uses, there are different aspirations for water use and river management between the different stakeholders. On the one hand, there are those (mostly local people) who want water use to be managed at the local level, principally for household use, for agriculture, fishing and transportation. On the other hand, there are the government and industry users who value water at a regional or national scale, where water is deemed valuable for its ability to provide for major uses such as producing electricity, providing water for irrigation and reducing flooding in downstream areas.

These different water use aspirations lie at the heart of conflicts between local people and government water resources management scientists. Although we recognise that different communities and villages will all have different specific aspirations, with different scientific requirements, overall we see an essential dualism between villagers and scientists: with local peoples generally desiring to see management being locally controlled, and scientists and government officials preferring to see management directed by the state, from above. So how can these differences be resolved in practice? What is the role for IK in water resources management in Vietnam?

INDIGENOUS KNOWLEDGE AND ITS IMPORTANCE

Importance of indigenous knowledge

In most parts of the globe, indigenous people have a special relationship with their traditional lands and waters, and possess unique languages, knowledge systems and beliefs in relation to water management; consequently, they have concepts of acceptable development that differ, at times, from those of government managers (Kingsbury, 1995; Stavenhagen, 2013; United Nations, 2009). There are many different definitions of what constitutes IK, which is often given different terminology, including 'indigenous ecological knowledge', 'traditional knowledge' and 'traditional ecological knowledge' (TEK). For the purposes of this research, IK is deemed to mean the relationship between local people and their living environment (cf. Berkes, 2008; Ross et al., 2011); in the case of the people of the Gam River, this includes the river and its resources.

IK is often described as subjective, experiential, social, spiritual and replicative (Agrawal, 1995; Fortier, 2002; Berkes, 2008; Ross et al., 2011); it is an extensive and valuable knowledge system covering local people's observations and ways of knowing (Battiste, 2005; Nyong et al., 2007). IK is not only about ecological relationships but is also about law, governance, philosophy and medicine (McGregor, 2004a; Berkes, 2008). IK has value for local culture as well as for scientists and planners endeavouring to improve natural resources management and environmental conditions in rural and remote areas (Nyong et al., 2007).

Agrawal (1995), Le (1999) and Al-Roubaie (2010) argue that IK plays a key role in development; ignoring IK, they argue, often leads to development failure. IK can prove useful in untangling local problems and in helping to facilitate the creation of new knowledge that must interact with, and be appropriate for, local conditions. Furthermore, IK is "the basis for local decision making and problem solving in areas including, but not limited to, agriculture, health care, food preparation, education and natural resources management" (Al-Roubaie, 2010: 119).

Sahai (1996: 3043) emphasises that IK is the foundation of modern science in the field of natural resources management (NRM) and conservation. He argues against the stereotype that science is research conducted by scientists in laboratories and instead suggests that rural communities' knowledge is worthy of recognition as 'science'. Berkes (2008) and Gadgil et al. (1993, 2003) agree, arguing that TEK is critical to rural production. They point out that TEK explains ecosystem dynamics leading to important applications such as ecological restoration and management. Ecosystems and natural resources are complex adaptive systems and, as a result, there is a need for flexibility in natural resources management (Berkes et al., 2000; Folke, 2004). The combination of different types of knowledge may benefit the management and governance of natural resources (Folke, 2004). Thus, TEK

may contribute to the evaluation and monitoring of management decisions and human uses of ecosystems (Watson et al., 2003; Donovan and Puri, 2004; Moller et al., 2004).

In Vietnam, research into local traditional ecological knowledge has expanded since the early 1990s (e.g. Do et al., 2002; Le, 2015). Such knowledge is recognised as being relevant to all fields of the life of local peoples, especially those living in rural areas, relating, in particular, to local livelihoods through such practices as cultivation, food preparation, rearing of animals, seed storage, medicine, hunting, natural resources management, and so on (Hoang and Le, 1998; Do et al., 2002; Le, 2015; Vietnam Institute of Economics and Ecology, 2000). This kind of knowledge is accumulated in communities and saved through folk mythologies, legends, songs, community rules, religious rituals, and so forth. Such knowledge includes the customary law of ethnic groups in mountainous areas and villagers living in lowland areas (Hoang and Le, 1998; Le, 2015). IK contributes to guiding and regulating social relationships and the relationships between humans and nature. For many living on the land, IK acts as the basis of contemporary, practical knowledge in the fields of agriculture, forestry, medicine, education, natural resources management and other aspects of sustainable development (Le, 2015). In addition, this knowledge has recently been recognised as playing an important role in dealing with issues of local and ethnic groups (Vu, 2010).

The role of indigenous knowledge in natural resource management

Western science defines a resource as "something that is useful and valuable in the conditions in which we find it [and] may be an input into the process of producing something of value" (Notzke, 1994: 2). Resource management, in a science context, is a complex decision-making process involving many components, such as assessment, goal formulation, policy development and implementation, legislation, strategies and programmes (Notzke, 1994) and is conducted by government agencies (Ross et al., 2011). On the other hand, for indigenous people 'resource *management*' implies "a human superiority incompatible with the holistic values" of indigenous people (Notzke, 1994: 1; cf. Bradley, 2001). Notzke (1994), along with Bradley (2001) and Sillitoe (2002), argue that the terms 'natural resources management' and 'conservation' have no equivalent in most indigenous languages; in indigenous epistemologies, resources are available for exploitation and are replenished through the performance of rituals and other socially constituted management activities. Therefore, Ross et al. (2011) argue, there is a need to distinguish between conservation and biological preservation. While 'preservation' means the complete protection of all resources, 'conservation' means 'caring for the earth' (Hunn et al., 2003: 82; Ross et al., 2011), and therefore includes species management and 'negotiation' with resources, including water, to ensure sustainable use.

Indigenous knowledge in water resources management

Many of the world's recognised water problems stem from mismanagement (a failure of governance) and inappropriate behaviour (a failure of resource use) (der Porten and de Loë, 2013). One way to address these problems is to shift from an approach to management that is based on technical and engineering solutions, to one that focuses on developing shared management initiatives which involve multiple stakeholders solving problems collaboratively (Holley et al., 2012; der Porten and de Loë, 2013).

In collaborative water management, indigenous people are often considered as one among many stakeholders (der Porten and de Loë, 2013; Fraser et al., 2006). In indigenous society, water is the centre of people's lives, religious beliefs and practices (Jackson, 2005). Water resources are often described as being created by ancestral beings, and are thereby considered as part of a society's identity and attachment to place (Strang, 2002; McGregor, 2004b; Jackson, 2005; Turner and Berkes, 2006; Moulton, 2011).

Over Vietnam's history, water resources have been recognised as akin to common property. Traditional knowledge of water resources management may be seen throughout the country, but especially in lowland areas or upland water catchment areas. This knowledge is based around spiritual forces and the customary laws of small communities; they combine with the management of other resources such as land and forest.

For Tay and Thai people in northern Vietnam, water resources used for daily living activities are divided into two categories: water for drinking and water for other activities (bathing, washing, running rice mortars, etc). Drinking water originates from upstream and/or from springs, and is believed to be more hygienic than water from downstream, which is for bathing and washing. Thai people have several specific local customary laws (called *hit khoong*) that relate to protection and management of water resources. The *hit khoong* lists prohibitions against activities that are harmful to water for drinking, including grazing, burying the dead, releasing toxic contaminants (*thuốc cá* – a poison made from a species of forest tree, lime and ash), defecating, discarding dead carcasses, slaughtering cattle and poultry, and so forth. They also have *hit khoong* to protect sacred forests (called *cửa xen*, *cửa pọng*) which are watershed areas. Any violation will result in a fine ranging from several *quan tiền* (an old unit of money) to three silver bars, together with meat and wine (Ngo, 1999; Centre for Culture Identity and Resource Use Management, 2011; PanNature, 2006; Tran, 2009). Such knowledge is well documented in literature, but how does this knowledge inform local aspirations for direct involvement in decision-making about water resources management? We now examine some of the barriers to recognising IK in WRM as identified in literature, before turning to specific data from local informants in the GRB.

BARRIERS TO THE INCORPORATION OF INDIGENOUS KNOWLEDGE INTO NATURAL RESOURCES MANAGEMENT

Epistemological barriers

Epistemological barriers are those associated with the differing nature of knowledge in different ontological frameworks. Ross et al. (2011) argue that a poor understanding of indigenous ways of knowing is one of the barriers to the engagement of local people in NRM. On a global scale, TEK was not formally recognised in policy or legislation until recently (McGregor, 2014), and it is still open to misinterpretation (Houde, 2007). Berkes (2008) highlights that TEK may be at odds with Western science and this may lead to the rejection of IK by scientists. Moreover, a lack of recognition may result from many indigenous people's reluctance to share their knowledge in the context of NRM (Huntington, 2000; Stevenson, 2006; Houde, 2007; McGregor, 2014).

A narrow definition of 'tradition' can be another important barrier to the involvement of IK in NRM. For some people, 'tradition' refers only to ways that are 'old' and 'outdated' and so traditional knowledge is often dismissed as irrelevant in the modern world (Berkes, 2008). Ross et al. (2011), however, argue that traditions always change over time, and thus IK must change to ensure continuity.

Another barrier arises when IK is not "proven to the satisfaction of scientists and resources management bureaucrats" (Ross et al., 2011: 100). Due to the privileging of science in our modern world, IK must be translated into the ways of scientific thinking for it to be taken seriously by Western-trained managers, which may lead to the ignorance of aspects of IK that are difficult to translate into scientific language (Stevenson, 2006; Houde, 2007; Ross et al., 2011). This also results in structural and methodological problems for TEK owners working in cooperation with government agencies (Houde, 2007).

Institutional barriers

Institutional barriers are those obstacles erected, usually by governments or other institutions, which interfere with the way local people can participate in mainstream management situations. In natural resources management, institutional barriers may include legislative obstructions to the incorporation

of indigenous knowledge, impediments to local people's physical presence at meetings, or challenges to the recognition of IK that arise from globalisation processes.

Ross et al. (2011) argue that bureaucratic arrangements and government structures may be difficult for local people to negotiate. Government agencies, which comprise experts in a variety of scientific fields and geographic regions, regulate a variety of boundaries of operation that compartmentalise NRM in ways foreign to the holistic management of resources by IK holders. In addition, governments have greater power and control than local people. Therefore, the State has power to deny or restrict the involvement of local people in NRM. Moreover, even when IK can contribute to NRM projects, the entire NRM process is generally controlled by experts (Briggs, 2005; Ross et al., 2011). Consequently, "IK is not ready to be trusted in this particular power game" (Briggs, 2005: 107)

Finally, globalisation has become a significant challenge to the incorporation of IK into NRM (Sachidananda, 2008). The globalisation of economics, technology and transportation has linked different areas and ecosystems leading to global environmental degradation which needs to be addressed on a global scale (Ross et al., 2011). This is challenging for TEK, which usually has a localised ontology and lacks a global dimension. Moreover, geographical distance, the spread of Western technology, and the modern emphasis on markets and projects formed outside the local context, result in the erosion of IK systems (Hoang and Le, 1998; Sachidananda, 2008).

TRADITIONAL PERCEPTIONS AND WATER MANAGEMENT IN VIETNAM

Vietnamese traditional concepts of nature and environment

Đất có Thổ Công, sông có Hà Bá – Lands are managed by Land Spirits; Rivers are managed by Water Spirits (Vietnamese proverb).

In Vietnamese traditional ideology, nature not only provides resources for the daily needs of humans (Jamieson, 1991) but is also a constant threat to human life due to the occurrence of floods, droughts and other natural disasters (Rambo, 1982). Le (1999) points out that, for ethnic groups throughout Vietnam, this human-nature relationship is dominated by the interactions between three different forces: Heaven, Earth and Humanity (*Thiên-Địa-Nhân*). Vietnamese people traditionally believe that everything on the Earth is given and created by Heaven (*Thiên*). The world of Earth or the Land (*Địa*) is the place of people and contains the visible, such as rivers, seas, streams and mountains, providing for the survival of humanity; and the invisible, consist of Mountain Gods, the Land Mother, Forest Spirits, and River Spirits. The world of Humanity (*Nhân*) includes things made by people and is divided into: the past, belonging to souls of ancestors and the dead; and the present, comprising the community of descendants. The concept of *Thiên-Địa-Nhân* is popular not only with Kinh people but also with other ethnic groups, particularly groups involved in rice cultivation, although of course the concept is expressed variously in the different local languages and customs. Each local variant is illustrated in local worship and agricultural ceremonies, but all include common elements, including ancestor worship and ceremonies involving prayers for crop yields and rain.

A belief that Spirits are everywhere is deeply rooted in Vietnamese consciousness generally; not only that of Kinh people but also that of many other ethnic groups, such as Tay, Thai, Dao and Hmong. The belief in Spirits forms the basis of Vietnamese religion in all social classes (Cadiere and Mabbett, 1989; Le, 1999; Hoang, 2011). This is summarised in the Vietnamese motto "*thiên thời, địa lợi, nhân hòa*" (*thiên thời* – opportunities given by Heaven; *địa lợi* – advantages of natural resources; *nhân hòa* – consensus of, and harmony with, other people), which reminds Vietnamese people that one of the key elements of a 'successful' life is sustainable use of nature (Hoang, 2007), including water. Vietnamese people believe that water is given and managed by the Water Spirit, while other Beings, such as the Rain Deity and Forest Spirits, also influence water resources. Therefore, people must maintain their

relationship with water resources by respecting the Gods and Spirits and obeying the laws handed down by such creator-beings in order to have enough water and avoid disasters such as flooding and droughts that occur due to the anger of these forces.

Importance of water in local culture and society

Vietnamese culture and tradition generally consider that water is given by Heaven to produce rice and other food (Dang, 2013). Dang (2013) emphasises that water in Vietnamese society is regarded as the origin of life, and is central to the regeneration of the human body and soul, and is a symbol of purity, wisdom, tolerance and virtue. Therefore, water is considered as the most important factor when choosing a place to build a house or village (Le, 1999; Hoang, 2011; Dang, 2013). We now outline some of the best-known water traditions that underpin water management aspirations of local people in the GRB.

The importance of water is also illustrated through the traditional festivals and ceremonies of many Vietnamese people including the Kinh, Tay, Hmong, Thai, Nung and Dao, all of whom live in various parts of the GRB. For example, in New Year celebrations, people filter water scooped from rivers, streams or wells and store it in a bottle. The water is then boiled with herbs to clean the bodies of family members to remove all the bad luck and 'filth' of the old year and clear the way for people to receive the new luck and health of the New Year. Water also features commonly in ceremonies involving the worship of Water Spirits.

One of the most important selection criteria used by Tay and Thai people to decide on the location to construct a home or a field is the proximity to a water source. Thai people believe that if they build close to water, the family will become very wealthy. Any house built on a high rocky hill with limited access to a water source is a sign of poverty. Names of Tay and Thai villages often include words related to water, such as *nặm* or *nậm* (water), *mó* or *bó* (water source), *huổi* (stream) and *noong* (pond) (Vi, 2011). Tay people choose to place their villages such that the river is in front of the village and mountain behind (Duong, 2010). In GRB, Tay villages are often in valleys that contain well-watered rice fields, or near the Gam River and associated transportation infrastructure.

Both Thai and Tay people have irrigation systems that provide water for agricultural activities. The system includes *mương* (a ditch), *phai* and *lái* (a dam), *lịn* (a pipe made from bamboo or wood) and *cọn nước* (a water wheel) (Vi, 2011; VOV4, n.d.). In GRB, Tay people still use ditches, bamboo pipes and dams in many of their villages, such as in Lac Nong commune (Bac Me district), Che Pen commune (Bao Lam District) or Thuong Lam Commune (Lam Binh District). Traditionally, Tay people have watershed forests (called *động ngược*) and sacred forests (called *động nài*). They have customary laws to protect *động ngược* and *động nài*, as well as to protect and manage watershed areas and irrigation systems (Nguyen and Cao, 2016).

One of the most important Water Spirits in Tay and Thai culture is *Tô Ngược* [now known throughout the basin as *Thuồng Luồng*, the name for this spirit in the Kinh language]. This spirit appears in various different forms in fairy tales, legends, customs and literature (Hoang, 2007, 2011). *Thuồng Luồng* represents strength *in* the water and *of* the water. When it comes to the management of the Gam River, *Thuồng Luồng's* image (existing in the stories of Tay people in the districts of Chiem Hoa, Bac Me and Bao Lac) is used to explain the laws of ethnic people, to predict river hydrology, and to encourage people to live in concert with nature. Because of this powerful connection between water and Spirits in the GRB – and throughout Vietnam more generally – local peoples may often be reluctant to accommodate government programmes that interfere with local water traditions.

In Dao culture, there are three elements that link resident communities to the natural and Spirit worlds. Dao people engage with Water Spirits and Forest Spirits through their ceremonies. They believe that there is a close relationship between water and the forest. Any activities that violate forest and water sources will impact on the Spirit world and will be penalised. According to Dao culture, the best

place to live is between forest and water. There are many different Dao words that incorporate the concept of water, such as, *oả́m* (water in general), *long oả́m hợ́p* (water for cooking), *oả́m đả́ng* (water for drinking), *bù́ng oả́m* (rainwater used for cooking and drinking), *oả́m ten* (water flowing from a small ditch), *oả́m mề́ng* (stream water with blue color), *oả́m pe gầ́i* (water flowing to a rice field), etc. (Tran, 2008). Dao people in GRB often live in upland areas that are near streams and forests. The water circuits (*mạ́ch nướ́c*) are strictly protected by barriers. Traditionally, people use bamboo pipes to carry water to their homes. Dao people have laws to protect watershed areas, distribute water to households and rice fields, and prohibit any wastewater discharging activities to other families, and these laws are reinforced through ceremonies.

All these examples of IK in the GRB demonstrate that, despite the differences between the specific knowledge held by the different communities, there are many essential similarities: all villagers desire to live close to water; there are strong taboos against activities that adversely affect the portability of drinking water and access to water for irrigation; and all respect the Water Spirits which ensure that laws are implemented. But how might these local laws affect government policies that require water to be used for purposes other than those deemed most important by local peoples?

Policy and institutions of water resources management in Vietnam

Traditionally, Vietnamese people try to keep a balance between the needs of humans and the requirements of nature through their customs and unwritten rules. The State, on the other hand, manages water resources based on a range of institutions and legal precedents. The *Law on Water Resources*, which was first issued in 1998, has provided a framework for WRM throughout Vietnam, and its principles are based on the philosophy of sustainable use of water resources, as perceived by government scientists. To support this epistemology, the *Law on Water Resources* was amended in 2012 and there are now more than 300 water-related regulations to guide and implement the law (Nguyen, 2013). The law stipulates that water and natural resources are the property of all people and are universally managed by the State. The law also states that all organisations and individuals have the right to exploit and use water resources for their living and production, but they also have a responsibility to protect the resources.

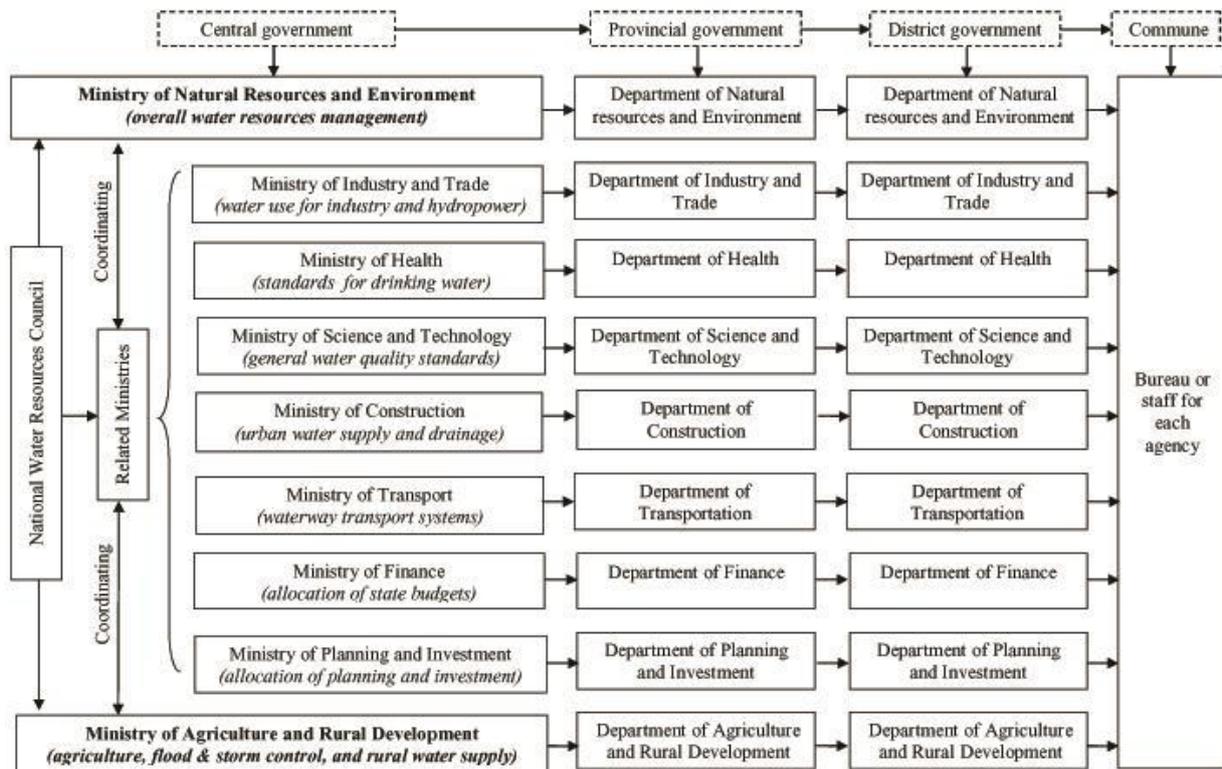
Before 2002, the Ministry of Agriculture and Rural Development (MARD) was responsible for WRM in collaboration with other government agencies. MONRE was established after Decree No 91/2002/ND-CP was issued in 2002. The management of WRM was then transferred from MARD to MONRE, with the aim of reducing the fragmentation of state management for water and natural resources. Along with the establishment of MONRE, the DONRE was formed in provinces and districts to implement the State's WRM policies at local levels. Beside MONRE and MARD, there are several government agencies involved in WRM, such as the Ministries of Finance, and Industry and Trade (illustrated in Figure 2).

Multiple stakeholders' participation in WRM

Stakeholders involved in water management in Vietnam can be classified into six groups: (1) State management agencies, (2) international organisations, (3) research and education institutions, (4) businesses companies, (5) civil society organisations, and (6) local communities (PanNature, 2006). As well as the State, there are several international organisations involved in WRM in Vietnam, such as the World Bank (WB), AusAID, and the United Nations Development Programme (UNDP). These institutions have all been active in addressing water problems, particularly related to construction of infrastructure and building local (government) capacity. Research and educational institutions such as the Vietnam Academy of Water Resources, the Institute of Water Resource Planning, and Hanoi Water Resources University, have all participated in WRM through educational programmes, the implementation of

water-related research projects, and the conduct of consultant activities in conjunction with numerous businesses (Nguyen, 2010, 2013).

Figure 2. Institutional arrangements for the water sector in Vietnam (Nguyen, 2010).



The participation of CSOs and local communities in formal WRM activities remains limited in Vietnam, although there has been some growth in their involvement since 2006 when the first national water resources strategy was issued (Nguyen, 2010, 2013). More than 10,400 local irrigation management organisations now exist at the grassroots level (Loi, 2007). There are also many non-government organisations (NGOs) undertaking water-related projects, such as Oxfam, WARECOD and PanNature. Local communities are mainly engaged in WRM through village-based consultation meetings, providing comments for local water plans and their implementation, voting for community representatives to attend regional management meetings, contributing labour and finance, and paying water fees. There are few opportunities for villagers to have a direct input into decision-making.

WRM in the GRB follows the management scheme stipulated by the State. Management is conducted within district and provincial boundaries. Although the Lo-Gam River Basin Plan exists, there is no specific river basin management organisation established for the GRB. Village leaders are representatives of villagers and they deal with a range of specific village-level problems, including water-related problems; they also act as village spokespersons in dealing with the authorities. The government provides only a small amount of financial support to village leaders to facilitate these duties (Vietnam Institute for State Organisational Science, n.d.).

So local people and the communities are encouraged to participate in WRM in the basin as just one of the many stakeholders, despite the fact that local people have the strongest attachment to the water. There are some international organisations and NGOs that also participate in WRM in the basin; however, their participation is mainly focused on the supply of drinking water, irrigation, and the facilitation of models of community-based water resources management and co-management

(PanNature, 2006). For example, under the financial support of ADB and UNICEF water supply stations and the models of Water User Associations for irrigation were conducted in Cho Don District (Bac Kan Province) in the 1990s (ADB, 2006; PanNature, 2006); a community-based water resources management project that established Water User Groups was funded and implemented by Oxfam Quebec in Bac Me District (Ha Giang Province); in 2011-2013, WARECOD conducted a number of projects, such as 'Indigenous knowledge research on aquatic resources in Gam River' in 2008-2009 and 2009-2010 funded by OSI; a Co-management model of aquatic resources in Gam River in 2010-2012 was funded by CEPF; and a range of projects in relation to climate change from 2011 to 2014 was funded by Rosa Luxemburg Foundation and Swiss Embassy. In these programmes and projects, local people participated in designing and implementing activities and making decisions on Water Users Groups or Water Users Associations, as well as in managing irrigation models. But all these projects were designed externally, with local involvement only enacted towards the end of the process. How do local people, in the light of such 'top-down' project development, perceive their opportunities to employ their own knowledge of water and its management? We now turn to an investigation of knowledge dissonance in water management regimes in the GRB in Vietnam.

A CASE STUDY IN LOCAL WATER MANAGEMENT ASPIRATIONS

To articulate these observations based on a literature review, we now provide an examination of the different perceptions of local people and government officials regarding statutory and customary laws, policies and practices relating to the uses of water resources, and knowledge-sharing in the GRB, as seen in a small sample of selective interviews with knowledgeable village representatives and active government officials.

Law and culture

Local people, culture and customs

Local people believe that water is infinite and endowed by Mother Nature. Water and River Spirits are considered as responsible for managing water resources. All people are deemed to have the right to use the resources supplied by Mother Nature and no single person is permitted to manage or control water (or other resources) for himself/herself alone. To ensure their safety and welfare, people organise annual ceremonies and festivals to worship and pray to Spirits for good weather and sufficiency of water. For example, Village informant VILL001 said that:

On Doan Ngo Festival on 5 May (Lunar calendar), each Tay family prepares and brings a tray of food to the edges of fields or riverbanks to pray for less flood, good weather, and a prosperous and happy life.

In another Tay community, informant VILL002 remembered a custom of worshipping the water Gods and *Thuồng lũng*. Similarly, VILL003 from the Dao group noted that "everyone in the Dao community abstains from the use of water for one day in March (Lunar calendar). The details of this are determined by the villager who is responsible for worshipping activities [thầy mo]". These customs are examples of the practices that ethnic communities in the Gam River Basin implement to demonstrate their respect for Mother Nature.

There is a deeply rooted traditional belief amongst local people that Spirits are everywhere. People interviewed said that, in their villages, people believe that Gods/Spirits and *Thuồng lũng* will protect and notify them about coming floods and droughts. Indeed, ethnic people can read the river's changing hydrology, they argued, using numerous environmental signs. VILL001, for example, related a story in which *Thuồng lũng* created red lines to inform local people about a flood:

*Thuồng lưỡn*g, a representative of Water Spirits, living in very deep water in the Gam River, commands white butterflies to make red lines on dried trees and rocks on the river's banks. If these lines are in a high position there will be less flooding this year. Conversely, if they are in a low position (near the water surface), local people know they will have to face severe flooding. Based on such signals, local people make plans and choose crops for the year.

In another example, VILL002 explained:

We often balance two cups of river water; one is scooped up (from the river) on the night before New Year's Day and the other on the morning of New Year's Day. If the first one is heavier, the coming year will have less water than the previous year, and vice versa; if the second is heavier, there will be more water.

Inhabitants of the GRB traditionally venerate natural resources and environmental forces (such as Water Spirits, Forest Spirits and Land Spirits). To respond to the support Mother Nature² provides them, senior villagers educate their community members, in particular, the next generation, on how to live in such a way that the natural environment is managed in accordance with local laws and culture. This is done through the use of oral stories, legends, proverbs and poetry. For example, all respondents stated that their ancestors had rules and customs to protect watershed forests at the head of the water resources, and to both maintain enough water for human needs and avoid flooding. VILL001 provided a specific example from the body of knowledge passed to him by his parents and grandparents:

To always have water running in streams, no one is permitted to turn forest land into cultivated land or to cut down the big trees in watershed forests; everyone has a responsibility to protect and maintain the green of the forests (23 March 2015).

VILL004 and VILL001 indicated that unplanned logging and indiscriminate deforestation in past decades have led to arid and infertile soils, exhausted streams and less productive crops. VILL002 added that:

Each family is responsible for managing and protecting a part of the river or streams near their home. They must monitor the river and stream banks. If they observe any problems such as collapse [of the river banks] or a landslide, local people must resolve it [according to local custom].

Law and culture thus inform the connections local people have with the river and its resources. Although modern legal systems similarly emphasise the importance of maintaining river flow and water quality, the method of representing such 'rules' is quite different from that used by local peoples.

Scientific and government laws

Water resources in Vietnam are formally managed under the provisions of the *Law of Environmental Protection 2014* and the *Law of Water Resources 2012*. MONRE, the People's Committee and relevant government agencies are responsible for WRM. All the government staff interviewed for this project highlighted that "water resources as well as other natural resources are owned by the Government and all citizens. Government agencies are responsible for managing these resources". However, GOV003 (who grew up in the basin and therefore may have had a greater empathy with local knowledge than other, 'outsider' government employees), complained that "almost all regulators and decision-makers are located in Hanoi and big cities; therefore, they lack an understanding of the situation in remote areas such as mountainous areas in the Lo-GRB".

All government respondents recognised that local peoples *did* have a role to play in water use and management. They all reported that the *Law of Water Resources* and the associated regulations stipulate that individuals, organisations and communities have a responsibility to participate in the use,

² Interviewees called this: 'mẹ thiên nhiên'.

exploitation, protection, monitoring and management of water resources. Nevertheless, most government interviewees noted implementing these regulations can be problematic. GOV002, for example, said that incorporating local knowledge into decision-making "is a very difficult process to apply due to the low level of education and capacity of local people".

While GOV003 complained that local people, especially ethnic minority people, "lack consciousness and responsibility in relation to water management", GOV004 indicated that "we have not had any projects or programmes that need to get the communities' comments and consensus since 2012". Thus, while regulations have taken some account of community engagement in water management processes, opportunities for community participation generally remain limited.

One issue we identified in our research is that indigenous and local knowledge still remains peripheral to management systems processes. GOV001, who (unlike the other interviewees for this research) does not come from the Gam River area, highlighted that "local people do not have any knowledge regarding water use and management as they believe that water is infinite". However, as was stated by several of the local respondents, this is not actually the case; there is a strong argument amongst our village informants that people in their villages do *not* believe that water is infinite. On the contrary, people in all villages in which our study was undertaken recognise that water needs to be managed; but the local preference is for locally based management, which includes both Spiritual and practical management. GOV002, GOV003 and GOV004, who were all born in the basin and have had the chance to engage with CSOs and local villagers, recognised traditional ways to manage local resources. For example, GOV002 stated that:

Ethnic people have unwritten rules to distribute water use among households. Whoever discovers the sources of [non-river] water [such as spring water or mountain pools] would have priority [of water use access], while others seeking to use this water must ask permission.

So, contrary to the view of many government agents, local water use knowledge *does* include provision for water *management* by villagers. It is not the case that villagers simply regard water as an unlimited resource.

Therefore, although there may be differences in the ways of knowing of the two main water users in the basin (local people and the government), there are several similarities between villagers and government regulators when it comes to recognising the needs of water management. So why are barriers to the incorporation of IK into WRM in the basin continued?

Local culture's challenge to scientific knowledge and government laws

According to Lertzman (2002), both IK and scientific knowledge are empirical and dynamic. However, local culture and laws are based around cultural traditions and stories while national laws are based around scientific principles and development needs and ideologies (Ross et al., 2011). Traditional knowledge sees the connection between natural and supernatural elements (Sillitoe, 2002). Ethnic people in the GRB believe that natural resources, including water, are controlled by Gods and Spirits. Throughout history local people have created stories, legends and poems about sacred forests; and invoked spirits like *Thuồng luồng*, and other river and mountain Gods to educate their descendants about the importance of living in a sustainable way with nature. The adherence to these unwritten rules is not based on any enforcement by the government; rather it is based on the beliefs of people and the consequent social pressures of their communities. VILL002, for example, emphasised that "our community has lived here for hundreds or maybe thousands of years and the river is respected by generations".

Nevertheless, all government officials who were interviewed for this research emphasised the difficulty of involving ethnic people in water resources management and protection. GOV002 and GOV004 both expressed concerns that local people had neither the knowledge nor the capacity to

participate in modern water management programmes. These officials believed that indigenous culture and knowledge is archaic, mystical and outdated, and this is despite GOV002's recognition of the existence of local knowledge. GOV002 argued that, although local knowledge existed, it did not apply in the 21st century, where 'scientific knowledge' must be the dominant form of decision-making.

Livelihoods and scales

One of the principal differences between local and scientific management knowledge is that of scale. In general, local knowledge is limited to the local area, while government laws are applied across the whole nation. This difference in the scale of application of law is evident in various aspects of people's livelihoods. The river and its resources are used for the daily lives of local people while the government develops water use policies for the benefit of large communities across regions or even the nation.

All the village leaders interviewed for this study stated that, in their villages, the river not only plays an important role in local culture and local spirituality, but also provides many resources for the survival of people and communities. According to VILL001, for instance, the river and its tributaries provide water for agriculture that feeds most of the local communities in the basin. Village leaders and GOV002 recognised that until recently local ethnic people mainly used water from the river and streams for domestic purposes such as for drinking and swimming. VILL003 recounted that:

Many ethnic people know exactly where they can find water in mound springs and mountain water source areas, based on their observation of moisture and the nature of those places. They place a bamboo pipe into the ground and water flows out and then they create a network of bamboo pipes to lead water to their houses and fields.

The river and streams also give local people protein through the supply of aquatic species such as fish, shrimp, oysters, turtles and plant foods. VILL004 highlighted: "there are many special and rare species that are famous in the basin; they were used to provide for the Kings! For example, the fish known locally as anh vũ [*Semilabeo obscurus*], and cá chiên [*Bagarius Rutilus and Kottelat*]".

Other respondents highlighted other uses of the river, apart from subsistence. For example, VILL004 noted that "the river is the home of many households who live in houseboats". VILL004 stressed the importance of the river as a transport corridor, saying: "it is very difficult for us to trade with people in other areas due to the poor conditions of the roads, so the river is a special waterway for local people to exchange goods". VILL004 also stated that another important function of the river is "to contribute to cleaning the environment by sweeping away all the filth in the area and bringing sediment to fertilise the land along riverbanks in flooding seasons".

These responses from interviews with villagers indicate that the river and its tributaries benefit local communities through providing water for agriculture and aquatic resources for nutrition, via waterways for transportation, and water for domestic use. People emphasise the importance of the river through the concept that *nhất cận thị, nhị cận giang, tam cận lộ* – "the best place to live is near the market; the second [best] is near the river; and the third is near the roads" (Vietnamese proverb – VILL001). Therefore, changes in water resource planning, use and management, such as construction of hydropower and development of mining, significantly impact on local people's living styles and livelihoods.

In contrast, government needs are expressed at larger scales, including district, provincial, and whole of basin or national levels. The government's primary concern is for water-use projects that benefit the majority of the people. For example, the government needs more electricity due to an increase in domestic and industrial demands. Therefore, hydroelectric schemes are being considered throughout the GRB.

Development

All villager respondents stated that the river and its resources were important for their survival and for the economic and cultural benefits brought about by local development. Thus, local people have paid close attention to any development projects, including construction of irrigation channels, development of hydropower dams, afforestation, and conservation.

Regarding participatory projects such as the construction of irrigation channels and water supply [in the period from 2010-2013], VILL002 said:

The government provides partial funding for these projects while local people contribute partial funding and labour when building water tanks and irrigation channels. Then, each village establishes a group of people to manage and protect these channels.

So local people are not necessarily against development along the river. In fact, all the local respondents interviewed for this research insisted that local communities were actively involved in development projects that brought benefits (especially economic benefits) to them, as well as to other major users. For example, VILL002, said that:

Projects provide monetary compensation for local people's time or through partial funding to build water tanks. Villagers, therefore, energetically involve themselves in projects (...) However, local people still participate in projects that have no monetary support even if they perceive [local] benefits for villagers and the environment. For example, the indigenous research projects of WARECOD have helped to open [people's] eyes and raise awareness in relation to protection of water and forests, and a clean environment. We will participate in these projects even though there is no monetary support.

In addition, VILL004 demonstrated support for large-scale projects:

We appreciate the construction of the hydropower reservoir because it benefits not only local people but also many other citizens due to increases in fish production,³ electricity generation and reducing flooding downstream (e.g. in Tuyen Quang city).

The primary concern of local people, therefore, is not how to prevent development, but how to ensure development does not adversely impact their families and their lives. They are enthusiastic about, and actively involved in, projects that bring them benefits, particularly monetary benefits, even though they may have to sacrifice portions of their homelands. In addition, local people encourage larger-scale development that may benefit the region as a whole even if they do not see local benefits accruing from such development. Consequently, they have a strong desire to be involved in decision-making about large projects, although many local people are also aware that their limited education is a barrier to their involvement in the development of the area.

All government officials interviewed argued that large-scale development projects and programmes had to adhere to national laws of environmental protection, water resources management, and forest protection. In response to the question: *Are there any water resource management projects that involve indigenous/local people in the Gam River Basin?* GOV001 and GOV002, who work at the district level, listed many participatory development projects including projects conducted by government agencies, the private sector and NGOs. On the other hand, GOV003 and GOV004, who are provincial officials, suggested that there were no locally based participatory projects or programmes conducted by government agencies in their localities. So, there are clearly differences in the perceptions of government staff depending on their relationships with, and connections to, local communities.

³ The hydropower dam has been operated since 2002. Until now, local people perceived dam construction as facilitating an increase in the amount of fish in the river. The connection between fish stocking levels and dam construction is not clear and further research into this phenomenon is required.

Government respondents all agreed that there *are* benefits to be gained from local people's participation in development projects. They argued that such participation ensured the sustainability of development and helped to deal with social conflicts. For example, GOV003 said that "participation is very important because the more people that participate in water management, the more effective it is".

Nevertheless, despite the recognition of the importance of local people's involvement in water resources management, there are not many opportunities for participation of the local community in water management in GRB because of the perceived low level of management knowledge held by the local people. GOV002, for example, emphasised that:

Local people can be involved in water use, exploitation, maintenance, and monitoring activities. They can also contribute resources such as finances and labour days. However, they do not have enough capacity to participate in water use planning, which requires a very complex knowledge.

Government officials complained that local cultural and traditional perceptions, deeply rooted in local knowledge, are significant barriers to development. "It is very difficult to change the traditional chronic practices and use of water resources that are embedded in local people's thinking and culture" (GOV004).

So the research presented here demonstrates that there are very different perceptions of development held by local people and government officials. Local people are concerned about the implementation, benefits and impacts of development projects on their lives and livelihoods while the government's concerns relate to what they see as local interference in development. Underpinning these perceptions is the lack of knowledge integration and information-sharing.

Knowledge and knowledge-sharing

Local people want the river to remain *their* river, supporting their local needs and local livelihoods. The government sees the river as having a place in national development. As well as being a conflict of scale, such differences illustrate the clash of different ways of knowing held by the different actors in natural resources management and development planning.

Government perceptions of local knowledge

Scientific knowledge is considered to be replicable, abstract, rigorously empirical and experimental while local knowledge, including indigenous knowledge, is pragmatic, spiritual, and explicit (Ross et al., 2011). Government officials interviewed for this study said that local people either do not have knowledge of water resources management or that their knowledge is generally outdated, being largely spiritually constituted (GOV004) or applicable only locally (GOV003). Although GOV002 agreed with his colleagues that local knowledge is outdated, he did recognise that, in the past, traditional knowledge was important for management:

According to law, government agencies are responsible for water management in the river basin, [and for associated] water sources and boundaries. [However], in the past, local people managed water resources well through communities' unwritten rules and customs.

GOV002 went on to say that "traditional rules and perceptions are good *baselines* for us to conduct water resources management and protection; a lack of [understanding about] local culture and customs is a big challenge when calling for the participation of local people". But GOV002 still believed that, for the present, local knowledge is not as effective as knowledge based in science.

In contrast, GOV003 stated that "local people's knowledge and understanding is very low" and that "it is very difficult for us to involve ethnic people in management because the traditional perception is that water belongs to the Gods and no one is allowed to manage the resource". Thus, although

recognising some indigenous knowledge, such as bringing water from the river and streams to higher fields, predicting droughts and flooding, and the existence of local customs on protection of the watershed forest, all the government employees agreed that all local knowledge is outdated and irrelevant to 21st century management systems. GOV004 summed up this view by saying that "it is very challenging to change the traditional practices and uses of water resources".

But the research reported here demonstrates that local knowledge is *not* solely situated in the past. Nevertheless, all interviewees were aware of the low level of local education of most of the villagers in the basin. "Not many ethnic people can speak Vietnamese and this is a major restriction for local people to work with government officers and organisations" (GOV002). To deal with the perceived low level of knowledge and the outdated nature of the knowledge of the local communities, most of the government respondents suggested that local communities, particularly ethnic people, needed to be taught by scientists. There was no recognition, however, that scientists could also learn from local people.

Local perceptions of knowledge

Due to the widespread privileging of science in the Vietnam government and in the application of national policies in natural resources management, many local people believed that they lacked awareness, understanding and knowledge of natural resources use and management; even though they recognised that their ancestors *had* managed natural resources well in the past. However, the rapid growth of population and rise of commercial markets mean that local people need more land area for subsistence agriculture and market production. As a result, there are more and more activities that harm nature, and that are deemed contrary to traditional laws.

VILL003 argued that there was a need for local knowledge and scientific knowledge to be shared, thereby increasing local people's capacity to work with government officials and developers:

The people who understand our locality well are older and lack the capacity to get involved in water management whereas the young, who have a high level of education and scientific knowledge, lack traditional knowledge and a real understanding of the river and our place. [Therefore], we need to increase IK research to document the precious knowledge and experience of local people, and to build our capacity and improve local people's voice in decision-making related to local natural resources.

Government officials are quite happy for local people to learn from scientists, but those in the local communities want to see two-way knowledge-sharing (cf. Stevenson, 2006). The local people believe that their knowledge needs to be acknowledged by scientists just as much as they recognise their need for greater science education.

DISCUSSION

The examination of knowledge constructs in the GRB reported in this paper has shown the different perceptions of local people and government officials in relation to water resources use and management. Our results demonstrate differences between local villagers and scientists/government officials in relation to the river and its management, with different knowledge frameworks lending support to the epistemological and institutional barriers to the involvement of IK and local peoples in GRB water management.

Epistemological barriers

Ross et al. (2011) and McGregor (2014) argue that a lack of recognition of IK is one of the obstacles to the participation of local people in NRM. Berkes (2008) also contends that the knowledge difference between TEK and Western science may result in the rejection of IK by scientists and managers. In the case study of the GRB, local people believe that water resources are given and managed by Spirits.

Spirits command their representatives (such as *Thường lữ*) to make signals – such as red lines on rocks near river banks – to inform local people about certain water events. Owing to the lack of recognition of these phenomena in scientific language, local knowledge is often considered by government agents to be superstitious and irrelevant to management in the modern world. Moreover, government officials have no, or very limited, understanding about local rules and customs in relation to WRM. They therefore often assume that local knowledge is outdated. We would argue, based on the research presented here, that the lack of recognition of IK into ways recognised and accepted by science, and the assumptions of the government officers about the outdated nature of local knowledge, are the first challenge for those promoting the involvement of IK and local people in the WRM in the GRB, as well as in other areas in Vietnam.

Government officials are concerned that the local belief that Gods and Spirits control water resources may result in a failure by local people to accept government management regimes. The officials are unaware of the existence of local unwritten rules and customs that contribute to the guiding of local people in the regulation of water to ensure their actions keep a balance between human consumption and the requirements of nature through people's respect for Gods and Spirits. Such customs may challenge the rigorous scientific theories of scientists and managers. As a result, it is very difficult for local knowledge to be incorporated into WRM in particular and NRM in general. We argue that the disconnect between local people and scientists in terms of their beliefs about water, where it comes from and how it should be managed, causes an indirect barrier to the engagement of IK and local people in WRM in the basin.

The lack of communication and knowledge-sharing between local water users and government regulators has resulted in a number of specific challenges for local people's involvement in WRM in the GRB. Local people recognise that they need to expand their knowledge base to include science, which will allow them to contribute to management. But they also want to see two-way knowledge-sharing, as advocated by Stevenson (2006), where scientists also learn about local traditions. However, scientists only see knowledge-sharing as one-way; with local people needing to gain scientific knowledge. There is little basis for genuine two-way communication and knowledge-sharing when there is such a vast chasm between indigenous/local ways of knowing and scientific ways of knowing.

Institutional barriers

In Vietnam, the State is at the centre of land and water resources management. Therefore, the State has the power to deny or restrict the involvement of IK and local people in management (Briggs, 2005; cf. Ross et al., 2011). In the GRB, government officials believe that local people do not have the capacity to be involved in water management and planning. In interviews reported here, government managers pointed out that local people could be engaged in water use, exploitation and protection or in projects listed by the government, but always under the direction of government agents.

Another obstacle to the involvement of IK in WRM is the lack of a clear mechanism to encourage and involve local people in water management. Although Vietnamese laws and regulations require the involvement of local people in a range of development projects, there are no guidelines on how to achieve such community involvement.

Another barrier is that of scale. Local people privilege local development that has local applications; yet they *do* recognise the importance of their river to the nation as a whole. The government's priority is development at regional and national scales. Although the government sees the importance of the river to local people, in our interviews they omitted to acknowledge any opportunities for local people to have an active role in decision-making at the regional or national scales.

In summary, the barriers to the incorporation of IK and local people in water management in the GRB can be divided into two categories: local management knowledge frameworks and government

management frameworks. There are epistemological and institutional barriers in each category (Table 3).

Table 3. Barriers to the involvement of local people in water resources management.

Barriers	Local people	Government
Epistemological	Hindered by beliefs and religious systems	Lack of recognition of IK that is constructed as spiritual; Failure to recognise knowledge that is not translated into science paradigms
	Erosion of IK due to external influences	Disconnect between local people and scientists Lack of communication and knowledge-sharing
Institutional	Lack of financial and human resources to build local capacity	The overarching power of the State
	Water has local values that are difficult to quantify	Lack of a clear mechanism to encourage and involve local people in WRM
	Different interests and goals of water use and management from those of government	Different interests and goals of water use and management from those of local people

Nevertheless, besides the barriers outlined above, we would argue that there are indeed some opportunities for the involvement of IK and local people in WRM in the GRB. The opportunities come from three different stakeholders: government and its officials; local people; and from CSOs.

Opportunities from the government

As mentioned earlier, water-related legislation has recently been made stronger and more effective. There is now a legal requirement for the participation of local communities in NRM in general and WRM in particular. Moreover, government agencies have been organising communication projects to enhance knowledge-sharing, and to develop an understanding amongst local people, of government water resources management and protection strategies. Government officials are now more open and willing to work with local people in the field of NRM. The success and effectiveness of many of the projects conducted by CSOs across the country, and especially in the GRB, have provided evidence for the importance of the involvement of IK and local people in NRM.

Opportunities from local people themselves

Together with the improvement in their living conditions – and enhanced access to information technology – people in the GRB today have more chance to access information and augment knowledge of their rights and responsibilities than in the past. There are now more communication and community development projects that aim to raise awareness and build knowledge and management capacity for communities in the GRB. Local people are more aware of the impacts of water-related projects and management decisions on their lives and livelihoods. In addition, better transportation and communication technologies – such as telephones and the Internet – may create chances for people to deliver their ideas and comments to developers and decision-makers. Furthermore, local people's depth of understanding about local natural resources in general and local water resources in particular

may be an advantage when it comes to their involvement in development projects as well as decision-making processes of WRM in the basin.

Opportunities from civil society organisations

As outlined above, there are a range of CSOs and international organisations working in the field of NRM and WRM in the basin. The increasing attention of these organisations on community-based WRM and capacity building for local people may facilitate the involvement of local people in managing water resources. These organisations not only raise their voices in advocacy for local people, but also create platforms from which local people can participate, together with other stakeholders, in the management of local resources. Participatory and community-based models of NRM may be evidence for the advantages of advocacy activities in relation to the clear definition of local community obligations, ownership and rights regarding water resources.

CONCLUSION AND RECOMMENDATIONS

In the introduction to this paper we asked: how have the different water use knowledge frameworks of local people and government agents affected aspirations for long-term water use in the GRB? How can these differences be resolved in practice? What is the role for indigenous knowledge in water resources management in Vietnam? We have demonstrated that local people's lives and livelihoods in the basin directly depend on the river and its resources. Local people are, therefore, keen to participate in relevant decision-making processes as well as in management activities. However, several barriers involved in government management frameworks (such as lack of recognition of IK; failure to see so-called 'ancient' traditions as having relevance in the modern world; and different scales of management considerations) and some barriers related to local people themselves (such as lack of education and poor levels of communication at government levels) restrict their involvement. We recommend that priority be given to overcoming these barriers and enhancing the opportunities that currently exist, including those recognised in government legislation, to permit IK to be considered in water resources management schemes in the GRB. Legal regulations in Vietnam do stipulate that local projects must have participation of local communities, but such regulations lack guidelines for how to involve the community. While government strategies relating to natural resources management continue to privilege development outcomes over local requirements, barriers to the incorporation of local knowledge into management and decision-making will continue.

Our major recommendation is that government officials be made aware of the importance of local knowledge to local people when it comes to resources management. Such knowledge should not be denigrated as 'inferior' to science, but must be recognised as integral to the development of policy solutions relating to natural resources management generally, and to water management in the GRB in particular. We argue that genuine, *two-way* knowledge-sharing, and power-sharing, from scientists to local peoples, *and from local peoples to scientists*, would lead to better communication between stakeholders than what occurs at present, and better management outcomes as a consequence. Formal mechanisms to achieve such knowledge-sharing need to be developed.

ACKNOWLEDGEMENTS

This research would never have been possible without the help and assistance of friends and colleagues in Vietnam and the people interviewed. We would especially like to thank Mr. Hao and Mr. Thuy for sharing their knowledge of the local culture and of people's water aspirations; and Ms. Phuong for her positive support. This article has benefitted from comments from Associate Professor Ron Johnstone and Dr. Karen McNamara, both of The University of Queensland.

REFERENCES

- ADB (Asian Development Bank). 2006. *Country water actions: Viet Nam integrated water resources management: Practical experiences and successful lessons in Bac Kan Province, Vietnam*. Hanoi
- Agrawal, A. 1995. Indigenous and scientific knowledge: Some critical comments. *Development and Change* 26(3): 413-439.
- Al-Roubaie, A. 2010. Building Indigenous knowledge capacity for development. *World Journal of Science, Technology and Sustainable Development* 7(2): 113-129.
- Battiste, M. 2005. Indigenous knowledge: Foundations for first nations. *World Indigenous Nations Higher Education Consortium – WINHEC Journal*, www.win-hec.org/docs/pdfs/Journal/Marie%20Battiste%20copy.pdf
- Berkes, F.; Colding, J. and Folke, C. 2000. Rediscovery of traditional ecological knowledge as adaptive management. *Ecological Application* 10(5): 1251-1262.
- Berkes, F. 2008. *Sacred ecology*. New York: Routledge.
- Bradley, J. 2001. Landscapes of the mind, landscapes of the spirit: Negotiating a sentient landscape. In Baker, R.; Davies, J. and Young, E. (Eds), *Working on country: Contemporary Indigenous management of Australia's lands and coastal regions*, pp. 295-307. Melbourne: Oxford University Press.
- Briggs, J. 2005. The use of Indigenous knowledge in development: Problems and challenges. *Progress in Development Studies* 5(2): 99-114.
- Cadiere, L. and Mabbett, I.W. 1989. *Religious beliefs and practices of the Vietnamese*. Working Papers No. 60. Australia: Monash University Press.
- Cao Bang Portal 2013. Văn hóa dân tộc Tày ở Cao Bằng [Tay culture in Cao Bang Province]. www.caobang.gov.vn/content/v%4%83n-h%C3%B3a-d%C3%A2n-t%E1%BB%99c-t%C3%A0y-%E1%BB%9F-cao-b%E1%BA%B1ng (assessed 18 October 2016).
- Centre for Culture Identity and Resource Use Management. 2011. Báo cáo nghiên cứu: Vai trò của luật tục và tập quán trong quản lý, sử dụng tài nguyên rừng, tài nguyên nước [Research report: The role of customary law and custom in the management and use of forest and water resources]. Hanoi.
- Crevello, S. 2004. Dayak land use systems and indigenous knowledge. *Human Ecology* 16(2): 69-73.
- Critchley, W.R.S.; Reij, C. and Willcocks, T.J. 1994. Indigenous soil and water conservation: A review of the state of knowledge and prospects for building on traditions. *Land Degradation and Rehabilitation* 5(4): 293-314.
- Do, D.S.; Dang, K.K and An, V.B. 2002. Điều tra nghiên cứu kiến thức bản địa về quản lý và phát triển tài nguyên rừng của một số cộng đồng thôn bản miền núi phía bắc Việt Nam [Investigating IK on forest protection and management of several communities in mountainous areas in northern Vietnam]. www.cres.edu.vn/vi/thu-vien-so/bao-cao-khoa-hoc/lu-tra-nghien-cu-kin-thc-bn-a-v-qun-ly-phat-trin-tai-nguyen-rng-ca-mt-s-cng-ng-thon-bn-min-nui-phia-bc-vit-nam.html (accessed 10 October 2016)
- Dang, T.N.P. 2013. Biểu tượng 'nước' trong đời sống văn hóa Việt Nam và Hàn Quốc [Symbol of water in Vietnamese and Korean life and culture]. www.hanquochoc.edu.vn/Cps/nghiencuu/-vanhoahanquoc_nghiencuu/2013/4/540.aspx (assessed 9 May 2015)
- Dellapenna, J.W.; Gupta, J.; Li, W. and Schmidt, F. 2013. Thinking about the future of global water governance. *Ecology and Society* 18(3): 383-391.
- Der Porten, S.V. and de Loë, R. 2013. Water governance and Indigenous governance: Towards a synthesis. *Indigenous Policy Journal* 13(4). www.blog.indigenouspolicy.org/-index.php/ipj/article/view/148
- Donovan, D. and Puri, R. 2004. Learning from traditional knowledge of non-timber forest products: Penan Benalui and the autecology of *Aquilaria* in Indonesian Borneo. *Ecology and Society* 9(3). www.ecologyandsociety.org/vol9/iss3/art3/.
- Duong, T. 2010. Người Tày với phong thủy [Tay people and Feng Shui]. Viewed 21 October 2016. www.langvietonline.vn/Kham-Pha-Bi-Quyet/115143/Nguoi-Tay-voi-phong-thuy.html
- Falkenmark, M. 1990. Global water issues confronting humanity. *Journal of Peace Research* 27(2): 177-190.
- Folke, C. 2004. Traditional ecological knowledge in social-ecological systems. *Ecology and Society* 9(3). www.dlc.dlib.indiana.edu/dlc/handle/10535/3323

- Fortier, F. 2002. Linking Indigenous peoples' knowledge and Western science: An international perspective. In Michel, H. and Gayton, D.V. (Eds), *SIFERP series 4*, pp. 19-22. Canada: Southern Interior Forest Extension and Research Partnership.
- Fraser, D.; Gaydos, J.; Karlesen, E. and Rylko, M. 2006. Collaborative science, policy development and program implementation in the transboundary Georgia Basin/Puget Sound ecosystem. *Environmental Monitoring and Assessment* 113(1): 49-69.
- Gadgil, M.; Berkes, F. and Folke, C. 1993. Indigenous knowledge for biodiversity conservation. *Ambio* 22(2-3): 151-156.
- Gadgil, M.; Olsson, P.; Berkes, F. and Folke, C. 2003. Exploring the role of local ecological knowledge for ecosystem management: Three case studies. In Berkes, F.; Colding, J. and Folke, C. (Eds), *Navigating social-ecological systems: Building resilience for complexity and change*, pp. 189-209. Cambridge University Press.0
- Global Wandering n.d. Dao. www.globalwanderings.co.uk/ethnic_minorities/dao.shtml (assessed 25 November 2016)
- Gunawansa, A.; Bhullar, L. and Hoque, S.F. 2013. Chapter 1: Introduction. In Gunawansa, A. and Bhullar, L. (Eds), *Water governance: An evaluation of alternative architectures*, pp. 1-43. Cheltenham, UK and Massachusetts, USA: Edward Elgar Publishing.
- Gupta, J. and Pahl-Wostl, C. 2013. Global water governance in the context of global and multilevel governance: Its need, form, and challenges. *Ecological and Society* 18(4). www.ecologyandsociety.org/vol18/iss4/art53/
- Hoang, L. 2007. Tín ngưỡng thờ Thường Luồng của các dân tộc nói tiếng Thái ở Việt Nam [The Thai-spoken groups' cult of worshiping Thường Luồng in Vietnam]. *Nghiên Cứu Tôn Giáo* [Religious Studies] 7: 49-55.
- Hoang, L. 2011. Sự đóng góp của dân tộc Tày-Thái cổ vào sự hình thành và phát triển văn minh Đông Sơn [The contribution of old Tay-Thai groups to the establishment and development of Dong Son civilisation]. www.tainguyenso.vnu.edu.vn/jspui/handle/123456789/9715 (assessed 25 March 2015)
- Hoang, X.T. and Le, T.C. 1998. *Knowledge of local community in mountainous areas in agriculture and natural resources management*. Hanoi: Agriculture Publisher.
- Holley, C.; Gunningham, N. and Shearing, C. 2012. *The new environmental governance*. London: Routledge.
- Houde, N. 2007. The six faces of traditional ecological knowledge: Challenges and opportunities for Canadian co-management arrangements. *Ecology and Society* 12(2). www.ecologyandsociety.org/vol12/iss2/art34/
- Hunn, E.S.; Johnson, D.R.; Russel, P.N. and Thornton, T.F. 2003. Huna Tlingit traditional environmental knowledge, conservation and the management of a 'wilderness' park. *Current Anthropology* 44(S5): 79-103.
- Huntington, H.P. 2000. Using traditional ecological knowledge in science: Methods and applications. *Ecological Application* 10(5): 1270-1274.
- IUCN (International Union for Conservation of Nature). 2009. *Water governance: A situational analysis of Cambodia, Lao PDR and Vietnam*. Mekong Region Water Dialogue Publication No. 2. Gland, Switzerland: IUCN.
- Jackson, S. 2005. Indigenous values and water resources management: A case study from the Northern Territory. *Australian Journal of Environmental Management* 12(3): 136-146.
- Jamieson, N. 1991. *Culture and development in Vietnam*. Indochina Initiative Working Paper Series No.1. Honolulu: East-West Center.
- Kingsbury, B. 1995. Indigenous people as an international legal concept. In Barnes, R.H.; Gray, A. and Kingsbury, B. (Eds), *Indigenous people of Asia*, pp. 13-34. Association for Asian Studies.
- Le, T.C. 1999. Vietnam: Traditional cultural concepts of human relations with the natural environment. *Asian Geographer* 18(1-2): 67-74.
- Le, T.C. 2015. Sinh thái nhân văn và phát triển bền vững [Human Ecology and sustainable development]. Hanoi: Hanoi National University Publisher.
- Lertzman, K. 2002. Science and Indigenous peoples' knowledge (Summary). In Michel, H. and Gayton, D.V. (Eds), *Linking Indigenous peoples' knowledge and Western science in natural resource management. Conference Proceedings. SIFERP Series 4*, pp. 29-32. Canada: Southern Interior Forest Extension and Research Partnership.
- Loi, D.T. 2007. *Current status of management organization and solutions for irrigation system improvement*. Center for Irrigation Economic Research, Vietnam Academy for Water Resources.

- McGregor, D. 2004a. Coming full circle: Indigenous knowledge, environment, and our future. *The American Indian Quarterly* 28(3): 385-410.
- McGregor, D. 2004b. Traditional ecological knowledge and sustainable development: Towards coexistence. In Blaser, M.; Feit, H.A. and McRae, G. (Eds), *In the way of development: Indigenous people, projects and globalisation*, pp. 72-91. London and New York: Zed Books.
- McGregor, D. 2014. Lessons for collaborative involving traditional knowledge and environmental governance in Ontario, Canada. *Alternative: An International Journal of Indigenous Peoples* 10(4): 340-353.
- Menon, A.; Singh, P.; Shah, E.; Lele, S. and Paranjape, S. 2007. *Community-based natural resources management: Issues and cases from South Asia*. India: SAGE Publications.
- Ministry of Agriculture and Rural Development. 2013. *Decision No2135/QĐ-BNN-TCTL on approval of irrigation plan for Lo-Gam River Basin*. Hanoi, Vietnam.
- Moller, H.; Berkes, F.; Lyver, P.O. and Kislalioglu, M. 2004. Combining science and traditional ecological knowledge: Monitoring populations for co-management. *Ecology and Science* 9(3). www.ecologyandsociety.org/vol9/iss3/art2/
- MONRE (Ministry of Natural Resources and Environment). 2009. *Báo cáo tổng hợp thuyết minh nhiệm vụ quy hoạch lưu vực sông Lô-Gâm* [Proposal report on water resource planning in Lo-Gam River Basin]. Hanoi, Vietnam: Ministry of Natural Resources and Environment.
- Moult, L. 2011. To just be here: Aboriginal relationships to, and management of, fresh water at Bummiera, North Stradbroke Island. PhD thesis. Brisbane: The University of Queensland.
- Ngo, D.T. 1999. *Customary laws and natural resources management*. Workshop Proceedings. Hanoi: Centre for Natural Resource and Environmental Studies.
- Nguyen, L. 2013. *The legal framework of Vietnam's water sector: Update. 2013*. Working Paper 116. University of Boon: Centre for Development Research, University of Boon. [www.academia.edu/5504082/The Legal Framework of Vietnam s Water Sector Update 2013](http://www.academia.edu/5504082/The_Legal_Framework_of_Vietnam_s_Water_Sector_Update_2013) (accessed 10 May 2015)
- Nguyen, T.P.L. 2010. *Legal framework of the water sector in Vietnam*. Can Tho, Vietnam: Can Tho University Publisher.
- Nguyen, T.T and Cao, T.T.N. 2016. Kiến thức truyền thống của người Tày trong bảo vệ tài nguyên thiên nhiên ở Lạng Sơn [Traditional knowledge of Tay people in nature resource protection in Lang Son province]. *Vietnam Environmental Administration Magazine*. www.tapchimoitruong.vn/pages/article.aspx?item=Ki%E1%BA%BFn-th%E1%BB%A9c-truy%E1%BB%81n-th%E1%BB%91ng-c%E1%BB%A7a-ng%C6%B0%E1%BB%9Di-T%C3%A0y-trong-b%E1%BA%A3o-v%E1%BB%87-t%C3%A0i-nguy%C3%AAn-thi%C3%AAn-nhi%C3%AAn-%E1%BB%9F-L%E1%BA%A1ng-S%C6%A1n-42001 (assessed 20 October 2016)
- Notzke, C. 1994. *Aboriginal peoples and natural resources in Canada*. Canada: Captus Press.
- Nyong, A.; Adesina, F. and Elasha, B.O. 2007. The value of Indigenous knowledge in climate change mitigation and adaptation strategies in the African Sahel. *Mitigation Adaptation Strategies for Global Change* 2(5): 787-797.
- Pahl-Wostl, C.; Craps, M.; Dewulf, A.; Mostert, E.; Tabara, D. and Taillieu, T. 2007. Social learning and water resources management. *Ecology and Society* 12(2): 1-19.
- PanNature. 2006. *Community-based water resources management in Vietnam. A literature review of experiences and the best practice*. Hanoi, Vietnam: People and Nature Reconciliation.
- Rambo, A.T. 1982. Vietnam: Searching for integration. In Caldarola, C. (Ed), *Religion and societies: Asia and the Middle East*, pp. 407-444. Berlin: Mouton.
- Rogers, P. and Hall, A. 2003. Effective water governance. *TEC background paper No. 7*. Global Water Partnership.
- Ross, A.; Sherman, K.P.; Snodgrass, J.G.; Delcore, H.D. and Sherman, R. 2011. *Indigenous people and the collaborative stewardship of nature: Knowledge binds and institutional conflicts*. Walnut Creek, Canada: Left Coast Press.
- Sachchidananda. 2008. Indigenous knowledge of tribals: Implications for development. In Choudhary, S.N. and Basa, K.K. (Eds), *Tribes and their indigenous knowledge: Implications for development*, pp. 19-24. Delhi, India: Pratibha Prakashan.

- Sahai, S. 1996. Importance of Indigenous knowledge in IPR [Intellectual Property Rights] system. *Economic and Political Weekly* 31(47): 3043-3045.
- Sillitoe, P. 2002. Maggots in their ears: Hunting incantations and Indigenous knowledge in development. *Journal of Ritual Studies* 16(1): 64-71.
- Stavenhagen, R. 2013. *The emergence of indigenous people*. Berlin: Springer Berlin Heidelberg.
- Stevenson, M.G. 2006. The possibility of difference: Re-thinking co-management. *Human Organization* 65(2): 167-180.
- Strang, V. 2002. *Life down under: Water and identity in an Aboriginal cultural landscape*. Goldsmith Anthropology Research Paper. Goldsmiths College, University of London.
- Tran, H.S. 2008. Ứng xử của người Dao Họ (Dao quần trắng) ở Lào Cai với nguồn nước [the dealing with water resources of Dao Ho (White Dao) in Lao Cai province]. www.vanhoahoc.edu.vn/nghien-cuu/ly-luan-van-hoa-hoc/vu-tru-quan-phuong-dong/566.html (accessed 22 October 2016)
- Tran, V.H. 2009. Vài nét về rừng thiêng của người Thái [Aspects of sacred forest of Thai people]. www.sachhiem.net/VANHOC/TVHAC/Vanhac10b.php (accessed 20 October 2016)
- Turner, N.J. and Berkes, F. 2006. Knowledge, learning and the evolution of conservation practice for social-ecological system resilience. *Human ecology* 3(4): 479-494.
- United Nations. 2009. *Who are Indigenous people?* Indigenous people, Indigenous voice Factsheet. www.un.org/esa/socdev/unpfii/documents/5session_factsheet1.pdf (accessed 19 April 2015)
- Vi, V.A. 2011. Tri thức dân gian của người Thái trong việc sử dụng và bảo vệ tài nguyên nước [Indigenous knowledge of Thai people in the use and protection of water resource]. www.vanhoanghean.com.vn/van-hoa-va-doi-song27/cuoc-song-quanh-ta46/tri-thuc-dan-gian-cua-nguoi-thai-trong-viec-su-dung-va-bao-ve-tai-nguyen-nuoc (accessed 21 October 2016)
- Vietnam Institute of Ecological Economics. 2000. *Recording and using indigenous knowledge: A manual*. Hanoi: Agriculture Publisher.
- Vietnam Institute for State Organisational Science n.d. Một vài điểm mới về tổ chức và hoạt động của thôn bản và thị trấn [Some new points of structure and operation of village and town]. www.isos.gov.vn/Thongtinchitiet/tabid/84/ArticleId/588-/language/vi-VN/M-t-s-di-m-m-i-v-t-ch-c-va-ho-t-d-ng-c-a-thon-t-dan-ph.aspx (accessed 16 May 2015)
- VOV4. n.d. Dân tộc Tày [Tay people]. www.vov4.vov.vn/TV/gioi-thieu/dan-toc-tay-cgt2-92.aspx (accessed 18 October 2016)
- VOV5. 2015. Tay people's culture and belief. www.vovworld.vn/en-us/Colorful-Vietnam/Vietnams-54-ethnic-groups/Tays-culture-and-belief/300962.vov (accessed 18 October 2016)
- Vu, T.G. 2010. Bảo tồn tri thức bản địa của các dân tộc thiểu số ở Việt Nam [Preserving Indigenous knowledge of ethnic minority in Vietnam]. <http://web.cema.gov.vn/modules.php?name=Content&op=details&mid=117451823> (accessed 8 October 2016)
- Vuong, D.Q. 2016. *Kinh tế và xã hội của người Hmông ở Việt Nam: Truyền thống và hiện đại [Economics and society of Hmong people in Vietnam: tradition and modern]*. Hanoi: Social Science Publisher.
- WARECOD (Centre for Water Resource Conservation and Development). 2014. *Báo cáo: Điều kiện tự nhiên, kinh tế, xã hội lưu vực sông Gâm [Report: Natural, economic and social conditions of the Gam River Basin]*. Hanoi, Vietnam.
- Watson, A.; Alessa, L. and Glaspell, B. 2003. The relationship between traditional ecological knowledge, evolving cultures, and wilderness protection in circumpolar north. *Conservation Ecology* 8(1). www.ecologyandsociety.org/vol8/iss1/art2/

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