ຄ່າຕອບແທນ ສຳລັບວຽກງານການຄຸ້ມຄອງ ແລະ ປົກປັກຮັກສາ ແຫຼ່ງນ້ຳ ໃນເຂດພາກເໜືອ ຂອງ ສ.ປ.ປ ລາວ

ແກ ມຸດສະເກ, ອາລານາ ຈອດເຊ, ພອນໄຊ ແສງສຸລິຈັນ, ແກ້ວອຸດອນ ລາດສະຈັກ, ໂອລິດ ແສງຕາເຮືອງຮຸ່ງ, ໂອລີເວີ, ອາແລັງ ປີແອເຣ

ບົດຄັດຫຍໍ້

ຈຸດປະສົງຂອງບົດນີ້ ແມ່ນເພື່ອສຶກສາຄວາມເປັນໄປໄດ້ ໃນການສ້າງຕັ້ງໂຄງການ ຄ່າຕອບແທນສຳລັບວຽກງານການຄຸ້ມຄອງ ແລະ ປົກປັກຮັກສາແຫຼ່ງນ້ຳ ເພື່ອຄຸ້ມຄອງຄຸນນະພາບ ແລະ ປະລິມານຂອງນ້ຳທ້ວຍໃນເຂດພູດອຍ. ພວກເຮົາສັງເກດເຫັນວ່າ ທາງດ້ານທິດສະດີແລ້ວ ຄ່າຕອບແທນສຳລັບການຄຸ້ມຄອງ ແລະ ປົກປັກຮັກສາແຫຼ່ງນ້ຳ ສາມາດປັບປຸງເພື່ອໃຫ້ເກີດປະໂຫຍດສູງສຸດ ໃນການປ້ອງກັນການເຊາະເຈື່ອນຂອງດິນ ແລະ ຮັກສາຄຸນນະພາບໃຫ້ໄດ້. ຕາມການສຸ່ມປະຊາກອນໃນເຂດເຫັນວ່າ ຄ່າຕ້ອງຈ່າຍແບບສະໝັກໃຈ (WTP) ປະມານ 0.3 US$ ຕໍ່ຄອບຄົວ ແມ່ນພຽງພໍເພື່ອຢັບຢັ້ງຜົນກະທົບຂອງການເຊາະເຈື່ອນດິນ. ໃນເຂດສຳຫຼວດ ອຸບປະສັກໃນການສ້າງຕັ້ງໂຄງການ ຄ່າຕອບແທນສຳລັບວຽກງານການຄຸ້ມຄອງ ແລະ ປົກປັກຮັກສາແຫຼ່ງນ້ຳ ມີດັ່ງນີ້: 1) ຂາດການປະສານ ລະຫວ່າງການບໍລິການ, ຜູ້ນຳໃຊ້ ແລະ ຜູ້ຕອບສະໜອງ; 2) ຂາດຄ່າຕ້ອງຈ່າຍແບບສະໝັກໃຈ (WTP) ເພື່ອຮັກສາຄຸນນະພາບນ້ຳ ໂດຍການຈັດການກັບສິ່ງເສດເຫຼືອລົງສາຍນ້ຳ; 3) ຂາດຜູ້ຊື້ທີ່ເປັນຂະບວນ ແລະ 4) ການປູກຈິດສຳນຶກ ກ່ຽວກັບບັນຫາສິ່ງແວດລ້ອມໃຫ້ແກ່ຊຸມຊົນ ແມ່ນສິ່ງເອື້ອອຳນວຍ ເພື່ອຄວາມສຳເລັດໃນການສ້າງຕັ້ງໂຄງການ ຄ່າຕອບແທນສຳລັບວຽກງານການຄຸ້ມຄອງ ແລະ ປົກປັກຮັກສາແຫຼ່ງນ້ຳ.

Relevance of Payments for Environmental Services (PES) for watershed management in northern Lao PDR

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Abstract

In this paper we discuss the main results of a feasibility study for the implementation of Payments for Environmental Services (PES) in a small northern Lao watershed. The aim of the work was to assess the relevance of a PES scheme as a way to control both the quality and flow of a small mountain stream. We found that the PES concept, with some adaptations, may offer interesting avenues as a means to maintain water quality through an improved control of soil erosion in the upper catchment: Willingness-To-Pay (WTP) within the sampled population was approximately USD 0.3/month/household which would be sufficient to abate the negative impact of soil erosion. At the whole catchment scale, major impediments to the immediate implementation of a PES scheme were i) the lack an unequivocal relationship between environmental services, users and providers, ii) insufficient WTP to maintain water quality along the stream through waste management and iii) absence of a critical mass of buyers. A precondition of successful implementation of PES in the area is to increase the awareness of environmental issues in the concerned communities.

Key words: *Payments for Environmental Services; Water quality; Soil erosion; Mountain stream; Lao P.D.R*

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Introduction

Environmental Services (ES) are benefits that humans obtain from natural and cultivated environments (Wertz-Kanounninoff, 2006). For example, hydrological services can be obtained through river flow regulation, flood control or protection against soil erosion (Wunder, 2002; Wertz-Kanounninoff, 2006). ES are threatened worldwide, in a variety of ways, by human activities. In response to such threats, the concept of Payments for Environmental Services (PES) has been proposed as a scheme to reward land users who adopt practices that generate ES, hence promoting sustainable land use (Mayrand and Paquin, 2004).

A PES is a payment or direct compensation mechanism by one or more users for the maintenance and/ or availability of an ES by one or more suppliers of the ES. The principle as explained by Mayrand and Paquin (2004) is as follows: "Communities that are in a position to provide an ES should receive compensation, and it is those who benefit from these services that should pay [...] PES schemes are aimed at giving a specific value to ES and to set-up effective systems of price setting, institutionalisation and distribution which favour changes in behaviour and the adoption of sustainable land-use practices that benefit the whole community" (Figure 1).

The aim of this study was to assess whether this concept could offer new perspectives for managing the hydrology of a small river basin in northern Laos. Identifying the most appropriate ES for a PES market in watershed services is a complex equation of socio-economic and environmental factors. In addition, it is important to ascertain that a demand for this ES exists among potential buyers. As part of a best practice approach for PES, a study was carried out in order to identify the most appropriate ES for a PES market in Houay Xon. Data required to carry out the successive steps of this approach were collected by i) a survey of the local population's perception of water issues, ii) a critical analysis and compilation of pre-existing biophysical, socio-economical and geographical information and iii) field measurements.

Location and characteristics of the study site

The Houay Xon watershed (Figure 2) covers 22 km^2 and includes 7 villages

located along the Houay Xon stream (Ribolzi et al. b, this issue). The stream runs for approximately 15 km and has three main tributaries. The average annual rainfall is 1403 mm (average of the last 30 years), and the mean annual temperature is 25°C. Two distinct seasons characterize the study site: a wet season from April to October, and a dry season from November to March. This catchment's maximum elevation is 584 m a.s.l., near the headwater area (Chaplot et al., 2005).

The study area encompasses a population of 6251 inhabitants mostly of the Lao Lum, Khmu and Hmong ethnic groups. Farming activities are located upstream, in the Houay Pano headwater catchment. In downstream villages, the population is dominated by government employees and agricultural activities are limited to small scale vegetable gardening and fish breeding. Over recent years, the Houay Xon catchment has been subjected to increasing environmental pressure which resulted in degraded water quality and reduced flow. In addition, extreme climatic events, such as a flood in September 2006, have reportedly caused increasingly severe damage to infrastructure essential to the community.

Survey design and implementation

To estimate the supply and demand for hydrological services in the Houay Xon catchment, we selected a sample of 67 people who were interviewed over a period of one month. People included in this sample represented the five main categories of water users identified along the Houay Xon: farmers from upland and downstream areas, gardeners, tradespeople and villagers who only use water from the Houay Xon for domestic purposes (Table 1). Not all categories are represented equally in the sample because not all categories encompass equal numbers of people and some individuals were not willing to participate. In addition, missing or false information made it sometimes difficult to compare all the villages amongst themselves.

All these users, who are scattered along the stream, potentially contribute to water pollution and/or flow decrease. They are therefore potential buyers and suppliers of hydrological services since they participate in water extraction, transformation and discharge. The questionnaire was designed to document interviewees' socio-economical background and that of their dependants,

their awareness of water flow and quality changes, their perception of the causes behind these changes, their ability and willingness to participate in a payment scheme and their understanding of institutional and governmental support. This data set was combined with information previously collected by public and private institutions and biophysical data monitored by IRD since 1991.

Results

Table 2 summarizes the information collected during this feasibility study. The need for improved water quality and more constant stream water flow in the Houay Xon catchment was clearly identified. These results can be used to define an ES, such as, for e.g. a guaranteed minimum water flow with precisely defined bacteriological and chemical quality.

Water Scarcity

The survey showed that most of the interviewees have noticed a decrease in the flow of water in the last several years: 62% of interviewees think that the stream has undergone a negative or very negative evolution (Figure 3). However, the quantity of water is not a major problem for the population surveyed: 48% of the sample held the view that the quantity of water is good or very good (see Figure 3). 34.8% did not perceive a change in the quantity of water in the stream. Furthermore, villagers did not appear to be affected by the changes in water quantity within the Houay Xon catchment. In fact most villagers use complementary sources of water, and do not rely upon the river as their only water source. According to the official census, an average of 91.2% of the population in the villages downstream of Ban Don Kang is registered to use the Nam Papa system. The survey also showed that the inhabitants have adopted the network and mineral water for convenience and comfort (it saves time in both transport and there is no need to boil the water), and not because there was not enough river water. Lastly, the cost of water is low for the surveyed communities. Only 2.28% of villagers' annual income is spent on obtaining water from the supply. The budget for mineral water is higher and represents one third of the income. Families are rarely too poor to pay for the private supply and therefore are not dependent solely on river water. A survey in Xiengkhouang showed that the inhabitants spend 4.8% of their annual income on water, which is twice the amount spent in our study area.

The price of water is therefore relatively affordable for the studied population so that a hydrological service to maintain water flow does not emerge as a priority.

Water quality decline

Unlike water quantity, the study revealed significant demand for an ES to control water quality: 67% of the sampled population thinks that the water quality in the Houay Xon is poor or very poor. A further 65% perceive changes in water quality as negative or very negative (see Figure 4). Interestingly, one third of the sample declared not to have seen any changes in water quality. This can in part be explained by the fact that their recent relocation to the area (on average less then 5 years ago) prevented them from observing degradation of the Houay Xon. A decline in water quality has been observed over the past 10 years. In Ban Lak Sip, a 2003 survey showed that 72.2% of the population complained about the deteriorating quality of water in the Houay Xon (based on findings by Lestrelin et al., 2006). In 1999, during a survey by the Rural Development Committee, five villages out of seven declared that the quality of water was "not satisfactory" (RDC, 1999). Water users strongly complained of the bad quality of the stream water and its degradation confirming demand for an ES in water quality control.

Challenges to implementing a PES in the Houay Xon

It has been documented worldwide that, most often, farmers, fishers and foresters do not manage natural resources in ways that increase the provision of environmental services due to a complex combination of social, economic, political and technical factors (FAO, 2007). Likewise, some of the most common barriers to the adoption of improved management practices such as, limited access to information, appropriate technologies and finance, as well as insecure property rights and legal or regulatory constraints (FAO, 2007), are likely to impede a straightforward implementation of a PES scheme along the Houay Xon. Remarkably, our study also found that a major constraint to the implementation of a PES could be that the binary approach to providers and users may not always be valid, which indicates that attentive consideration should be paid to the conceptual definitions of PES.

ES users vs ES suppliers

First, the binary concept of user vs supplier is poorly suited to the situation studied because water extraction and contamination are diffuse along the stream. Complex interactions between the location of users and impact upon hydrological services impede any straightforward implementation of a PES scheme (Figure 5). Farmers and garden owners extract water either all the way upstream or downstream, and the water is used for domestic purposes all along the stream. The consumption of river water occurs randomly from upstream to downstream (Figure 5). Villagers in Ban Lak Sip use more water from the piped supply network than from the river, but the situation is reversed in the downstream villages and the reverse again in Ban Khoy. Therefore potential buyers are distributed erratically throughout the watershed. Likewise, the factors responsible for the deterioration in water quality are not easy to clearly identify. Furthermore, it is not clear which one group of users among the community is (more) responsible for the degradation in water quality. Almost half of the sample thinks that the degradation in water quality is not due to specific usage upstream but rather climatic or other natural causes, which are inevitable. During the 2003 survey, 93% of those surveyed in Ban Lak Sip supported this view (from data collected by Lestrelin). This poses a challenge in implementing PES because the interviewed villagers appear to believe the changes are beyond their control. Education of environmental processes and human impact is critical to overcoming this obstacle. Identifying an ES provider is thus difficult in the studied region because all stakeholders upstream and downstream play a role in degrading the stream. Furthermore, it may be difficult to convince users to modify their usage patterns unless they first accept their responsibility in the deterioration of the Houay Xon.

In theory, the demand for the ES within a hydrological services PES context usually comes from downstream. In this case, the ES appears distributed all along the stream. Furthermore it would seem logical that the buyers of the ES would be those that are most affected by the current situation. However, in this area, the damages suffered vary irrespective of the location of the interviewee along the stream. For example, the villages that suffered the greatest damage during the 2006 flood events were Ban Donkang and Ban Kouathineug. The surveyed inhabitants downstream of these villages

were much less affected. Thus there is a demand for an ES all along the stream and it is not confined to downstream. Locating potential buyers downstream leads to an additional two obstacles. Firstly, downstream villagers are not the main water users. These villages are made up of a large majority of employees, factory workers, and shopkeepers, with only 3.7% identifying themselves as gardeners or farmers. A large number of farmers obtain irrigation water from artificial streams and not from the Houay Xon, and the villagers do not use the stream very often. The downstream population is rather unaware of the degradation of the hydrological service, and the villagers would be reticent to buy a service that they do not use.

Unfavourable socio-economic context

The socio-economic context of the Houay Xon catchment is characterised by subsistence economic strategies that also appear to be an obstacle for the implementation of a PES scheme. Farming and market gardens are typically low yielding with corresponding low profitability. 71.91% of the interviewees produce food for their own consumption, which seems to be characteristic of the region (for example, a socio-economic study carried out with 53 households in the neighbouring Nam Kham catchment showed that farmers could only sell their produce for one or two months of the year - personal communication, Mr Keonakhone, NAFREC). The vegetable yields in the study area are relatively low with an average of 2.41 tonnes/ha. The area cultivated is also restricted, with on average 1.33 ha for the farmers we interviewed and 0.44 ha for the market gardeners. The photo in Figure 6 shows the size of the one of the biggest garden plots at Ban Sangkhalok.

Consequently, the income of the inhabitants in the study zone is low, with an average of 500USD/year/household (as a comparison, this is less than half the income calculated during the survey of the Nam Kham catchment - personal communication, Mr Keonakhone). The majority of the population have just enough money to satisfy their basic needs: 95% of income is spent on food. Furthermore, an average of 15% of the studied households does not have access to electricity.

Overall, the downstream users (farmers and gardeners) do not have sufficient income to support a PES market. In the villages of Ban Ma and Ban Sangkhalok

the sale of vegetables represents only 46.3% of the income. Furthermore, data from the DAFEO (District Agriculture and Forestry Extension Office) from 2003 shows a clear decrease in the percentage of revenue derived from farming or market gardens of the entire revenue between 1990 and 2003 in Ban Lak Sip and Ban Donkang (data from Lestrelin). This decrease is also observed in the villages downstream of Ban Donkang, which earned almost all their income from agriculture 8 years ago (RDC, 1999). The main economic activity of these villages is now commerce and there has been a large decrease in crop production. Half of the producers interviewed declared that they want to decrease their area under cropping. High-income earning stakeholders in the region do not seem to be the appropriate buyers of the ES. The majority of operating PES markets work with a single buyer of the service and several suppliers. The major companies in the study area, that is Nam Papa and DLPCP (LuangPrabang Pre-Stress Concrete Plant), are potential buyers. However, the quality of the stream water does not pose a major problem to Nam Papa. Furthermore, this company has license to act independently in an area of 3000 ha. It aims to completely reforest the Phu Phung Mountain by banning flooded rice production in the area. The situation appears to be the same for the DLPCP Company that also owns large tracts of land around the spring source. It appears difficult to propose a PES to these companies that already have a huge influence on land usage in the surrounding areas. Thus in principle, there is a lack of buyer(s) for the ES, having determined that the few users downstream do not have the means to pay for such a service, and that the few potential buyers who do have enough money do not use the river or already have control over the usage of land upstream from their spring water source. In the study zone, therefore, we cannot clearly identify the provider of the ES upstream or buyers downstream. As opposed to the simple conceptual framework summarize in Figure 1, the potential buyers and suppliers of this service are scattered in a diffuse manner all along the Houay Xon, as can be seen in Figure 7.

Policy impediments to the implementation of a PES

Finally, while it is a basic principle of the PES concept that land use can be altered with a certain flexibility so as to ensure delivery of ES, the current land allocation system makes

it difficult, if not impossible, for farmers to alter land use (National Growth and Poverty Eradication Strategy, cited in NAFRI, NAFES and NUOL 2005). The population relocation policy initiated in the 1970's by the GoL (Lestrelin et al., 2006), also contributed to the emergence of conditions rather adverse to the immediate success of a PES scheme: it resulted in the cohabitation of several ethnic groups within small communities, often leading to tensions, and fell short of establishing good communication between villages and between villages and local authorities. A side effect of the relocation policy was also that displaced populations did not fully bond with their new environment. This resulted in limited awareness of environmental issues and unsustainable use of the natural resource base by the community, naturally leading to a lack of WTP for ES among many.

Conclusion

The need for improved water quality and more constant stream water flow in the Houay Xon catchment was clearly identified. These results can be used to define an ES, such as a guaranteed minimum water flow with precisely defined bacteriological and chemical quality.

This study identified several obstacles likely to impede the straightforward implementation of a PES scheme along the Houay Xon. First, the binary concept of user vs. supplier is poorly suited to the situation studied because water extraction and contamination are diffuse along the stream. In addition, the current land allocation system means that farmers can not independently alter land use although this is a precondition to successful PES implementation.

In spite of these obstacles, the MSEC (Management of Soil Erosion Consortium), program clearly established that alternative farming practices and careful management of sensitive areas (e.g. riparian areas) opens new avenues for the improvement of water quality by reducing sediment delivery (Van Breusegem, 2005; Valentin et al., 2006; van der Helm, 2007). WTP within the sampled population was approximately USD 0.3/month/household which, if put in practice through a PES, would be sufficient to significantly abate the negative impact of soil erosion on water quality. However, at the whole catchment scale, this would not warrant good water quality as it would not be enough to maintain the waste collection system essential to abate the observed

distributed contamination of the stream. Therefore, one of the preconditions of successful implementation of PES in the Houay Xon watershed is to increase the awareness of environmental issues in the concerned communities to increase their WTP for ES, as at the moment, they fail to recognize the cost of producing these ES.

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Table 1 – *Categories of Houay Xon water users.*

Category of user	**Type of water usage**
Villagers	Domestic activities
Farmers	Crop irrigation
Market gardeners	Garden irrigation
Fish farmers	Supply of water for fish ponds
Trades people (garages and diverse manufacturing)	As part of production process

Table 2 – *Main results of the survey.*

Characteristics of the community	
Socio-economical background	Low average income (USD500/yr/household). Consumption of self-produced food dominates. Most villagers need more than one job. Lack of private property: land use entirely depends on land allocation by the Government of Laos (GoL).
History	Forced relocation (under GoL policy) but newcomers seem attracted by better life conditions in the area (proximity of Luang Prabang is seen as an asset).
Space allocation and management	Population along the stream is increasing. There is no planning of new developments. Farm plot size is decreasing.
Observed water use	
Water extraction	Main form is distributed water extraction. Farming and fish breeding use less water than gardening and domestic activities distributed along the stream. Other sources of water (piped spring and ground- water, bottled water) are used for daily household and production activities.
Water quality	Main form is distributed contamination. Farming and fish breeding contaminate the stream with chemical fertilizers and organic matter. Villagers are responsible for non point source pollution all along the stream (solid wastes and grey water).
Perception of water use	
Water extraction	Decrease in water quantity widely acknowledged but flow still deemed sufficient by many.
Water quality	Unsatisfactory water quality with steady deterioration over years.
Damage related to stream degradation	Economic damage difficult to quantify. Most significant damage ascribed to floods: huge impact of Sept. 2006 floods.
Prospect for change	
Accountability	Villagers are believed to be responsible for water quality degradation. No clear opinion re. changes in water quantity.
Willingness to implement change	Population is ready to pay for waste collection system but not to invest in upstream land use change although WTP sufficient to abate soil erosion.

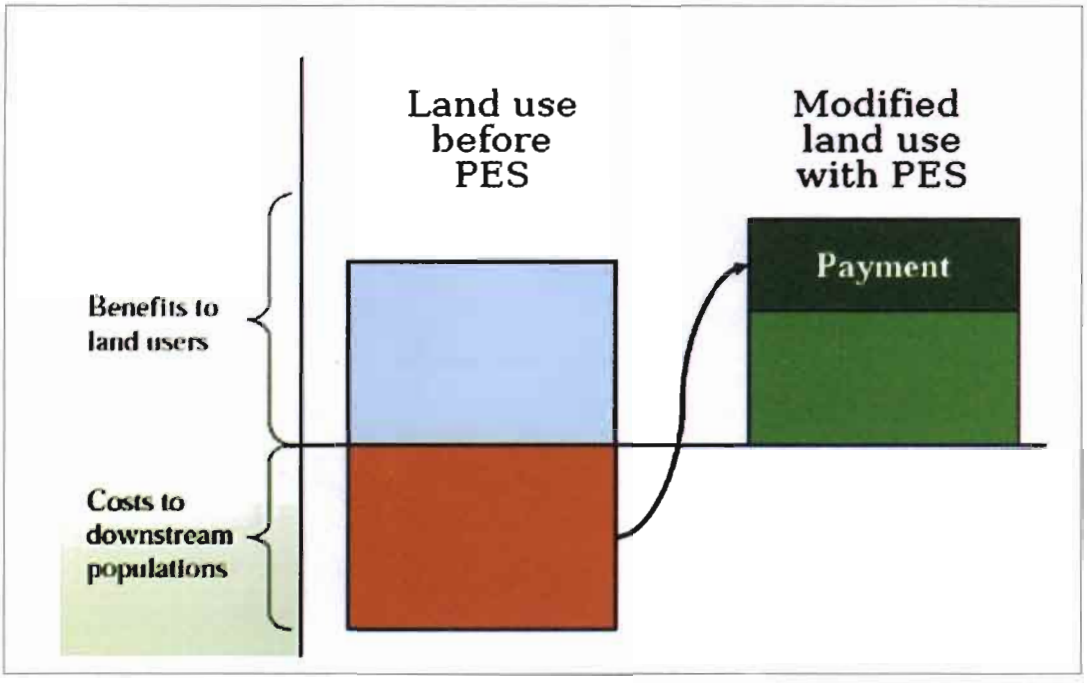

Figure 1 – *Schematic representation of the PES principle (After http://www.itto.or.jp/live/Live_Server/2869/18_Sander.pdf).*

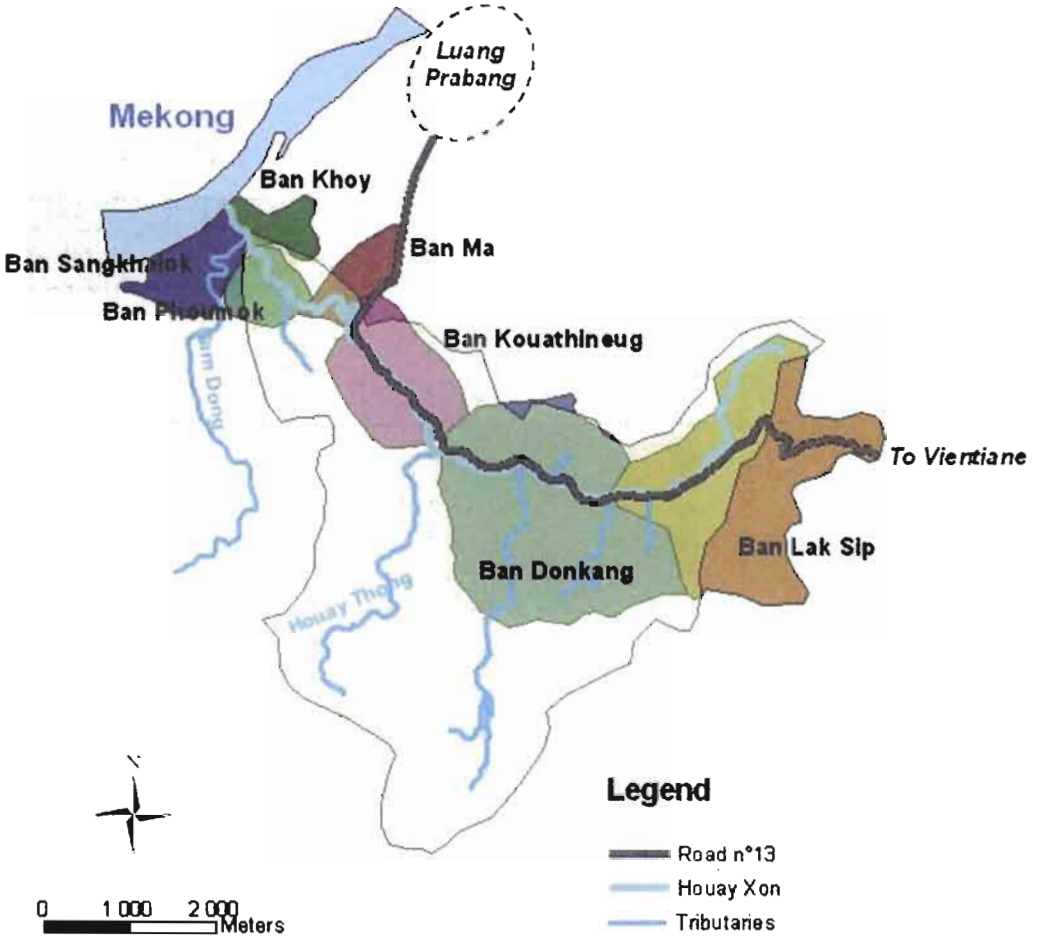

Figure 2 – *Map of the watershed and location of villages*

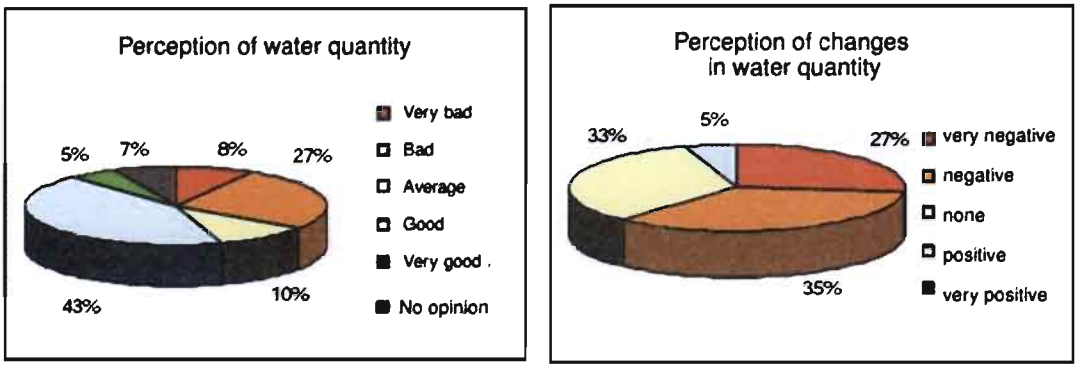

Figure 3 – *Map of the watershed and location of villages*

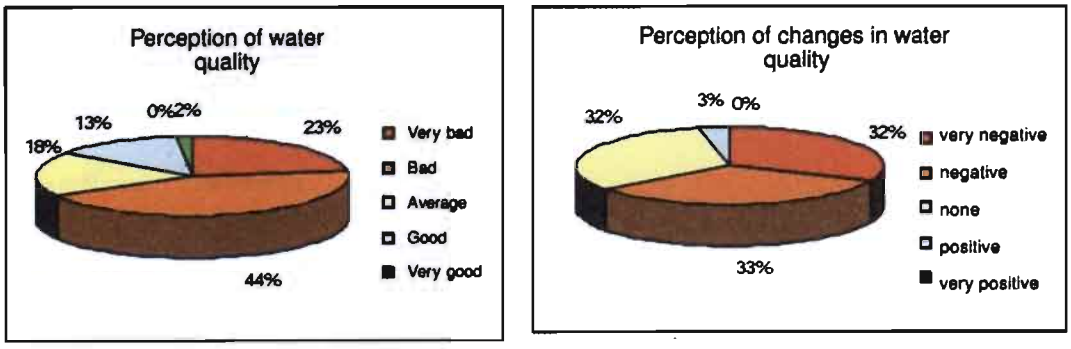

Figure 4 – *Map of the watershed and location of villages*

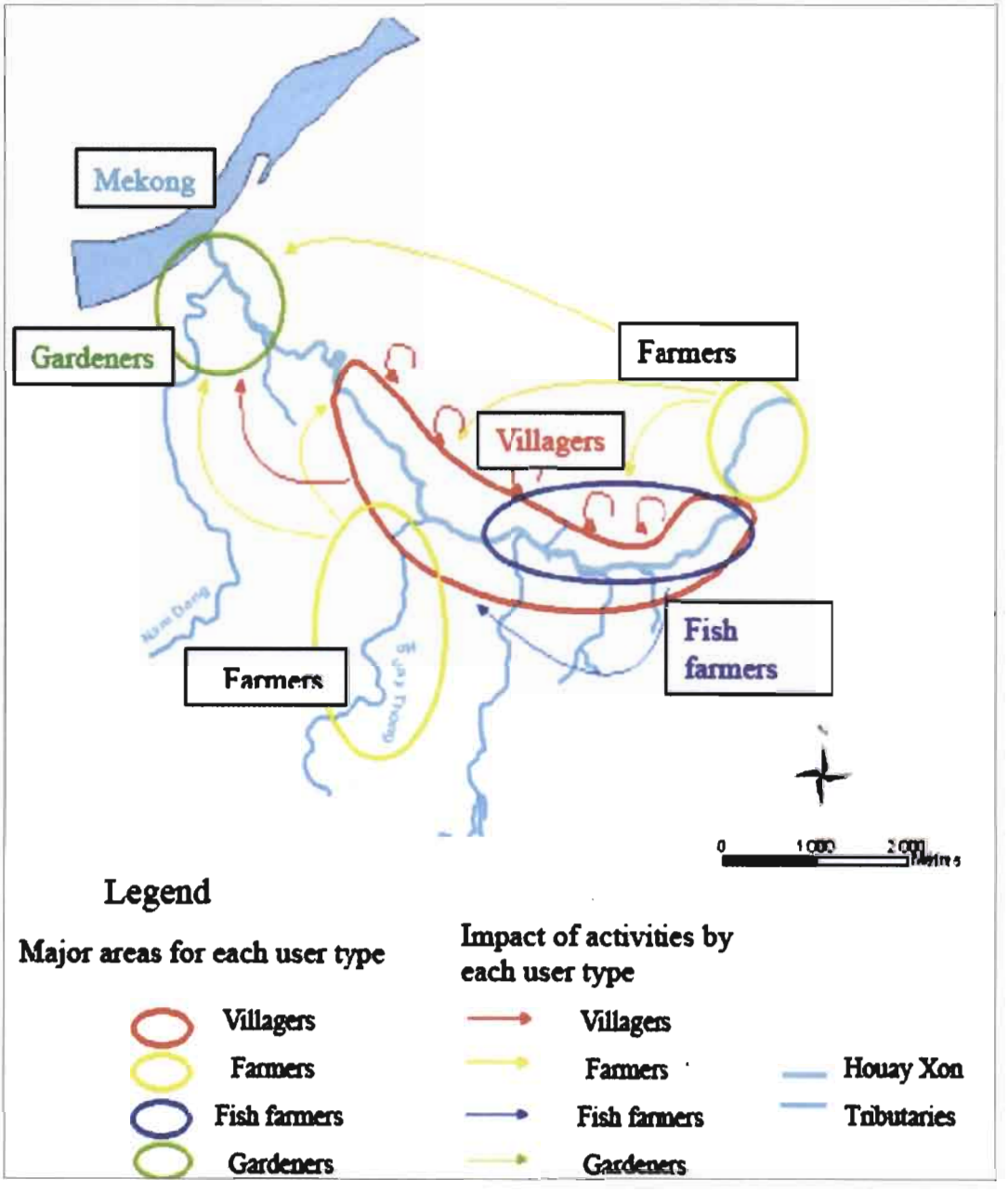

Figure 5 – *Spatial relationship between the different water users along the Houay Xon.*

Figure 6 – *Garden plots in Houay Xon.*

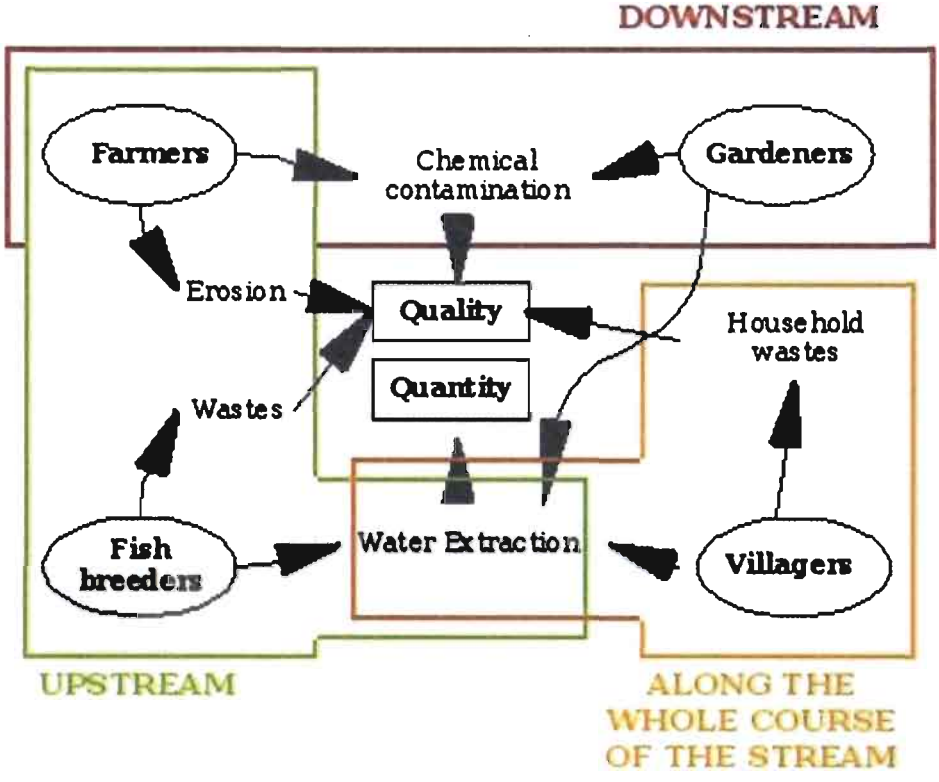

Figure 7 *– Complex water use relationships in the Houay Xon watershed.*

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Designed and Layout by: Khanhkham Ouneoudom, Information Center, NAFRI

ออกแบบ ແລະ ຈັດໜ້າ ໂດຍ: ຂັນຄຳ ອ້ວນອຸດົມ, ສູນຂໍ້ມູນຂ່າວສານ, ສຄກປ