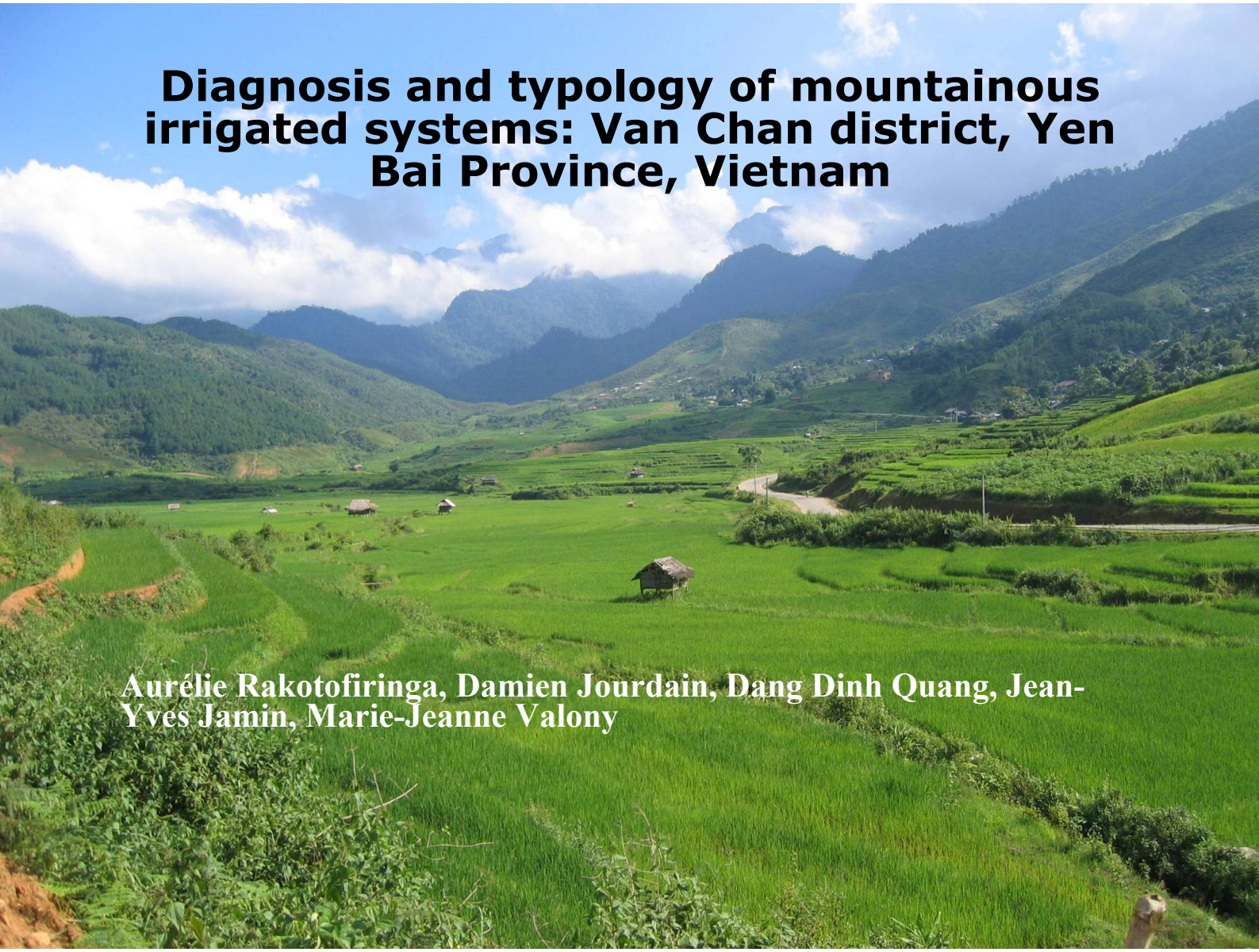
Diagnosis and typology of mountainous irrigated systems: Van Chan district, Yen Bai Province, Vietnam



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Most data and results presented here have been presented, in French, in Aurélie Rakotofiringa Msc. Thesis “Diagnostic et typologie des systèmes irrigués de montagne : cas du district de Van Chan, province de Yen Bai, Vietnam”. They are now presented in English and in a more condensed form to comply to the CPWF reporting procedures. Damien Jourdain, Dang Dinh Quang, Jean-Yves Jamin, and Marie-Jeanne Valony who participated in the supervision of Aurélie's master's thesis contributed to this revised and abstracted report and were therefore included as co-authors.

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PRELIMINARY INFORMATION

Throughout this document, several Vietnamese and French terms will be used. For practical typing reasons, these terms will be written without accent. Proper nouns will be presented without particular fonts whereas common nouns will be in italics.

Terms such as irrigated perimeters and irrigated systems will be used several times all the report long. Hence, their given meanings should be precised.

When the term of irrigated perimeter is used, it refers to a real surface watered by an irrigation network, so it represents a physical object. At a water supply point (dam, diversion canal...) on the source of water (spring, stream, river..) an irrigated perimeter will be allocated. We associate then a perimeter to its water supply point and not to the source of water used. As for the irrigated system, it is composed by the physical structure of an irrigation network, but also by users, the organisations in charge of its management and the rules the farmers use to manage the system.

ACRONYMS

CGIAR: Consultative group on international agricultural research

CIRAD: French Agricultural Research Centre for International Development

CPWF: Challenge program for water and food

IRC SupAgro: Institute for tropical and subtropical regions of SupAgro (International center for higher education in agricultural sciences)

IRRI: International rice research institute

NOMAFSI: Northern mountainous agriculture and forestry science institute

VCP: Vietnamese communist party

PVC: Polyvinyl chloride

SAM: *Systèmes agraires de montagne* or Mountain agrarian systems, research project working on mountain areas situated in the North part of Vietnam

TUEBA: Thai Nguyen university of economics and business administration

VND: Vietnam *dong,* Vietnamese currency; in October 2008, 1 euro = 22 000 VND

GLOSSARY

Water allocation: water sharing between several users (in volume)

Water supply: water sharing in time that specifies who will have access to water and in which priority order

Irrigated perimeter: surface really watered by an irrigated network

Irrigated system: it is composed by the physical structure of an irrigated network, its users, organisations in charged of its management and the rules the users and other contributors use to manage the system

VERNACULAR TERMS

Doi moi: translated from Vietnamese by renewal or renovation. It refers to a new strategic orientation of Vietnam adopted in 1986, for a liberalisation of the socialist economy of the country

Thi Xa: official unit equivalent to a urban district (identical to an agglomeration)

INTRODUCTION

Vietnam is a strip of land which shape reminds the letter 'S', occupying a surface of 326,288 km^2 and expanding from north to south over 1650 km. Situated in the middle of South-east Asia on the Indochinese peninsula, the territory is bounded in the east by the China sea (3260 km of coast), in the north by China, in the west and south-west by Laos and Cambodia. Three quarters of the country are covered with hills and highlands[1], whereas the last quarter is covered with low lands[2].

Figure 1: Situation of political and economic capitals, and of Van Chan district in Vietnam (Satellite image: Google Earth)

Today, the Vietnamese territory is broadly dominated by a rural landscape. Rural area represents nearly 95 % of the whole surface area of the country, gathering 79% of the population (Bui Ngoc Hung and Nguyen Duc Tinh, 2002).

1 Areas with real hilly or uneven topography (Brabant and *al.*, 1997), or mountainous areas
2 Areas with altitude lower than 50 m, with even topography and slight slopes (Brabant and *al.*, 1997)

The SAM project (Mountain agrarian systems in Vietnam) was established in 1998 in order to workout technical alternatives for agricultural households living in unfavorable mountainous areas. This initial project evolved over time and today research questions are linked to improving soil and water productivity at the landscape level.

This study deals with the water use in irrigated fields of a mountainous area in north-west of Vietnam. The logic of a research project is that intensification of irrigated agriculture will affect both household livelihood and the natural resources they rely upon. Intensification can be obtained through technical improvements, but also through institutional and organizational changes.

What types of organizations are managing irrigated systems in the Van Chan district? Who are the protagonists of this water management? What are the irrigated system characteristics? How does water management interfere with intensification possibilities of the irrigated paddy fields?

After briefly presenting the context of the study, water management structures and organizations will be presented and analyzed. Finally, future perspectives will be presented.

1 General context of the study

1.1 Institutional context of the study

The current study has been carried out within the CPWF funded project "Rice landscape management for raising water productivity, conserving resources, and improving livelihoods in upper catchments of the Mekong and Red River basins", led by IRRI, and covering three countries Laos, Thailand and Vietnam.

The district of Van Chan (Yen Bai province), where most of this project activities are carried out, includes within reasonable distances a great diversity of irrigated systems that are characteristic of mountainous areas of Vietnam

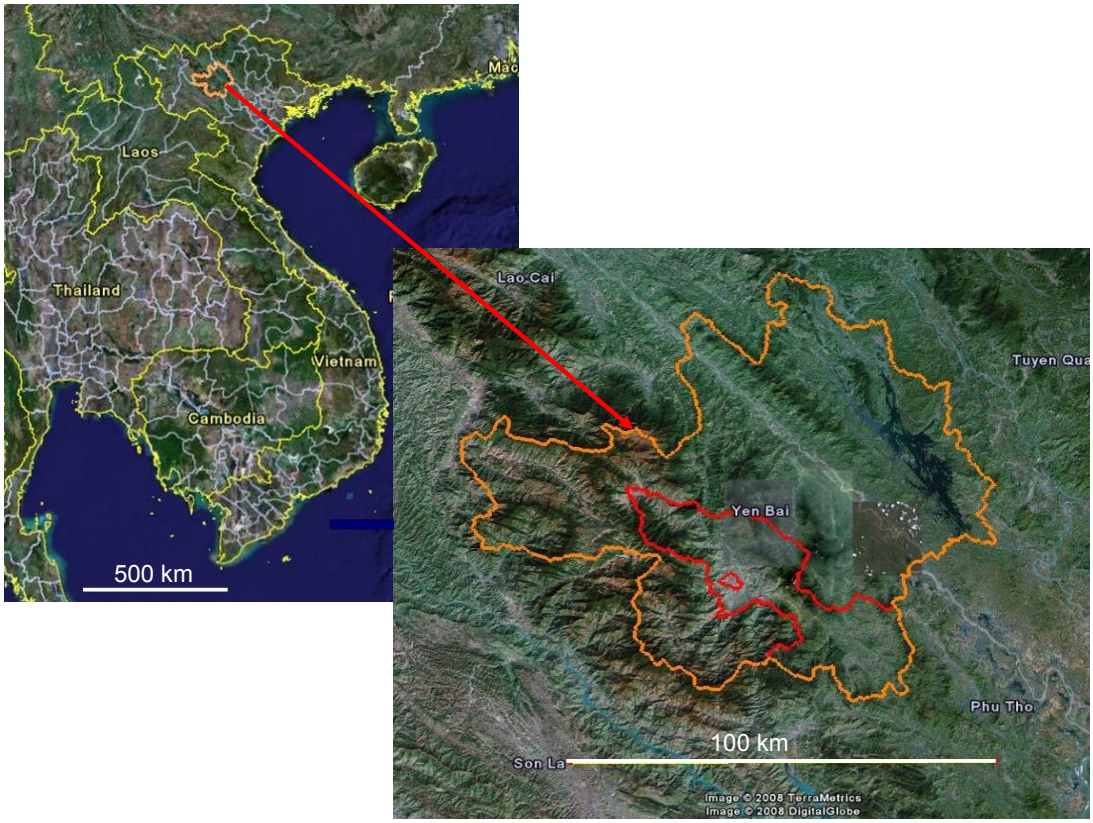


Figure 2: Van Chan district situation within Yen Bai province (Satellite images: Google Earth)

1.2 Natural and socio-cultural mountain contexts: non-standard situations in Vietnam, Van Chan district case

Van Chan district is situated in the South of Yen Bai province (see Figure 2). Its covers 1,228 km^2, of which 60 to 70 % are sloping land. As of 2006 the district had a population of about 144,000 inhabitants divided in Kinh and 13 different ethnic minorities. The district is subdivided into 31 communes. The *Thi Xa*[3] Nghia Lo doesn't belong to Van Chan district. It is an official enclave represented in red, as the limits of Van Chan district, on Figure 2.

1.2.1 Hard natural conditions: hilly landscape and cold and humid winters

Crossed by an extension of Himalaya chain, the mountain range **Hoang Lien Son**, the North area of Vietnam presents a hilly landscape, with plain areas and valley bottoms. Sixty to seventy percent of Van Chan district are sloping lands. The district also

3 An official unit equivalent to a district but at the urban level (corresponds to an agglomeration)

contains a large irrigated plain, “Muong Lo” (situated around Nghia Lo, Figure 3). This large plain is not really representative of the district where the major part of irrigated plots are situated in small valley bottoms, small basins, or on terraces built on mountain sides.

This central area of Van Chan district, although it presents moderately high altitudes, highlights altitude variations characterizing the district topography. Figure 4 shows that on a small distance (15 km) the altitudes can significantly vary with a difference of more than 300 m between a town and a mountainous village.

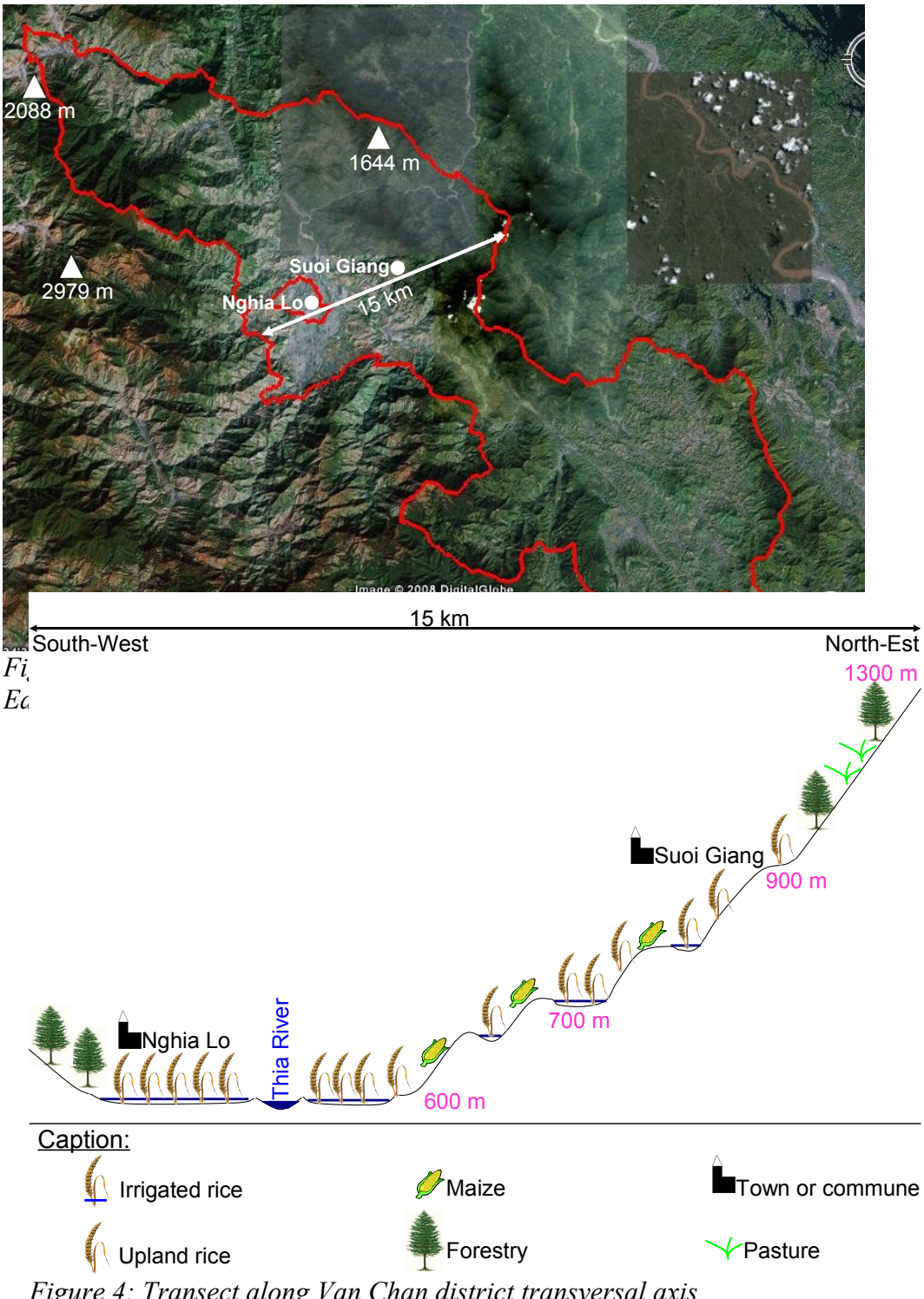


Figure 4: Transect along Van Chan district transversal axis

The climate represents a second important natural characteristic of the area. In the North of Vietnam, it is subtropical humid with monsoons, and presents two seasons: winter and summer. The winter starts from November to April and it is very humid. The summers are hot and begin in May, last up to October and sometimes bring devastating typhoons.

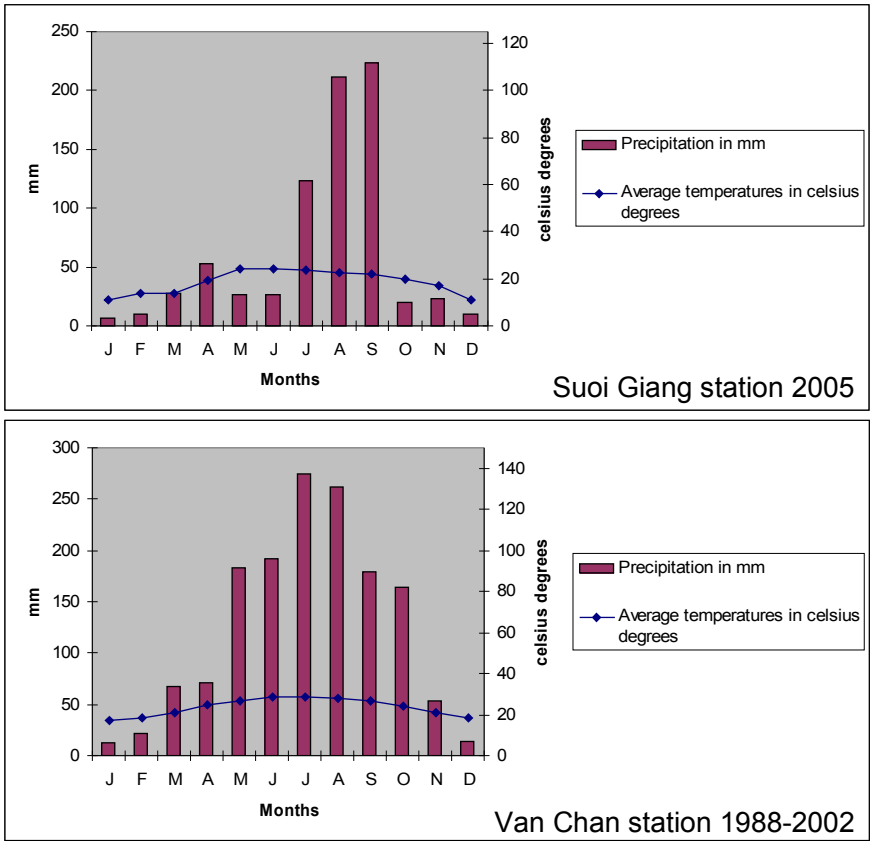


Figure 5: Suoi Giang and Van Chan ombrothermic diagrams (Source: SAM project)

Figure 5 concerns Suoi Giang village, a high mountainous village (about 900 m high), and Van Chan (about 600 m high), the district administrative centre, with a central situation compared to the studied area. The lowest temperatures are stated from December to February, dry period for Suoi Giang and Van Chan according to the presented ombrothermic diagrams.

1.2.2 Climatic and topographic constraints

Natural constraints of this area, such as steep slopes, low temperatures in winter and heavy rains in summer are important.

Steep slopes are a constraint since they require a greater physical effort while carrying out different cultural operations. Furthermore, associated to summer heavy rains, they make the cultivated plots more fragile (irrigated terraces or cultivation on slopes), being able to strongly erode cultivated soils, cause great damages to irrigation canals and silting up dams downstream.

Low temperatures typical of mountainous areas can affect cultivated plant development during the coldest months. At Suoi Giang, the minimum average temperature was 16 ºC in 2005 and 19 ºC at Van Chan between 1988 and 2002. However, rice plants are dying when exposed to a daily average temperature inferior to 12 ºC for more than three consecutive days (Bouman and *al*., 2001 quoted by Montagne, 2008). A recent study carried out in the Van District showed the susceptibility of existing varieties to cold-spell (Montagne, 2008). Low temperatures reduce yields and cold resistant varieties for those altitude climates are needed. Irrigated rice cultivation can be risky for the farmers.

Compared to the deltas, mountainous areas of North Vietnam, where Van Chan is located, are in general rural, poor and landlocked areas. They are distinct from other Vietnamese areas by their topography and climate, and also by their ethnic diversity.

1.2.3 An area populated by minority ethnic groups

The majority (85%) of the Vietnamese population belong to the *Kinh* ethnic group. Other populations are divided into fifty four minority ethnic groups officially recognized in Vietnam. Thirty one minority groups Vietnam are present in northern mountainous areas (Michaud and *al*., 2003), each of them speaking their own language. In Yen Bai province, about 50 % of the population belongs to one of these thirty one minority groups.

	Van Chan	Yen Bai	Vietnam
Population density (2005)	85.3	106.0	257

Table 1: Population density of Van Chan District (Source: GSO, 2007)

In Van Chan district, as of October 2008, 64 % of the population belonged to a minority ethnic group (mainly *Thai*, *Tay*, *Hmong* and *Dao*).

Kinh people live in the South-East part of the district (the lowest one), in particular in the tea production area, in towns and plain areas. Several migration waves of this ethnic group took place in the course of recent history especially in 1961, 1971 and 1974. The people came from overpopulated provinces of Red river delta. Today, *Kinh* farmers are predominantly irrigated rice and tea cultivators.

Thai people who live in Van Chan district mainly live in large irrigated plain areas such as Muong Lo great plain (Figure 6), located around *Thi Xa* Nghia Lo. They were the first ethnic group to colonize this large plain.

Tay people, like *Thai* people, live in houses built on piles. They essentially cultivate irrigated rice, their main food (Dang Nghiem Van and *al*., 1993). In Van Chan district, they can be found essentially on the South-East part, in the tea production area.

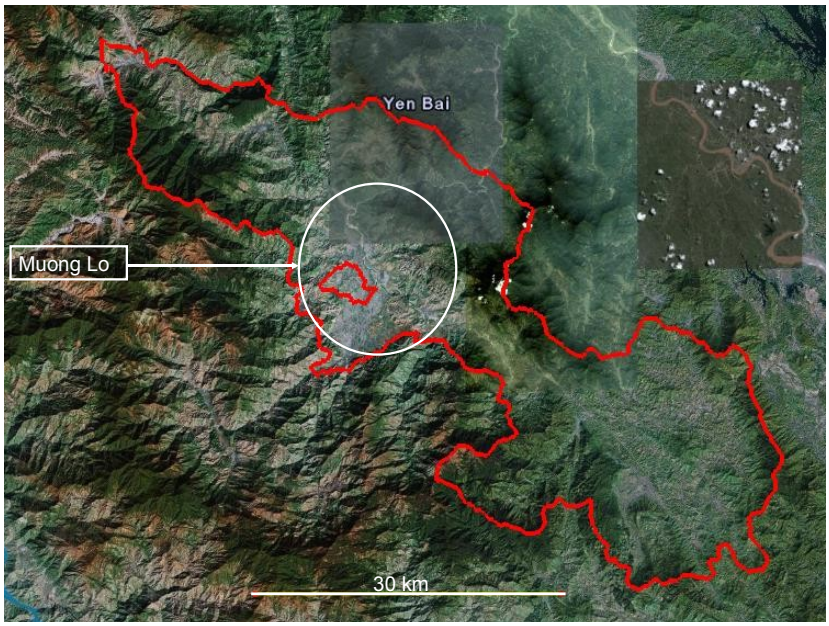


Figure 6: Situation of Muong Lo rice plain (Satellite image: Google Earth)

Hmong people eat mainly maize and rice. Traditionally, they have been upland rice and maize cultivators on high altitude sloping lands. Today, they also grow irrigated rice on terraces.

Dzao people, like *Hmong* people, mainly grow upland rice and maize, but also cassava (as a cash crop) on sloping lands.

2 Rationale of the study

2.1 Research questions

After the de-collectivization of Vietnamese agriculture (in the 1990's), during which the means of production and the management of irrigated schemes have been transferred from the cooperatives to the farmers, rapid changes have been observed. Within the upper-catchment of Northern Vietnam, a large number of rural households depend on rice-based production systems (irrigated more particularly) to fulfill their food needs. To improve farm incomes and increase food security, increasing water productivity, while conserving natural resources is necessary. But to improve water productivity within irrigated systems, we must first understand and analyze the diversity of situations under which water is used. We should then be able to identify the strong and the weak points of each irrigated system and possible factors that restrain water productivity, in order to specify possible improvements.

Several questions are to be asked to understand the situations farmers of North of Vietnam have to face with :

- What are the different types of irrigated systems? What are the main factors of differentiation between those different types (infrastructure, management...)?
- What are the specific problems (and associated research questions) of each irrigated system?
- What are the strong and weak points of each system?
- What are the main factors that prevent improvements of water productivity?
- What are the feasible options for an eventual intensification of irrigated paddy fields?

2.2 Study objectives

Given these research questions, the following objectives have been specified:

- Analyzing the different irrigated systems configurations;
- Carrying out a typology of mountain irrigated systems of upper-catchments of Northern Vietnam;
- Make proposals for possible improvements in terms of infrastructure or management;

2.3 Methodology

2.3.1 Bibliographical research

Before and during the field work phase, bibliographical research and interviews with resource persons have been conducted in Montpellier, France, and in Hanoi, Vietnam. They concern studies carried out in Vietnamese mountains, and studies on irrigation water management in other areas in Vietnam and Southeast Asia as well.

Upon arrival in Vietnam, a first set of irrigated systems where chosen during a field visit.

2.3.2 Detailed study of contrasted irrigated systems

For this first phase, the following sites have been selected:

- Sai Luong village in Nam Bung commune (typical upper-catchment with a relatively large bottom valley;
- Pang Cang village in Suoi Giang commune (with no real bottom valley, and only scattered terraces systems on sloping land);
- Tan Thinh commune located in the "low" tea production area, in which two irrigated perimeters have been located, one presenting a small basic dam (in wood, stones) and only concerning one village, the other presenting a small concrete dam

and irrigating plots of three consecutive villages;

- The case of a perimeter irrigated by the big concrete dam called Nang Phai irrigating the plots of several villages (of Van Chan district and *Thi Xa* Nghia Lo as well). Considering the size of the perimeter, only an upstream part of the network (Hanh Son village) and a downstream part of the network (Nghia Loi commune, *Thi Xa* Nghia Lo) have been studied.

For each of these case studies, the approach was similar:

- Interviews with the People's Committee of the concerned commune to get a broad view of the different irrigated systems present in their commune;
- If the irrigated perimeter has not been already selected precisely, perimeter selection with the people's committee members;
- Visit of the chosen irrigated perimeters and mapping of the irrigated system main infrastructures (dams, canals, gates, etc.);
- Interviews with village's chief to identify the principal actors of the water management of the selected system and getting a global understanding of the situation;
- Interviews with the elders or the notables to know the history of the concerned village/ villages but also the one of ethnic groups living there;
- Interviews with other stakeholders: people in charge of dam/canal/users...

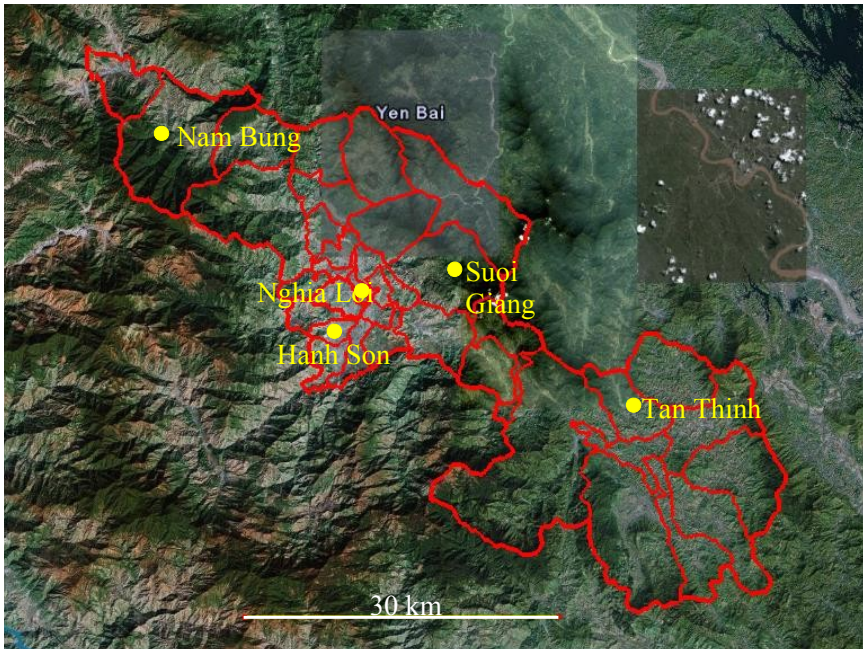


Figure 7: Situation of first communes studied (Satellite image: Google Earth)

Further to this first interview phase, a pre-topology of mountainous irrigated systems has been established.

2.3.3 Van Chan district's irrigated systems pre-typology confirmation

In order to confirm, and improve the established pre-topology, a second round of interviews has been carried out in new and randomly selected irrigated systems. New districts to be visited have been chosen according to their topographic and geographic situations in the district, and their ethnic composition. Within the communes, the studied irrigated systems have been selected after discussions with the People's committee members. Figure 8 shows the location of the visited irrigated systems during the course of the study.

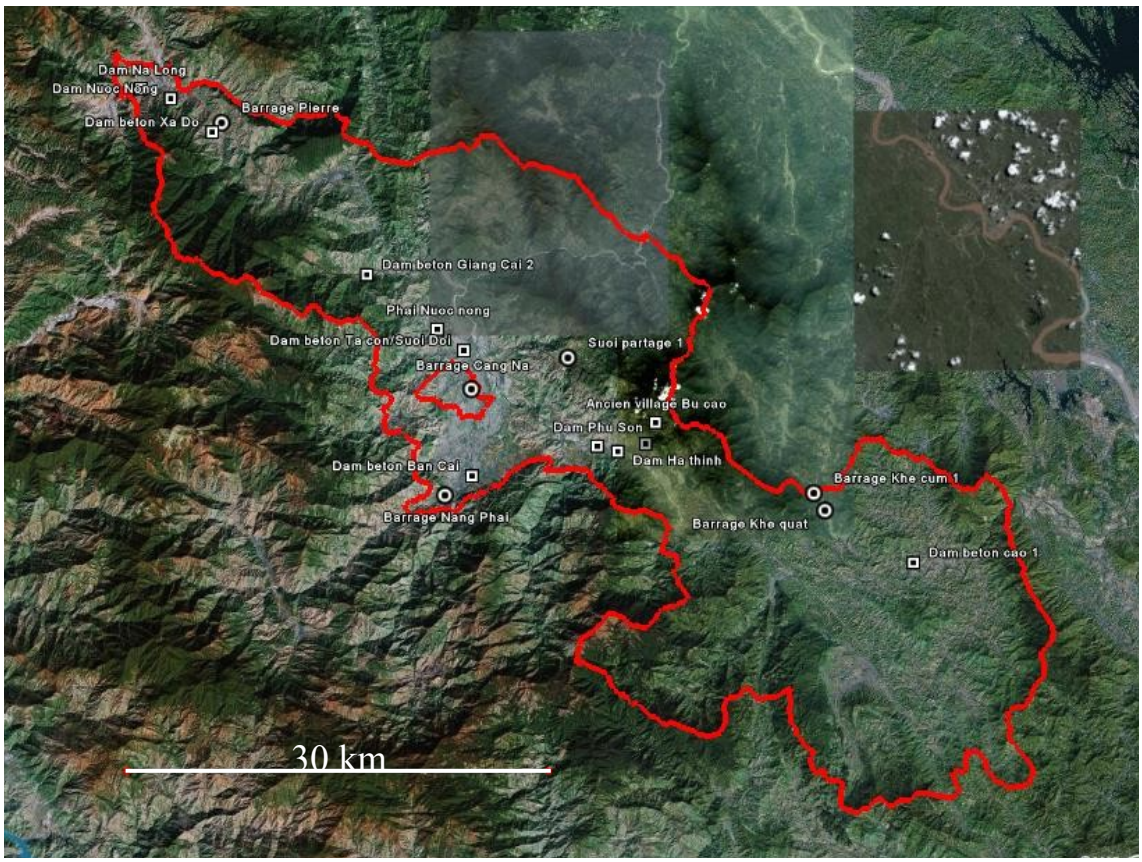


Figure 8: Situation of all the irrigated perimeters studied in Van Chan district (Satellite image: Google Earth)

Circle are those studied during the first interview phase and the squares the ones studied during the pre-typology confirmation phase

For each of the cases, visits and interviews were more succinct than for the first studied cases.

- Presentation and interview with a commune people's committee member;
- Selection of one or several perimeters to be studied;
- Visit of selected irrigated perimeters;
- Interviews with one or some concerned village headmen and sometimes with one

of the central protagonists of the system management (in charge of dam or canal...).

2.3.4 First results presentation

Finally, four meetings were organized to present preliminary results. The first meeting has been organized for the principal protagonists of the studied irrigated system management (people in charge within the communes, village headmen, users...)

Figure 9: Participation of a village headman a commune people's committee President during the first presentation

The second restitution has been organized for the agriculture and rural development department of Van Chan district. The last two meetings were organized with researchers from NOMAFSI (mainly agronomists), and TUEBA (mainly economists).

The study lasted about seven months in which five and a half months were spent in Vietnam for the field phase and about a month and a half for the data analysis report writing.

3 Management of irrigation water in the mountainous areas of Northern Vietnam: the Van Chan district case

For the administration of agriculture and irrigation, some characteristics are common throughout the whole Vietnamese territory.

3.1 Administration of agriculture and irrigation

Given the importance of irrigation, the different levels of Vietnam's administration (from Central Government to communes) are overseeing the management and development of irrigation in agriculture. Decisions, usually taken by the Central Government, are passed down to provincial authorities that in turns may adapt it to local conditions and transmit objectives and recommendations to the next levels.

3.1.1 The ministry and departments of agriculture and rural development (MARD) in charge of agriculture and irrigation

At central level, MARD is responsible for all decisions related to the management of water by agriculture and irrigation. Similarly, at province and district levels, the "Departments of Agriculture" are responsible for issues related to irrigation and water. These province and district departments depend on political orientations from the central level, taken over from different People's committees (Figure 10).

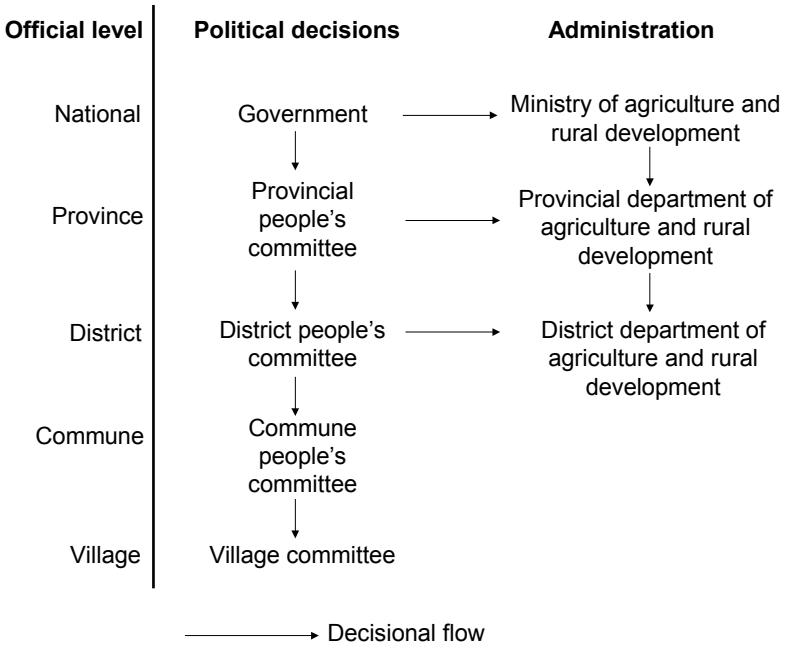


Figure 10: Agriculture and irrigation administration in Vietnam

3.1.2 State companies for the management of some irrigated systems

In some cases, designated State Companies will be directly in charge of managing irrigation systems. These companies are the State's properties (at the province level) and may manage several subordinate organizations. Their functions are (a) to provide water to irrigated systems, (b) to collect irrigation service fees from farmers necessary to their functioning, and (c) to maintain main infrastructures (dams, canals). The irrigation service fees they collect are not their only financial sources, they can also receive funds from the province or perceive incomes from activities parallel to the irrigation management.

Yen Bai province possesses three State companies for the irrigation management: Nghia Van State Company is one of them, intervening in Van Chan district and in *Thi Xa* Nghia Lo.

However, in mountainous districts, irrigated systems are very diverse and are not always managed by these state companies. Usually, the State companies are in charge of relatively large irrigated systems associated with an important infrastructure to maintain (large concrete dam, large network of concrete canals). For smaller irrigated areas, different local administrations such as communes and villages may be in charge of their management.

3.1.3 Irrigation service fees for water management up to 2008

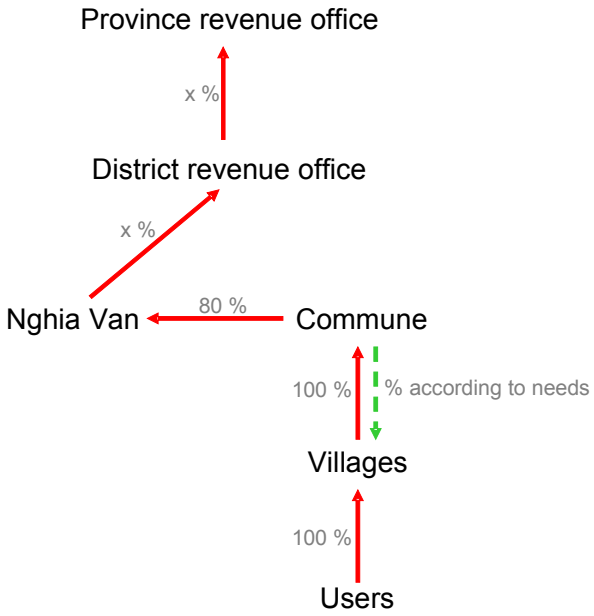
Irrigation service fees have been established by the Vietnamese Government in 1984, the same year as the irrigation management companies in order to cover the costs linked to the management of irrigated systems. The practical details of collecting and managing the fees present great variations depending on communes, districts, provinces. This is partly due to the freedom of interpretation left by the general theoretical rules established by the Central Government (Fontenelle and Tessier, 1997).

As a general rule, these fees are collected by the entity in charge of the management of the irrigated system (State company, commune, village). When not administered by one of these entities (small irrigated areas), no fees are collected.

When fees are collected, it creates financial flows between the administrative entities that are described in Box 1.

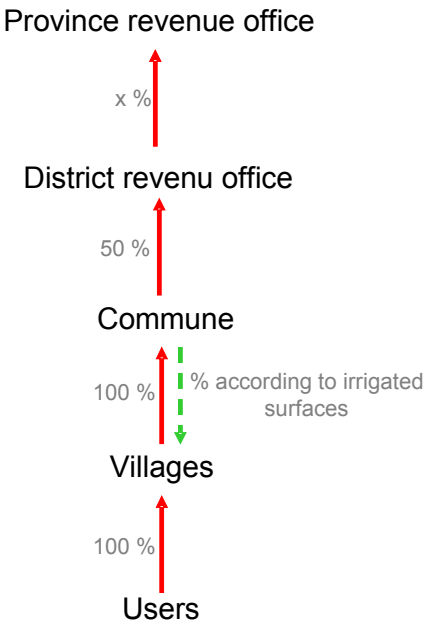
Box 1: Financial flow examples due to irrigation service fees in three communes of Van Chan district, Yen Bai Province

Case 1: Hanh Son commune, with State company Nghia Van intervention



- *Continuous red line: direct flows*
- *Dotted green line: indirect (secondary) flows*
- *The 20 % left to the commune are used for some repairs or maintenance*

Case 2: Tan Thinh commune, without Nghia Van intervention



- *Continuous red line: direct flows*
- *Dotted green line: indirect (secondary) flows*
- *A part of the 50 % left to the commune will be given to village headmen for small repairs/maintenance or to pay people responsible for dams and canals*

Case 3: Suoi Giang commune

No financial flows due to irrigation fees: users don't pay irrigation service fees to the commune

Box 2: Main characteristics of Nang Phai irrigated system (several communes) mainly managed by Nghia Van State Company

Figure 11: Nang Phai dam and beginning of primary canal

Source: Thia river

Irrigated surface: 680 ha divided up among 3 communes of Van Chan district et 5 « quarters » of Thi Xa *Nghia Lo*

Total network length: more than 10 km

Number of households using the network: more than 2000

Uses of water: paddy field irrigation

Irrigated system management: Nghia Van State Company

3.2 Irrigation water management in mountainous areas of Northern of Vietnam

The management of irrigation in the mountainous areas of Northern Vietnam also presents some specificities

3.2.1 Irrigation water management submitted to climatic and topographic constraints in the mountains

In the mountainous areas, given the topographic conditions, the most important activities for managing irrigation water are linked to the maintenance of infrastructures (dam, canals...). Water allocation and distribution tasks are much less important than in lowland areas, since it is mostly determined by rice plots layout (i.e. during the design phase of the irrigation system).

During rainy seasons, the time spent for dam and canal maintenance is particularly significant. Considerable damages can be caused (Figure 12).

Figure 12: Canal blocked by a landslide after heavy rains of July 2008 in Nam Bung commune

Khe Cum's irrigated system case presented in Box 3 highlights access and maintenance difficulties which can be engendered by a difficult topographical situation (Figure 13). Given the length of canal between the dam and the first water supply point compared to

the primary canal (Figure 14), the presence of a person in charge of watching and maintaining the dam and the canal between the dam and the first water supply point can be justified indeed.

Box 3 : Main characteristics of Khe Cum irrigated system (Tan Thinh commune)

Figure 13: Dam and beginning of canal of Khe Cum irrigated system on very steep slopes

Source: Dat Quang torrent

Irrigated surface: 3 ha

Canal lenght: 900 m

Number of households using canal: 20 to 25 for irrigated paddy fields, 35 all uses included

Uses of water: ponds (a dozen), paddy fields irrigation, domestic water

Irrigated system management: village headman represents villagers and appoints someone responsible for the maintenance of the dam and a portion of canal (long part from the dam and the first water supply point)

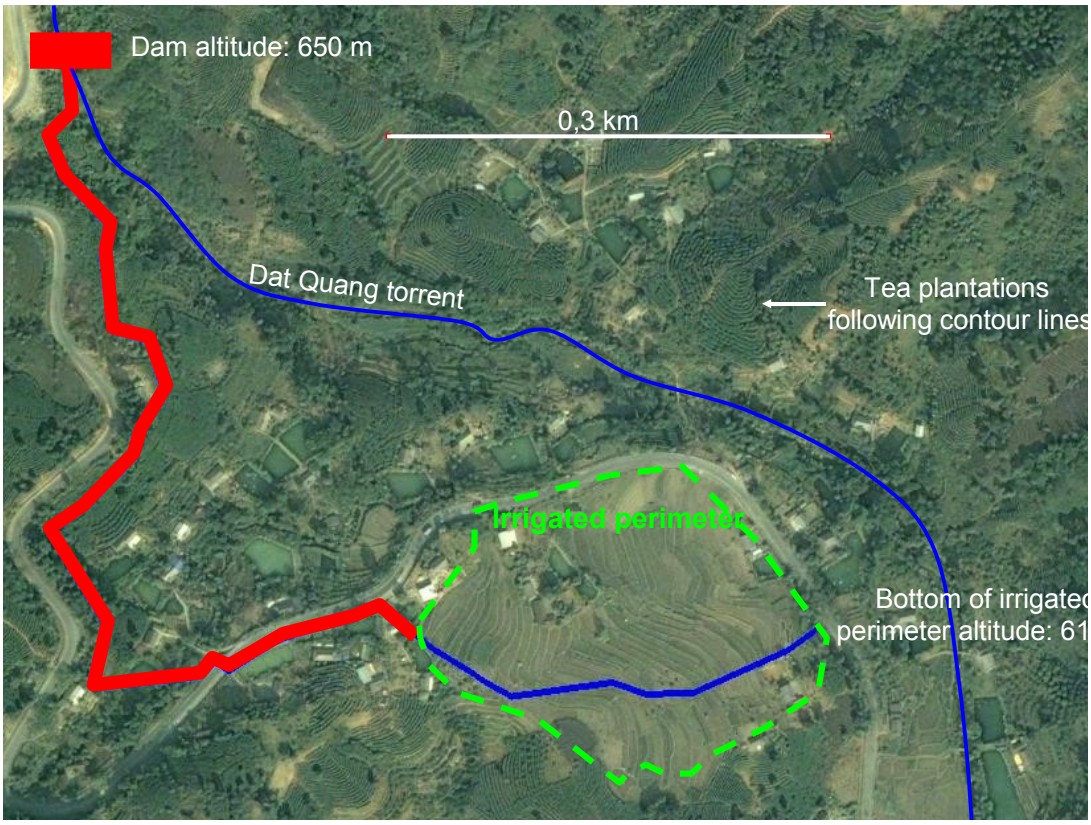


Figure 14: Aerial view of Khe Cum network (Satellite image: Google Earth)

Red rectangle: dam; continuous thick red line: part of canal with no water supply point (slope: 2 %); dotted green line: irrigated perimeter; continuous blue line within the irrigated perimeter: primary canal taken care by users.

Maintenance works, in case of damage, can be carried out by a person in charge or a worker group named by the village headman. In other cases, village headmen can decide to call up all the users (often a member of each household) for the general cleaning of canals. In the case of networks taken in charge by Nghia Van state irrigation management company, the company itself is in charge of the dam and primary and secondary canals maintenance. In case of extra-workforce needs, the company can ask the villagers but will have to pay them. But most often, on most of the networks or at least of intra-field canals, users clean, maintain and repair themselves minor damages occurred to the canals. Their involvement in these daily works is essential to the good functioning of irrigated systems.

Irrigation water distribution and allocation Vietnamese mountains

The water distribution (defining the priority order to water access) and water allocation (water sharing between several users in terms of quantity) depend on the plot location from source and various water supply points. As a matter of fact, the irrigation water is

made from plots to plots, by gravity. When the nearest plot to a water entry is filled, the second one will be irrigated and so on. Thus, the upstream position is a privilege. Users near a source or near a water supply point have a comparative advantage since they will be served first, and they have larger quantities of water available.

The upstream position and the social position can be linked (upstream plots usually belong to long established lineages). However, in some areas, land redistribution carried out after decollectivisation has changed pre-existing social order. Let's precise that in the course of history, for some communes, some households have been granted the privileged choice for their plot location, depending on their involvement with the local government, or in different wars, or sometimes depending on their ethnic groups.

Depending on configuration types, terraces or plain plots, water distribution can be presented as in Figure 16.

3.2.2 Decision-making levels and irrigation management units in mountainous areas: Van Chan district case

In the case of Van Chan district, several decision-making levels were identified that have an influence on the management of irrigation water: province, district, Nghia Van State Company (NVSC) at the same level as communes, village headmen and users.

First, Yen Bai provincial administration (Agriculture and Rural Development Department) plays a limited role in Van Chan district water management. It has the possibility of investing in hydraulic works and were fixing the amount of irrigation service fees prior to the 2008 reform.

Second, the Van Chan district, through its Agriculture and Rural Development Department, represents the highest decision-making level which really intervenes in the management of irrigation over its territory. First, it decides where the investments coming from provincial and central levels will be allocated. Moreover, the district take decisions for communes and state companies (NVSC).

Third, NVSC, whose only shareholder is Yen Bai province, manages irrigated systems selected by the province or the district. Usually, NVSC is not involved in the design and construction of hydraulic structures, but is only assigned their management and maintenance once they have been completed. NVSC is mostly in charge of large-sized systems, i.e. those larger than 100 ha.

Communes can also be granted the management of irrigated systems by the district. Most often, the commune People's Committee directly takes in charge this management, although they can have commune professional employees.

The smallest official sub-unit, especially socially recognized, is the village. The village is represented by one or some village headmen to whom commune People's Committee members often assign tasks related to the management of irrigated system: collecting irrigation service fees, choosing some people in charge for dam or canal maintenance, total management of some irrigated systems... The village headman plays also an important role while arbitrating conflicts (granting land and sources). Thus, the village is the interface between traditional and official authorities.

Finally, the irrigation network users seem to have only little power for important decisions regarding irrigation (investments, maintenance). However, their role must not be neglected. There are cases in which water users are the only protagonists of the irrigated system management so they hold all the power of making decisions. This is often the case of the small-sized irrigated systems (often less than 2 ha) and concerning only one or a few households.

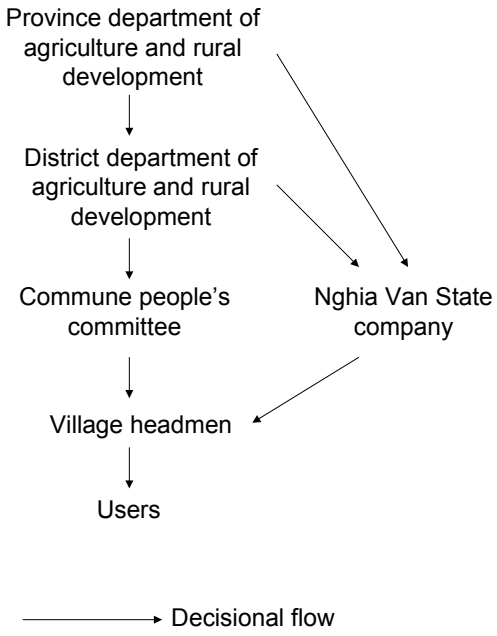


Figure 15: Decision making in irrigated system management in Van Chan district

By this description of different decision-making levels intervening in the irrigation management in Van Chan district, actual management units of the irrigated systems have been thus defined:

- Users;
- Village (the village headman or headmen directed by the village cell of Vietnamese communist party, VCP);
- Commune (its people's committee and its local employees directed by the commune cell of VCP);
- NVSC.

The existence of different units of irrigation management leads to the building of an irrigated system typology for Van Chan district.

3.2.3 Mountain irrigated system typology: Van Chan district case

Mountainous irrigated system typology construction is a tool to highlight different situations in mountainous irrigation management and to attempt to give keys to understand these differences. This typology, presented in Box 4, is based on the study of several irrigated systems. Each type is a model therefore a synthesis of observed different irrigation systems.

Box 4: Typology of mountain irrigated systems

Type 1: Very small mountain irrigated systems managed by one or some households

Discriminating criteria:

- Irrigated perimeter size: less than 2.5 ha;
- Irrigated perimeters situated in mountain areas, on steep slopes;
- Management and maintenance done by the households concerned (1 to10).

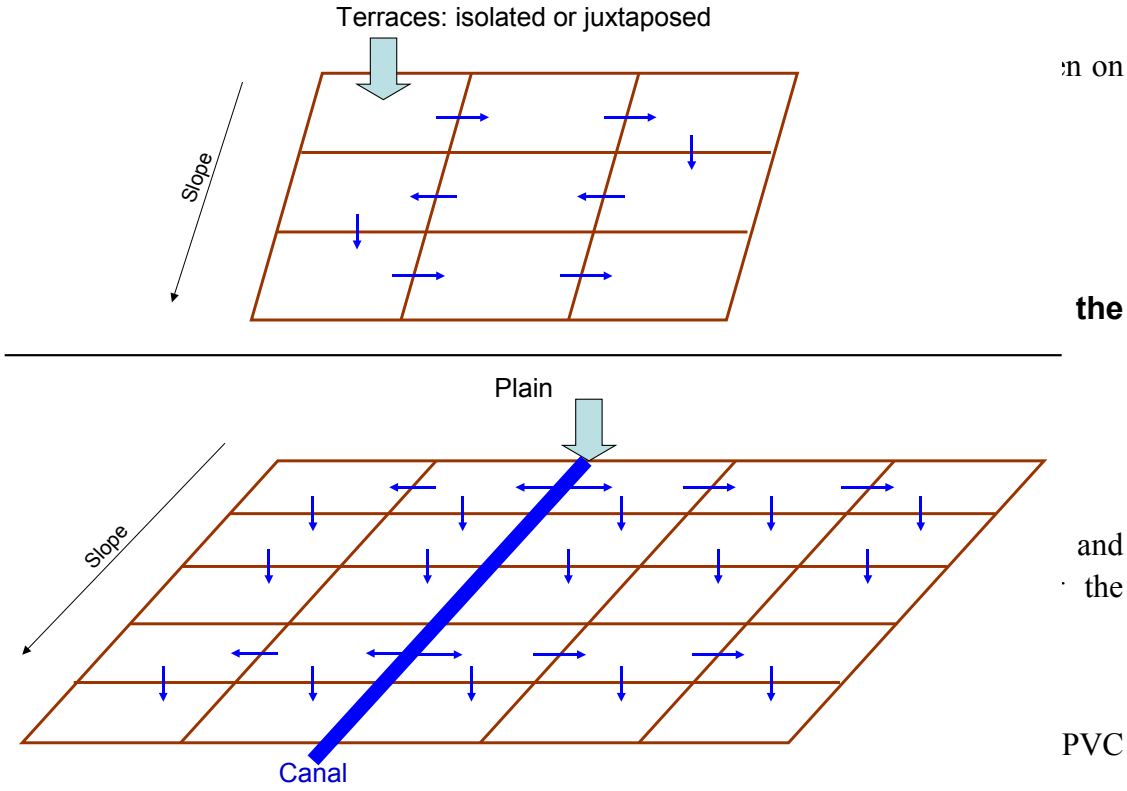


Figure 16: Water distribution modes according to topography

- Construction by users (possible State-financed reconstruction in concrete);
- 1 to 2 rice cycles per year.

Type 3: Medium plain/valley bottom irrigated systems

Discriminating criteria:

- Irrigated perimeter size: 5 to 50 ha;
- Irrigated perimeters situated in plain/valley bottom/basin.

Additional information:

- Dam in stones, gabions or concrete, concrete or earth canals;
- Construction by users and reconstruction financed by the State or international projects;
- 1 to 2 rice cycles per year an or 1 rice cycle plus one non irrigated crop per year.

Type 3 a: Medium plain/valley bottom irrigated systems managed by one or several villages

Type 3 b: Medium plain/valley bottom irrigated systems managed by the commune

Type 3 c: Medium plain/valley bottom irrigated systems managed by a State company

Type 4: Large plain irrigated systems managed by a State-controlled company

Discriminating criteria:

- Irrigated perimeter size: more than 50 ha;
- Irrigated perimeters situated in large plains;
- Managed by a State company.

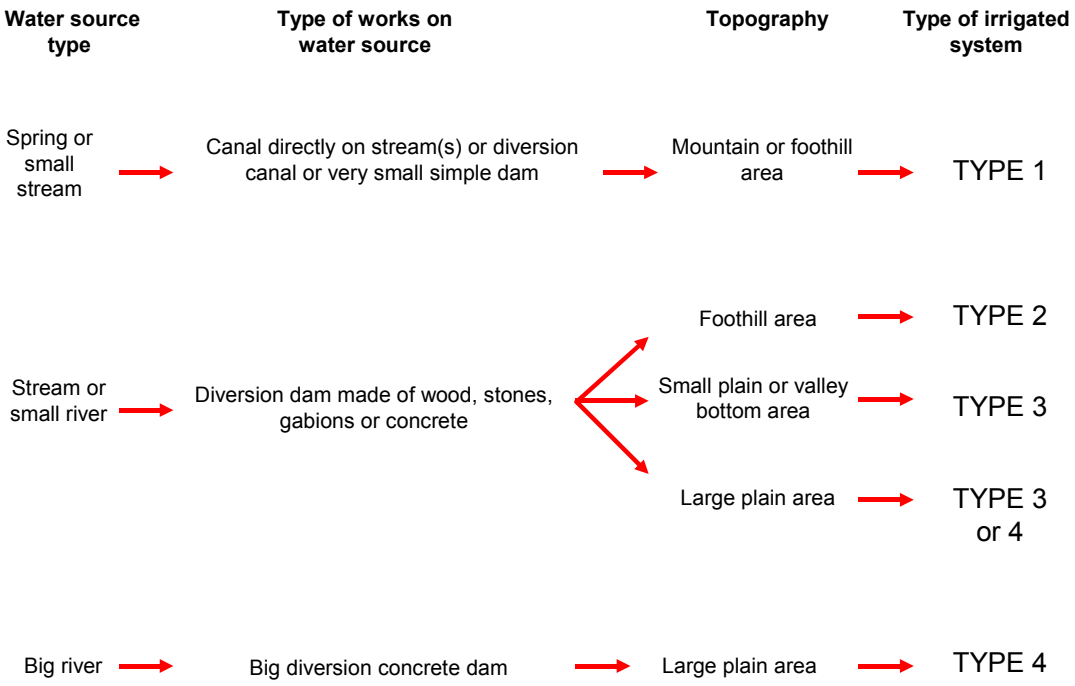
Additional information:

- Large concrete dam, primary (and secondary) canals mainly in concrete;
- State-financed construction (villagers' participation for workforce);
- 2 rice cycles per year plus a third maize cycle (or other crops).

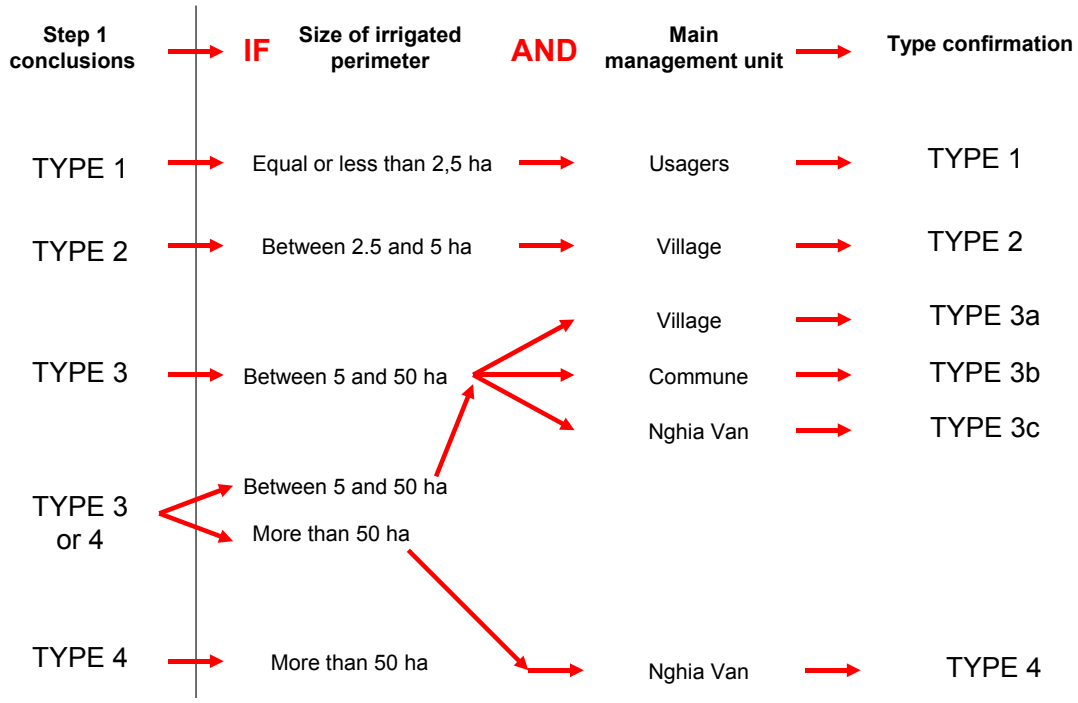
If the irrigated systems are presented in the typology as independent entities one another, that is often not true in actual situations. Apart from systems fed with an only source, most of the systems are linked with one or several other systems. Each system, whatever size it is, often depends then on one or several other systems.

3.2.4 Rapid determination key to recognise irrigated system types

Step 1: observations and first conclusions



Step 2: confirmation



This rapid determination key has been worked out from mountainous irrigated system typology previously presented. It allows to determine, on observations and short interviews, the types of irrigated systems observed on the field. Each type has its own functioning, common problematics (risks, potentials),the same type of management.... Because of this, an irrigated system analysis by type could be pertinent and useful beyond this study.

4. Northern Vietnam mountainous irrigated system analysis

In this part, four various themes concerning mountainous irrigation system management will be dealt with and analyzed.

4.1 Correlations between main typology criteria

Principal criteria of this typology are irrigated system command area, topographic unit and main management institution of this system.

	Very small	Small	Medium	Large
Users	1			
Village		2	3a	
Commune			3b	
State company			3c	4

Table 2: Types of irrigated systems according to management units and size

	Very small	Small	Medium	Large
Mountain	1			
Foothill		2		
Valley bottom/plain			3 a, b et c	
Large plain				4

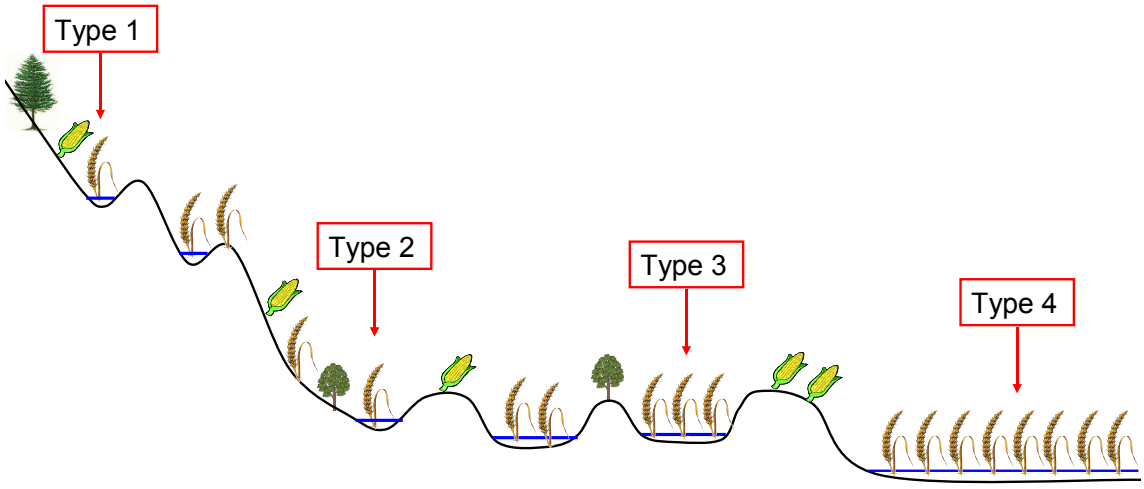
Table 3: Types of irrigated systems according to topographic unit and size

	Mountain	Foothill	Valley bottom/plain	Large plain
Users	1			
Village		2	3a	
Commune			3b	
State company			3c	4

Table 4: Types of irrigated systems according to management and topographic units

This series of tables reveals a strong correlation between selected typology principal criteria. The bigger the irrigated perimeter is (and the more users it has) the more important is the management unit. The bigger the irrigated perimeter is, the more the topographic units present weak slopes. As the management units are determined by the irrigated perimeter size and the topographic units determine the size of irrigated perimeters, hence management units and topographic units are linked with each other.

These correlations can be explained by the situation of these systems, in mountainous areas where the topography is a characteristic and a fundamental criterion. It is a determining factor for a great deal of situations, as it is underlined in previous parts for agriculture, irrigation... Thus, it's possible to locate irrigated system types on an imaginary transect, on which district topographic units appear (Figure 17). In reality, each commune or even each village presents a somehow topography variety what can't lead to an irrigated system zoning on Van Chan district.



Mountain	Foothill	Valley bottom	Large plain
-Size<2.5 ha -Management by one or several households -1 to 2 rice cycles per year	-2.5 ha<Size<5 ha -Management by the village -1 to 2 rice cycles per year	-5 ha<Size<50 ha -Management by the village, commune or a State company -1 to 2 rice cycles per year	-Size>50ha -Management by a State company -2 rice cycles per year + a third crop (maize…)

Figure 17: Situation and main characteristics of irrigated systems according to topographic units

4.2 Irrigation service fees: what equity between farmers in relation to received service?

In general, in Van Chan district, within one commune, either all the farmers pay irrigation fees or none of them pays. Fees are proportional to the farmers' irrigated area but may vary between villages or even between users, according to the network type for example (Table 5: interview data).

Nam Bung	Nam Lanh	Suoi Bu	Suoi Giang	Tan Thinh	Tu Le	Son Thinh	Chan Thinh	Thach Luong	Nghia Loi	Hanh Son	Son A
0	0	0	0	10 to 30000	20 to 30000	24000	27000	27000 or 55000	45000	55000	55000

Table 5: Amount of irrigation service fees (in VND/1000 m^2/year) paid by farmers from different communes of Van Chan district (except for Nghia Loi: belongs to *Thi Xa* Nghia Lo), in 2007 (Source: interviews with communal authorities)

The four communes presented in Table 5 who do not pay irrigation service fees are located on the highest altitudes and with often steep slopes on the whole commune. The irrigated systems' management is under users' responsibility themselves or village headmen (type 1 or 2 according to our criteria). This justifies the absence of fees paid to the State. Farmers of these villages do not receive any kind of service for the management of their perimeters, but receive investments for the building of small works, funds eventually coming from irrigation service fees (from the district or even other provinces).

Hanh Son, Nghia Loi Son A and Thach Luong communes are located in the large irrigated plain supplied with a very large dam and network of canals (Nang Phai network, see Box 2). They received service intervention of NVSC, what can be justified by the highest amounts in irrigation fees paid by the users of these communes.

4.3 Users' essential role in the irrigated systems, but a very slight decision-making power

Rice cultivators, who are users of mountainous irrigated systems, have a central role in their management and this on several levels and for each type:

- They sometimes take part into the conception and very often to the construction of hydraulic works;

- They daily watch dams, canals...
- They take part into daily maintenance of intra-field canals and often to exceptional maintenance of other canal divisions.

However, the users seldom directly take part into investments, what minimizes their decision-making power, in such a system in which the administrative hierarchy must be respected. Only in the case of irrigated system type 1, in which the users are the only actors, the decision-making totally belong to them. Before 2008, the users who paid irrigation fees took part into investments in irrigated works; irrigation fees which have been collected, were partly re-invested in these works. In the case when contributions would be directly given by users to repair or pay a person in charge for example, users would be in a position to give their opinions and take part into the decision-making. This type of initiative would be possible for irrigated system type 2, 3a, 3b and even 3c and 4.

4.4 Agriculture intensification for Van Chan district farmers

The project "Rice landscape management" financed by CPWF, supposes that irrigated paddy field intensification, by a water productivity improvement, will allow to insure a food security for the inhabitants of the high parts of river basins while preserving natural resources.

4.4.1 Water productivity improvements: potential and constraints

A water productivity improvement could be obtained through different means:

Increasing yields or crop values

High yielding varieties (such as hybrid rice), and increased use of chemical inputs could potentially increase rice production. Moreover, the introduction of a second rice crop during the spring season is important to make use of the available (and otherwise "lost for the system") water during that season.

Reducing water losses (drainage, percolation...) except plant transpiration

Loss reduction concerns mainly losses in canals. As a matter of fact, once arrived on the plots, the water flows from plot to plot, and there are only few losses system-wise.

Above all, reducing water losses is necessary at the beginning of winter-spring cycle when the water seems to be a limiting factor. For most users of the studied area, and more particularly users of type 1, water is brought to rice plots through earth canals, allowing significant water seepage and minimizing water quantities arriving at the end of the canal.

A more efficient use of rainfall, by storing water

Water storage is rarely used in this district, but could help a lot for providing water during the early spring season, and could also allow for complementary activities (fish ponds, etc.). Only a few storage tanks have been noticed throughout the study. The few storage ponds observed are usually build by individuals. There is probably a lack of collective action in some communities to develop water storage capacity, and to make sure the resource is shared among villagers afterwards.

Intensification of irrigated paddy fields by such an improvement of water productivity will come up against three types of constraints.

Natural constraints

As mentioned earlier (see 1.2.2) topographical characteristics such as steep slopes and cold winter are creating especially difficult conditions to increase yields. Moreover, the irregular flows of water in the course of the year is another significant natural constraint to take into consideration for an improvement of water productivity.

Households constraints

Farm households financial constraints may prevent them to buy high yielding variety seeds, fertilizer and pesticide in satisfactory quantities. Moreover financial resource lack can prevent from repairing or setting up of water supply structures that would reduce water losses and improve water productivity.

Institutional or organisational constraints

According to irrigation management modes and consequently irrigated system types, these institutional constraints will be of different kinds:

For individual system type 1, the main organisational constraint is the lack of coordination between different irrigated systems within the same territory. Different irrigated systems of type 1, co-existing in the same environment are sometimes negatively affecting one another which can reduce the potential yield increases.

These systems are often linked one with another since they depend on the same water source, or are inter-connected one to another. Thus, a coordination system between these systems would allow the least privileged ones to better take profit of the water resource available and prevent some useless losses. For example, we have observed that some farmers having a relative abundance of water were not using all their potential water by lack of labor force, while their neighbors being constrained by water could not use the water.

Concerning the system types 2 and 4, on the village level, inter-village or inter-commune level, a few organisational systems for the water distribution and allocation

have been observed. People in charge of the management of an irrigated system often play a role in the maintenance and watching of one part of the irrigated system network. These people are not in charge of sharing equitably irrigated water. Users possessing plots at the network ends are hence the most disadvantaged and so are slow down in their possibility of intensification of their productions.

4.4.2 Water productivity improvement: types related constraints

Users of irrigated system type 1 usually grow only one rice crop per year, and some of them can't buy hybrid rice seeds every year. Intensification possibilities are greater than for other types by growing one more crop per year. However given the geographic position of these systems, the two limiting factors for the start of a suitable winter-spring cycle between January and February, the cold and water availability, must be taken into consideration.

Most of the users of irrigated systems of type 2 practise two irrigated rice cultures a year, and the most often with the possibility of using hybrid seeds on the two cycles. Intensification possibilities would rather concern water productivity in this case. Canals of these systems are often in most parts in earth. This is critical during dry seasons because the canals can let a great part of water infiltrate and penalise households at the network end.

In irrigated systems of type 3, farmers already grow two irrigated rice crops per year, use improved varieties and have concrete canals. Intensification potential of their irrigated paddy fields is smaller than previous types. Depending on the importance and regularity of source water, water tanks could ensure a more regular water supply especially at the beginning of winter-spring cycle. But depending on the type of dam type, needed works can be more or less important.

Finally, irrigated systems of type 4, most intensification factors are already fully used (improved varieties, fertilizers, herbicides, pesticides, two rice crops per year and an additional a dry crop after summer rice), and a good water supply network ensures an already high productivity of land and water. Moreover dams take water from relatively big rivers, which are not much limited throughout the year. In addition, users of this type receive technical knowledge from the irrigation management State company, like the users of systems 3c, a strong point for the water productivity improvement. But the fact of noticing a slight communication between users and management company can diminish the efficiency of the system. On the one hand, users have a little decision-making power but also have difficulty to express their everyday needs, what could reduce the water productivity and therefore the irrigated paddy field intensification as well. The organisation of meetings with employees of the irrigation management State company and the users could make such systems more efficient.

5 Evolution perspectives of irrigated system management in mountains of North of Vietnam

Throughout 2008, the irrigation management underwent several changes coming from administration decisions made at the national level. All the consequences of these changes could not be evaluated immediately, and still leave farm households in an unstable situation.

5.1 An irrigated system management per commune

Officially, in Van Chan district, the management of one irrigated perimeter could be attributed either to Nghia Van State company, or to the commune People's committee. From 2008, instead of attributing one irrigated perimeter it's the whole irrigated surface of a commune which is attributed to the company or the People's committee.

There will not be great changes for the irrigated systems which were already taken in charge by NVSC. As fas as irrigated perimeter managed by NVSC are concerned, the system protagonists were already kept close to the State company before 2008. They saw the company intervene on other irrigated systems of the commune, and could often receive technical advice. However, NVSC has now to manage small irrigated systems. It can possibly decide to delegate the irrigated system management to villages or users, like the communes did it and still do.

This new reform may have few consequences on the effective irrigation management of Van Chan district. It will possibly lead to a simplification on the administrative level (management by village and no long by irrigated system).

5.2 What kind of reorganisation without irrigation service fees?

From 2008, households and individuals possessing land or ponds used for farming production (with only some exceptions), are exempted of irrigation service fees. This decision has been made at the central level, concerning almost all the Vietnamese irrigated rice farmers. In Van Chan district, it concerns all the irrigated rice farmers without exception. In mountainous areas, depending on the irrigated system types, repercussions of this exemption will be more or less important.

This will not affect farmers of irrigated systems type 1 and some farmers of irrigated system of type 2 who were not subjected to irrigation fees before 2008.

The situation may be different for irrigated systems of types 3 and 4 that are managed by NVSC. Before 2008, water users paid more expensive irrigation fees which could be explained by the services provided by NVSC. Today, farmers are exempted from

irrigation fees but still benefit from services of NVSC (which will be financed only by the State). The users will not pay any charges but receive the same service. Potentially, those farmers (already better off than farmers using type 1 and 2 irrigated systems), will be the one receiving most of the benefits of this reforms (which could be questionable in terms of equity impact of the reform). Besides, it is not clear how the service provided by NVSC will evolve after this reform: will the State fully compensate NVSC for the previously collected fees; how NVSC will prioritise its activities between agriculture and hydro-electric projects when potential profitabilities will be different. As of now, we can only say that there is a risk that the service provided by NVSC decreases other time.

5.3 The creation of irrigation management committees: opportunities and reefs

During 2008, for irrigated systems not managed by State companies, the communes will establish Irrigation Management Committees. This process, started in June 2008, concerns 19 communes of the district of Van Chan.

The committees will comprise four members, of which the Vice-president of the commune People's Committee and the person in charge of agriculture.. As of October 2008, these management committees were not yet in activity in Van Chan district. But some potential issues could be raised concerning the role of these committees, and their usefulness for some communes.

The creation of these committees will allow the villagers to have an interlocutor dealing with irrigation questions at communal level. However, the creation of these committees could present some reefs. First of all, this committee will be composed by two compulsory members in each commune. These two persons being the principal people in charge of dealing questions concerning agriculture in the commune, if the other two persons chosen for this committee are also parts of the commune staff, it is possible that the presence of this committee will not change much in comparison with previous years.

In addition, in the communes where the major irrigated systems are those of types 1 and 2, for which the commune does not intervene much or not at all in the irrigation management, the creation of these committees and the payment of their members could be difficult to justify. For these communes, the risk of creating "ghost committees", and useless payment for some commune employees is real.

General conclusion

In Vietnam, recent policy changes have had important impact on the rice production in the great production basins of Mekong and Red river deltas, but also in the remote areas such as mountainous areas. Concerning irrigation, a diversification of water management modes have been observed in Van Chan district.

A typology of mountainous irrigated systems highlighting this diversity has thus been set up. It comprised four types:

- Type 1: Very small mountain irrigated systems managed by one or some households;
- Type 2: Small foothill/slope bottom irrigated systems managed by the village;
- Type 3: Medium plain/valley bottom irrigated systems separated into 3 sub-types according to management modes;
- Type 4: Large plain irrigated systems managed by a State-controlled company.

This typology above includes 3 main criteria: topography, irrigated system command area, and the irrigated system managing mode. In a general way, the topography is an important characteristic of the environment because it is a constraint of the farming practices, but it also determines principal tasks of mountainous irrigated management (network maintenance). Moreover, with humid subtropical climate, users are confronted with water excess management rather than water scarcity management. The irrigation management is allocated to different units of management possessing the main decision-making power. The users themselves, village headmen, commune people's committees or a State company can be in charge of irrigated system management in the mountains. Even if, except for systems of types 1 and 2, users have a reduced decision-making power, they have a central role in the irrigating management: construction of works, watching, daily maintenance, water distribution... The irrigated system typology suggested in the study has been worked out by studying several irrigated systems within the district. The definition of irrigated types is quite general and could be used for a larger territory, as the whole mountainous area of the North of Vietnam. In addition, a rapid determination key linked with this typology will allow future irrigated system analysis by taking into account characteristics and research questions for each type.

Throughout Vietnam, the year 2008 has been marked by several changes in the field of irrigation management. These changes mainly result from administrative decisions taken at the central level: allocation of commune irrigated perimeter management, exemption of irrigation service fees for almost all Vietnamese irrigated rice farmers and the creation of irrigation management committees for some communes. Today, all the repercussions of these great changes can't be noticed yet, and the peasants are still in an unstable situation.

In the research field, and more precisely within SAM project researches, some research study concerning intensification possibilities of irrigated paddy fields, in high mountainous areas with no winter-spring rice cycle, can be suggested. It would be to define quantitatively the water sufficiency or not in function of needs for the set up of the first cultivation operations between January and February. Whereas a previous study showed that farmers who only practised one irrigated rice cycle were constraint by available cultivars and technical itineraries, such a study could show that in fact, not only hard natural conditions prevent the cultivation distribution of two rice cycles, but may also be organisational and social constraints (risk management..). Methodologically, concerning irrigated system typology, it would be interesting to explore district areas with difficult access and see if the typology can be applied on the whole territory. Beyond these limits, it would also be interesting to see if the irrigated system typology and the suggested rapid key determination as well can be applied in the mountainous areas of other provinces of northern Vietnam.

Lastly, with different institutional changes which have been set up by the central power in the course of 2008, some farmers have been destabilised. With irrigation fee exemption for instance, organisation mode of peasants for watching and irrigation network maintenance have been affected. The rapid and punctual set up of teams composed by commune or district employees, would make the farmers adaptation easier. These teams could clarify new decision consequences, their possible repercussions on farmers' activities... and help them to reorganise if necessary. Meetings between users and communes or State company, are also to be planned for a better taking into account of needs and users' concerns and their involvement with the decision-making.

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Contents

Résumé

L'histoire récente du Vietnam a été marquée par vingt dernières années de transition, passant d'une économie socialiste à une économie de marché. Dans le domaine agricole, les politiques récentes ont causés d'importants changements jusque dans des zones plus reculées comme les régions montagneuses du Nord du pays. Concernant l'irrigation, une diversification des modes de gestion des systèmes irrigués a été constatée dans le district de Van Chan, province de Yen Bai, situé dans ces zones de montagne. C'est l'histoire, mais aussi les contraintes du milieu naturel dans lequel évoluent les paysans qui déterminent la diversité des situations observées aujourd'hui. Une typologie des systèmes irrigués de montagne mettant en évidence cette diversité a été établie, élaborée en synthétisant l'étude de plusieurs systèmes irrigués du district de Van Chan :

- Type 1 : Très petits systèmes irrigués de montagne gérés par un ou quelques foyers d'usagers ;

- Type 2 : Petits systèmes irrigués de contrefort/bas de pentes gérés par le village ;

- Type 3 : Moyens systèmes irrigués de plaine/fond de vallée décomposée en 3 sous-types en fonction des modes de gestion ;

- Type 4 : Grands systèmes irrigués de grande plaine gérés par une entreprise étatique.

La topographie est un critère déterminant de cette typologie, elle définit les principales tâches de la gestion de l'irrigation dans les montagnes (surveillance et entretien du réseau). Dans le district étudié, la gestion de l'irrigation est réalisée par différentes unités de gestion : les usagers, les chefs de villages, les comités populaires des communes ou une entreprise étatique.

Au Vietnam, l'année 2008 a été marquée par plusieurs changements dans le domaine de la gestion de l'irrigation. Dans le district de Van Chan, les répercussions de ces grands changements ne peuvent encore être constatées, et laissent les paysans dans une situation encore instable.

Mots-clés

Gestion de l'eau, irrigation, riz irrigué, typologie, montagne, Vietnam

Abstract

The last twenty year-transition has left its mark on the recent history of Vietnam, passing by a socialist economy to a market one. In the agriculture field, recent policies have caused important changes up to the far away areas such as Northern mountain regions of the country. As far as the irrigation is concerned, a diversification of irrigated system management has been observed in the district of Van Chan, in Yen Bai province, situated in the mountain areas. The history but also the coercion of the natural environment in which peasants evolve, determine the diversification of the observed situations nowadays. A typology of mountain irrigated systems highlighting this established diversification, worked out by synthesizing the research of several irrigated systems of Van Chan district :

- Type 1: Very small mountain irrigated systems managed by one or some households;

- Type 2: Small foothill/slope bottom irrigated systems managed by the village;

- Type 3: Medium plain/valley bottom irrigated systems separated into 3 sub-types according to management modes;

- Type 4: Large plain irrigated systems managed by a State-controlled company.

The topography is a determining criteria of this typology. It specifies the main tasks of irrigation management in the mountains (control and maintenance of the network). In the district, the irrigation management is achieved by different management units : users, village headmen, people's committee of communes or a State-controlled company.

In Vietnam, several changes in the field of irrigation management have left their mark in 2008. In Van Chan district, the knock-on effects of these great changes can't be observed yet, and let the peasants still in an unstable situation.

Key words :

Water management, irrigation, irrigated rice, typology, mountains, Vietnam

Synthesis from:

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