An Institutional Analysis of Changes in Land Use Pattern and Water Scarcity in Dak Lak Province, Vietnam

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Table of Contents

Acronyms:

CPR	Common-pool resource
DARD	Department of Agriculture and Rural Development
Danida	Danish International Development Agency
GTZ	Gesellschaft fur Technisches Zusammenarbeit
MARD	Ministry of Agriculture and Rural Development
NIAS	Nordic Institute of Asian Studies
PIM	Participatory Irrigation Management
REPSI	Research Policy Support Initiative
SWAP	Srepok Water Action Plan
SWRM	Support to Water Resources Management
TNU	Tay Nguyen University
UAF	University of Agriculture and Forestry
VBA	Vietnamese Bank for Agriculture
VND	Vietnamese Dong
WRI	World Resources Institute

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Abstract: The fertile highland of Dak Lak, the largest province in Vietnam, is highly suitable for coffee production. With economic reforms in Vietnam, coffee production in Dak Lak has increased rapidly in the past ten years. But economic success in coffee production has created enviornmental stress such as water scarcity and deforestation, and social conflicts as a result of migration from other areas. This paper explains the causes of environmental problems in terms of institutional failure with respect to common-pool resources, and inconsistent economic policies. The study focuses on the public good characteristics of common-pool resources, and the difficulties faced by local stakeholders in reaching a collective solution.

1. Introduction

One of the significant changes in Vietnam in the past 15 years is the commercialisation of agriculture, particularly the expansion of coffee area in the Central Highlands. The changes in land use pattern have brought economic prosperity, but at the cost of damages to the watershed and social conflicts due to scarcity of water. Research Policy Support Initiative (REPSI) funded by different donors has recently undertaken a case study of Dak Lak Province in order to help Vietnam in sustainable management of the uplands. Two complementary aspects of the REPSI case study are an assessment of water availability/scarcity in relation to land use changes, and secondly, an analysis of institutional changes in response to resource crises. The institutional analysis has been carried out by the author on behalf of NIAS together with a team of researchers from the University of Agriculture and Forestry (UAF) and Tay Nguyen University (TNU) during May-July, 2000. This paper is based on the findings of the research team. The paper presents first the conceptual framework that has been used to explain the problem of water scarcity in Dak Lak Province. Sections 3 and 4 are devoted to a situation analysis of Dak Lak, especially Ea Tul Catchment. Sections 5 and 6 deal with the responses of different stakeholders, and the difficulties faced towards collective action. A brief summary and conclusions are taken up in Section 7.

2. The conceptual framework

Although the problem of water scarcity is an outcome of land use pattern at local level, it needs to be analysed within the context of national and regional policies for sustainable development. Moreover, an analysis of local institutional responses to resource scarcity requires an understanding of the public good characteristics of common pool resources (CPRs) like groundwater and forestland.

2.1. Sustainable development and tradeoffs among economic, social and environmental goals

Sustainable development has three main objectives: economic, social and environmental (Munasinghe, 1995). The process of achieving these objectives involves tradeoffs, and economic policies and institutions play an important role in resolving or intensifying the conflicts.

Economic goal concerns growth, stability and efficiency, and is facilitated under a free market system. Social goals involve equity, poverty alleviation and the preservation of culture and heritage. But a free market system has certain weaknesses in achieving social goals. With an initial unequal distribution of assets, income and human capital, a market system breeds further inequality unless corrective measures are undertaken. Hence, economic policies and institutions need to be designed to broaden economic opportunities to most people, and to provide safety nets to those who are unable to take part in the growth process. This implies that some form of intervention in the market system is necessary to attain social goals.

Environmental goals are expressed in terms of bio-diversity/resilience, natural resource base and pollution. The public good nature (non-rivalry and non-exclusion) of environmental goods and services implies that a market system with exclusive, universal and transferable private property rights may be difficult to establish, and a proper valuation of resources becomes difficult without a market. In pursuing the goal of economic growth, environmental resources are used, and when existing institutions including the market fail to reflect their true costs, and to deal with externalities, an overuse of resources takes place that may conflict with environmental goals.

There is a strong but complex relationship between environmental and social goals as well. Equity and poverty alleviation can improve the environment because people become more interested in resource management, and an improved environment reduces poverty. A win-win situation for social and environmental goals, for example, gender equity and protection of the interest of ethnic minorities can go hand in hand with local management of environmental resources. However, the achievement of equity and poverty alleviation goals often requires economic growth and brings forth increased demand on natural resources.

As explained in Sections 3 and 4, the problem of water scarcity in Ea Tul catchment, Dak Lak Province is largely an outcome of conflicting goals and policies, and the lack of proper institutions to cope with open access problems. Conceptual issues related to open access problems are discussed below.

2.2 Public good characteristics of common pool resources – groundwater and forestland

Goods and services may be classified into four broad categories.

Diagram 1

Exclusion		**Rivalry**	
		Low	*High*
	Low	Pure public good	Common-pool resources in open access
			Community managed resources
	High	Toll or club good	Pure private goods

Private goods are highly rival and subject to exclusion whereas public goods have low rivalry and low excludability. Non-rivalry means that once a good is produced it is consumed jointly and no extra cost is involved for an additional consumer, whereas low excludability implies difficulty in preventing anyone from benefiting from the good. National defense, information and street lighting are examples of pure public good (Samuelson, P. A. 1954).

Common pool resources like groundwater supplies, forests, fishing ground, pastures are neither public or private goods but share some attributes of both. Unlike pure public good, (or like a private good) common pool resources are rival. The rivalry is associated with the flow of *resource unit.* For example, gallons of groundwater extracted or number of trees felled and appropriated by individual consumer are not available to others. But similar to a public good, there is a jointness in the use of the *resource system*, i. e. groundwater aquifers or a given forestland are jointly used by many people. Rivalry or subtractability of the resource-unit (flow of water) implies the possibility of approaching the limit of the number of resource units produced by common pool resources (groundwater aquifers/forestcover). Crossing the limit can lead to higher costs of extraction for everyone, or in worst cases, destroy the resource system with severe external effects (Ostrom, 1992).

Common pool resources share another characteristic with public good i. e. low excludability. Low or non-excludability implies that it is costly to exclude users from obtaining subtractable resource units (Musgrave, R. A. 1959). The cost of exclusion depends on the scale or boundaries/divisibility of the resource system, and technologies available for exclusion (Oakerson, 1992). For example, exclusion may be easier for forestland than groundwater because of its divisibility and technologies (fences) available for exclusion.

The *partial subtractability* or rivalry of common pool resources together with their *low excludability* pose management problems, and hence, institutional arrangements play an overwhelmingly important role.

2.3 Institutional arrangements for the management of common pool resources

The word institution has a specific meaning in this context, and it is different from organisation that is commonly used. An institution is a set of norms or effective rules used by a group of people in order to organise a certain sphere of their collective activities. According to North (1990) institutions give structures in our everyday life and reduce uncertainties. Efficient institutions reduce transaction costs, promote exchange, and thereby lead to economic growth in a society. Market systems based on clearly defined and properly enforced *private property rights* are usually considered to fulfill these criteria. However, market works best for private goods with high rivalry and low costs of exclusion, but not for common pool resources with public good characteristics. It is easier, however, to establish private property rights in forestland than in groundwater because of its higher excludability. But private ownership does not guarantee sustainable management because of externalities. Individual owners are often not interested in the conservation of forest because the benefits come late and fall on others. The costs of deforestation are also not fully borne by the private owner.

Other institutional arrangements are state management and communal property. State-owned common pool resources are often managed under a centralised system whereby rules are imposed from the top level. A centralised system has the problem of acquiring local-level information that are important for monitoring and control. Under a decentralised system, rules are enforced by local bodies with clear mandates from the central authority. There is a difference between decentralisation in administration and decentralisation in decision-making. Decentralisation by transferring the management function to lower governmental levels can obviate information and monitoring problems. However, the devolution of administrative functions to local bodies cannot solve the problem of governance and efficient use of community resources without the participation of the users themselves and without the decision-making power of the actors operating at local-level (Ostrom, Schroeder and Wynne, 1994). Transaction costs of enforcing the rules may be high if local people do not cooperate. A polycentric government structure that “distributes circumscribed but independent rule-making and rule-enforcing authority in numerous jurisdictions” is considered by researchers to be the best solution (Ostrom et al, op. cit).

An optimum management of CPRs usually occurs when users in the community work in a coordinated way to set operational rules, rather than act individually. There are many instances where resources are owned and managed in sustainable manner by local community (Berkes, 1996). There are, however, cases of breakdown of community management. In the absence of private, state or communal property rights or their poor enforcement even if they exist, the resources may lie in open access. In such cases, individuals have the incentive to exploit resources beyond the limit of sustainability, and the so-called “tragedy of the commons” occurs because private benefits of extracting resources are greater than the personal loss from the damage done to the commons. The breakdown or weakening of a previously sustainable community-management system

may arise due to population growth, increased commercialisation and disruption of traditional community rules.

2.4 Towards a solution to open-access problem – a polycentric and nested approach

The most important prerequisite for successful management of common pool resources is the willingness among users to switch to a coordinated strategy from independent strategies to exploit the resource base. The emergence of an user or appropriator organisation ("conceptualised as a small polity constituted by appropriators for the purpose of gaining a joint benefit, the regulation of CPR" Ostrom, 1992) depends, first of all, on the *common understanding* with respect to

- the existence of the common problem
- the need for coordinated action
- trust and reciprocity that ensure coordinated behaviour instead of individual strategy
- benefit of coordination exceeding the costs

Secondly, *the conditions of collective action* are important. The factors that affect the possibility of user organisations to emerge are characteristics of the resource, demand/supply relationships, types of users, and existing institutional arrangements including organisations and formal/informal rules (Ostrom, 1992).

The difference between large-scale CPRs and small resource systems is that the processes of common understanding are far more difficult and costly for the former. A small resource system, for example, groundwater, may, however, be a part of a large system like the watershed, and management at local levels may be affected by management of the whole watershed. In such cases, institutional designs relying on nested structures of smaller organisations within larger organisations are most likely needed (Coward 1980; Bendor and Mookerjee, 1985). Moreover, the integrated nature of the resource system demands coordination of activities in different sectors like, water, forest, agricultural land, etc. Sustainable development in general and watershed management in particular, needs a polycentric approach where rules and regulations are promulgated, designed and enforced at different levels, and central, provincial, district-level organisations work with peoples´ representatives at the lowest level (Ostrom, 1994). *A polycentric approach by no means undermines the crucial importance of collective action at the local level.*

User organisations are likely to emerge when the demand for the resource begins to exceed the supply. Other conducing factors towards collective action at the local level are homogeneous character of the users and proximity among them that can facilitate communication. When the conditions of collective action are weak in a community, external intervention is needed. However, it is important for external agents to consider existing formal and informal rules before introducing new rules.

The survival of a management system also depends on a number of conditions. A small set of simple rules that involves low transaction costs in enforcement is needed. Dual

enforcement is often necessary if respect for community rules is on the verge of erosion. Internally adaptive mechanisms can meet the needs of changing circumstances. While simple operational rules should be directed at the use-point, the organisational structure needs to be complex enough to deal with conflicts among different stakeholders. Nesting of a user organisation in a larger system may ensure stability as well as consistency among different goals of sustainable development. It is also important that simultaneous exogenous changes, such as rapid population growth, conflicting economic policies are avoided. According to Ostrom (1994), four criteria may be applied to evaluate a management system – efficiency, equity, adaptability and accountability. A polycentric approach is being applied in countries like Costa Rica (Aylward and González, 1998).

3. The case study of Dak Lak Province - Ea Tul Catchment

3.1 Recent trends in the land use pattern and resource scarcity in Dak Lak Province

Agro-climatic conditions in the Central Highlands, Dak Lak Province are suitable for the cultivation of a variety of crops. Perennial crops are rubber, coffee, pepper, cashew, durian, rambutan, longan, avocado and citrus fruits. Annual crops are upland and lowland rice, maize, bean of different varieties and vegetables. There have been tremendous changes in the cropping pattern in Dak Lak in the past few years. The main change is the increase in coffee area and production. There are three ways in which coffee area has expanded: conversion of upland rice area into coffee area, conversion of forestland and conversion of land under other annual crop to coffee. "The cultivated area has been increasing at the rate of 6.1% since 1995. Newly-cultivated areas permitted to change from forest land are about 7,000-8,000 ha per year." (Dak Lak Irrigation Sector Institutional Review Report 2000, Danida, p. 8). Coffee area increased from 11,563 ha in 1975 to 124,990 ha in 1996 (Gender and Ethnicity Adviser´s Audit, Danida, 1999). Latest figure is 180,000 hectares (Badenoch, N. 1999).

While coffee production is expanding because of its economic profitability, serious environmental damages are occurring. Available data indicate rapid degradation of the watershed in Dak Lak reflected in deforestation, water scarcity and soil erosion (Review and Assessment Report, Vol. II, Technical Studies, Danida, 1998). Forest cover in the Central Highlands is reported to have decreased from 90% in the 1960s to 57% in 1995 (Gender and Ethnicity Adviser´s Audit, Danida, 1999). According to DARD´s foresters, the rate of loss of forest is one per cent per year, mainly caused by small-holder agriculturists. (Badenoch, 1999). Depletion of groundwater and its effects on river flows downstream in some catchments have been observed (Review Report on Irrigation Sector Institutions, Danida, 2000). Overuse of fertiliser and pesticides has also affected the quality of drinking water.

3.1.1 Exogenous factors behind changes in land use pattern and pressure on the resource-base

Given the suitable natural condition for coffee production, the main exogenous factors that worked behind the recent upsurge of coffee production are as follows.

Economic reforms promoting commercialisation of agriculture

Towards the end of 1980s Vietnam undertook economic reforms (doi moi) that signified a movement from centrally-planned economy to a market-based system. The development of agriculture and the forestry sector is being promoted through establishment of private property rights in land and relaxed government control over output and factor markets. These reforms have led to increased commercialisation of agriculture in the Central Highlands in Vietnam.

Resettlement policies and migration

Migration to Dak Lak Province has been induced by population pressure and poverty in other areas and government´s resettlement policies. The main objective of encouraging migration to Dak Lak Province by the government is to utilise national resources rationally to achieve economic growth, and alleviate poverty in rural areas..

Between the late fifties and mid-sixties migration was promoted through Special General Commission for Land Development of the Republic of Vietnam (South Vietnam). The first group of Kinh people from the northern provinces of Vietnam started to migrate to this area in 1954. After 1975, some new economic zones and state farms were established in the area to receive a large number of migrants from the crowded provinces in the northern and the central coastal region of the country. Low landers from Quang Nam and Quang Ngai numbering 274,245 migrated to 225 land development centers. Between 1976 and 1996 Dak Lak Province absorbed around 311,765 largely from northern province (Gender and Ethnicity Adviser´s Audit, op. cit).

Besides this planned migration spontaneous migration of 350,128 people took place during the same period. The latter type of migration is much higher than official migration. Spontaneous migration has been taking place due to poverty and demographic pressure in the north and untapped economic opportunities in the Central Highlands. Hence, both push and pull factors have induced migration.

High coffee prices

High coffee prices in the 1990s have also induced migration in recent years. In spite of yearly fluctuations, coffee prices, on average, have been very high in the last two decades. In 1995, coffee price reached over 3 dollars per kg of coffee in Dak Lak (Crystal, 1995).

The exogenous forces mentioned above have not only brought changes in land use pattern, but also caused various social conflicts and environmental damages. These can be understood through an analysis of farm-level data.

3.2 Local-level conditions in Ea Tul Catchment

The problem of water scarcity in Dak Lak as a result of commercialisation of agriculture and forestry is analysed with data from Ea Tul catchment and two communes – Ea Tul upstream and Cu Sue downstream. Specific issues investigated are:

- What is the nature of resource scarcity such as water? Are individuals investing more and obtaining less from the commons? Are yields declining with increasing efforts?

- What is the nature of interaction among users? Are they competing with each other?

- What are the physical and technical characteristics of water? What are the decision making arrangements? How are they affected by exogenous factors?

- Are there initiatives for collective action in the community?

- How do other stakeholders like the central government, provincial authority and NGOs respond to the problem?

Data requirement:

- Information on the resource system – sources of water and hydrological condition, that determine the size/boundaries, and technologies for extraction of water for irrigation.

- Farm-level data on land use pattern, access to land, water, credit and other inputs like fertiliser, labour, machines, marketing services, output prices, technology according to large/small producers and upstream and downstream, etc.

- The perception of farmers regarding the scarcity of water and possible solutions

- Perception and responses of other stakeholders

Data have been collected from secondary sources, mainly SWRM (Support to Water Resources Management) project, Danida, and field surveys/interviews with the stakeholders on several occasions during March–June 2000. Unfortunately, data from the REPSI project on the hydrological condition of the study area are not available yet.

3.2.2 Description of the study area

Ea Tul catchment covers two districts – Buon Don with 6 communes and a population of 47,000, and Cu M´gar with 2 towns and 13 communes and a population of 121,000. Both districts are situated near Buon Me Thuot, the capital of Dak Lak Province.

The area is characterised by a relatively flat upland intersected by deep streams crossing the communes. In some locations it is hilly and rolling with relatively steep slope. In general, soil in the study area is found to be very fertile. The climatic and soil condition of the area are favourable for the cultivation of coffee, rubber, pepper, fruit trees, secondary forest and annual crops such as rice, maize, green beans, soy beans, peanut, cotton, etc.
Over the last decades, the study area has undergone remarkable changes in land use. Many forest areas had been replaced first by annual food crops and then by coffee plantations. This is mainly due to its fertile balsatic soil and water resources that are suitable for coffee and other cash crops. The proportion of land first cultivated by the respondents after 1990 is quite high (58%). The high world and domestic coffee prices made coffee production a very profitable enterprise and so have encouraged farmers to establish new coffee plantations on new or idle land.

Economic opportunities of the catchment have attracted migrants from other regions in the country that has also induced changes in the cropping pattern. Although with the gradual exhaustion of new land the rate of migration declined, the number of new arrival was still high even after 1995. The majority of the population is from the Ede ethnic group.

Agricultural production and cropping pattern in the study area

Agricultural production plays a significant role in the economy of the surveyed district contributing the largest income of the local people. The main income of most farmers is from coffee production. Other important income sources are from upland cash crops such as maize, beans, cotton, sugar cane and rice. In some communes of Cu M’gar district, work in rubber plantation owned by state farms is also an important source of income for local farmers.

In terms of land area, coffee occupies the largest proportion of the total farm land in the study area. The average area per farm allocated for rice, and other cash crops was very small compared to that of coffee (only 0,1 hectare on average). Cu M’gar is one of the major coffee producing district in the province with a large coffee area (22,780 ha in 1999) that contributes to about 14% of the total coffee area of the province. The two areas under survey, upper and lower areas of Cu M’gar district, have both very high coffee area of 3563 ha and 3467 ha, respectively. In the upper and lower area of Cu M'gar district, due to the better soil conditions, more than 90% of farmers is growning coffee. In the lower Buon Don area, the area planted with coffee is, however, much smaller due to less favourable soil condition and poor access to water.

Other major perennial crops planted in the study area are rubber, black pepper, and cashew. Like coffee, Cu M'gar is one of the districts having the largest rubber plantation in the province (about 32% of the total rubber plantation area of the province). Within the study area, rubber is planted with large areas in the three surveyed communes, namely Ea Tul, Ea Kpal, and Ea Pok. Rubber plantation is managed by state farms.

Rice production is not a profitable farm enterprise; many farmers (65% of the respondents) however grow rice for home consumption while some of them also sell the surplus on the local market. It is usually being cultivated on fields in deep stream valleys. The proportion of farmers cultivating maize, beans, and other crops is smaller, i.e. 27.8% only.

Farm structure

The average farm size of the respondents in the study area is 1.4 hectare with about 3 plots of land on average. The majority of the respondents (83%) are allocated less than 2 hectares; only 5.2% of the respondents occupied more than 3 hectares of land. The average distance to farm plots is relatively long (about 2.4 km) in the study area. This relatively long distance to the fields requires farmers to invest in tractors for transportation of labour farm inputs and produce. This has also important implications for community management of resources as the costs of enforcement go up with distance.

The ownership pattern indicates that the majority of farmers (87.3%) are owners of the land they cultivate. Besides cultivating their own land, some of the farmers also rent land for cultivation, or have contracts with other farmers, state farm or coffee company to cultivate on product-sharing basis. The percentage of the land rented or cultivated under share-cropping arrangement is only 12.7% on average.

3.2.3 Allocation of resources at farm-level – individual strategies

Crop choice

The rapid increase in coffee production and the general prosperity in coffee producing areas indicate that market forces are working in rural Vietnam, and farmers are responding to economic incentives. Farm-level data confirm that farmers are making crop choice according to relative profitability of different crops. For almost all farmers, coffee is the main cash crop for the farm households. The average area planted to coffee in the study area was 1.1 hectare per household occupying the largest proportion (76%) of the total cultivating area of their family. For most surveyed farmers, coffee production was a very profitable farm enterprise. Even with a low coffee price of 12,000 VND/kg of coffee bean at the end of 1999, the average income per hectare of coffee was 17.6 mill. VND per year. Very high income of about 24 mill VND per one hectare of coffee was achieved by farmers in EA Pok and Quang Phu commune while an average income of 5.6 mill VND was obtained by farmers in EA Tul commune.

In terms of income per one family labor, the data also show a similar picture. With an average of 61,000 VND per manday of family labor, the income from coffee crop is significantly higher than the income from other crop planted in the study site. The calculation of net income per one cubic meter of irrigation water used for coffee give a high return for per m3 water use with an average of 9,200 VND/m3 water. Other studies (SWRM Project, Danida 2000) indicate that

> "for coffee economic value of irrigation water from groundwater was calculated at VND 6,150 per m3 in 1999 for mature coffee. This compares with an economic value of water used in winter-spring rice of VND 18 per m3, and VND 62 per m3 for summer autumn rice. Water use for winter-spring rice is four times higher than that for coffee. Winter-spring rice is only marginally profitable, and farmers can be expected to seek alternative more profitable crops once they have satisfied their own domestic consumption needs. Irrigating winter-spring rice represents a wasteful use of scarce water."

The switch from winter rice to other less water-demanding crops is being facilitated by the relaxed policy of the government on self-sufficiency in rice at province level. But the land for winter-spring rice is often not suitable for coffee. There are other alternatives to irrigated rice for example, of annual crops, hybrid maize shows good economic returns and is a more efficient user of irrigation water, with an economic value of VND 140 per m3 for the winter-spring crop and VND 580 for the summer autumn crop. Of the other irrigated perennial crops, pepper gives very high economic returns, since only a small quantity of water is used. However, investment costs for pepper are very high. Besides it is dependent on forest resources that affects the watershed. Cocoa also produces a good economic return to water. It is a relatively new crop in Dak Lak with a significant development taking place since 1997, and farmers need to learn about its cultivation (Ron Parkin, Danida, 1999).

There are evidences that farmers are switching to other crops in response to water scarcity. For example, in an interview, farmers in Ea Tul commune stated that they were switching to less water demanding crops like cashew. However, there are no data on the extent of such shifts. The Socioeconomic Survey 2000, indicates a low degree of diversification in the area that indirectly points towards a slow response of farmers to resource scarcity. While this may be attributed to the lack of suitable land and knowledge of appropriate technology and crops, the survey points towards the weak extension services in the area.

Input use

The use of other inputs for coffee production also reflects the incentive of farmers to respond to market signals.

Mechanisation: The rapid expansion of coffee area due to high coffee prices in the last few years has undoubtedly speeded up the rate of farm mechanization in coffee production in the study area. The main production facilities and equipments invested by farmers for coffee production include tractor, pump, irrigation tubes and irrigation wells. Almost all farmers have their own pump (87%) and irrigation tubes (99%) and all farmers in the study area have dug at least one well for using ground water for irrigating coffee.

On average, farmers have to invest 1 pump and 1 well for irrigating one hectare of coffee. The investment of coffee farmers in irrigation tubes is also high in the study area.

Within the last few years, farmers in the study area have invested a large number of tractors and other farm equipments, locally made or imported, for cultivating coffee. The number of farmers owning tractor, mostly small hand tractors, for coffee production is rather high in the study area with 77% of the surveyed farmers. Small hand tractor is used mainly for coffee production to transport inputs and irrigation equiptments to the field, transportation of labor to field, and transpot fresh coffee beans to farmers house, and for bringing the products to the market.

Fertiliser: Most farmers consider coffee as one of the highest economic value and profitable crops. Hence, coffee production in the study area is based on an intensive use of purchased inputs like fertilizers and pesticides. There are, however, considerable variations with respect to the amount of fertilizer and application practices among the surveyed farmers. The number of fertilizer applications range from 2-7 times with an average of 3.7 times per year. The pattern of fertiliser application by farmers is mainly determined by the availability of fertilizer in the local market, the affordability of farmers household and the perception of farmers about the correct proportion or combination of fertilizers. Most of the respondents report that there is no shortage of fertilizer in the market. It is revealed from the farm household survey and farmer group discussions that fertilization is a technology that farmers have learned mostly through experience or from other farmers. Many farmers, especially those of the EÂ Ñeâ farmers´ group in Ea Tul and Ea Pok communes report that they lack the knowledge of the best level of fertilizer application for their coffee plantation. The data show that some farmers use incredibly high amount of fertilizer for coffee but do not obtain higher yield, indicating an overuse of chemical fertilizer.

The quantity of organic fertilizer used for coffee plantation is relatively low and does not vary much among farms in the surveyed areas. Almost all farmers agree that the use of manure is excellent for improving soil condition and increasing soil fertility, but they do not have enough manure on their farm, and have no easy access to other sources.

Chemical weed control is not a common practice among the respondents as indicated by the fact that about 71% of the coffee farmers do not employ herbicide at all It seems that weed is not a major concern of coffee farmers in the study area. Low pesticide application is recorded by coffee farmers in EA Tul communes but in other surveyed communes a relatvely higher amount of pesticide of 8 to 14 litters per hectare are recorded. It is also revealed from group discussion among farmers that many of them are lacking the technical knowledge about proper pest management methods, the right kind and amount of chemicals for specific pest. They have to rely on other farmers and sellers for technical information on the amount and method of pesticide application.

Labour: The major activities in coffee production include: pruning, weeding, application of fertilizer, pesticides, herbicides. Irrigation, harvesting, post harvest activities. On average, 378 man-days are needed per year to operate 1 hectare coffee plantation. Of these, 13% and 18% for pruning and weeding are used, respectively. Harvesting requires the largest

labor input (29 %) of the total labor requirement. Both family and hired labour are used. While labour market exists, the practice of labour exchange in the community is also prevalent.

Output market: The distribution and marketing of coffee are also guided by market forces. Marketing is done mainly by private traders who also provide credit to farmers. Some farmers take the produce themselves to the processing plants. Our interview with the representatives of farmers indicates that farmers are quite satisfied with marketing arrangements. But they complain about the instability in prices. High uncertainty and sharp fluctuations in the price of coffee affect the ability of the farmers to allocate resources efficiently. This is confirmed by the investment analysis of the survey data discussed below.

The pattern of crop choice and input use suggests that farmers are responding to economic incentives. But economic efficiency (the combination of allocative and technical efficiency) has not been achieved by all farms. The analysis of economic returns to farm-level investment indicates that some farmers are using too much fertiliser relative to the level that is considered as optimum given the current fertiliser/coffee price ratio. This is mainly due to an expectation of higher coffee prices.

Secondly, technical efficiency is not attained by all, as some farmers fail to avail of the best production practices. This is due to the weakness of extension services in reaching all farmers. Production efficiency among farms can be enhanced significantly if production techniques of best farmers are introduced to other farmers under similar production conditions (Agro-Socieconomic Survey, Danida 2000).

There are also some differences in the allocation of resources among small and large farmers who face different relative prices of inputs. For example, the cost of labour relative to capital is lower for small farmers than large farmers because of the availability of family labour and the limited access to formal credit. Small farmers also face higher fixed costs of machines and equipment as the size of the farm is small.

The access to credit determines the access to water through financing of extraction costs. There are different government credit programmes in Vietnam. According to the Credit Inception Report of Danida-supported SWRM Project (Andy Batkin, Iain Francis, 1999), VBA loans (Vietnam Bank for Agriculture) are overwhelmingly used by the better-off sections of the community. Our interviews with the farmers in Ea Tul commune and the Agro- Socioeconomic Survey, 2000 indicate a similar pattern. Since the access to formal credit market is limited to large farmers, poor farmers depend on informal sources, friends, relatives, own savings, traders or in worst cases money lenders. Other studies on Dak Lak province as a whole indicate that ethnic minorities and women farmers face more constraints with respect to credit because they lack the required collateral and knowledge about loan formalities (Gender and Ethnicity Adviser´s Audit, op. cit).

3.2.4 Competition over resources and depleting resource base

Individual strategies, however rational from economic growth point of view, have not led to efficient management of common-pool resources and the fulfillment of social goals.

Since rainfall in the dry season is usually very low, rice and coffee cultivation is not possible without irrigation In the upper part of Cu M'gar district, there is no irrigation facility available. Irrigation systems are available in the lower part of Cu M'gar and Buon Don, but they are poorly developed and managed. The supply of surface water in most of the communes under survey is not adequate for irrigating rice and even less for coffee, especially in the dry season of drought years.

Hence, the only source available for coffee farmers is groundwater. On average, coffee plantations (about 1100 coffee trees/ha) have to be irrigated four times during the dry season. The average amount of water for irrigation is about 500 liters per tree each time. This implies a huge demand for water in the dry season. Other studies suggest that in areas there are serious dry season water shortages in specific catchments including the study area. In some catchments there is insufficient groundwater even in years of average rainfall. In these locations farmers are aware of the shortage and try to extract as much groundwater and as early as possible.

Climatic stress usually starts in January in the area of deficit groundwater balance and increases until April. During such a prolonged period of climatic stress, intensive use of underground water for irrigating coffee are reported to have lowered the water table, increasing pump lift and pumping costs in many places in this area (Review and Assessment Report, Danida 1998).

Although individually, farmers are incurring higher costs of extraction, some of the costs are external or implicit as the damages are done to the overall resource system. In the past, water both surface and groundwater, was regarded as an abundant resource in the study area but now it is considered as a scarce resource (Agro-Socioeconomic Survey, Danida, 2000).

Besides the long-term non-sustainability of the system that affects everyone, there is a social dimension of the problem. There is unequal access to water among upstream and downstream farmers, and farmers within a given locality. River flows are reduced due to smaller groundwater discharge, and rice farmers in the downstream are adversely affected (Danida, 2000). The social and environmental problems related to the use of common-pool resources, groundwater and forestland are discussed below in terms of the existing institutional arrangements that determine the access to and control of resources.

4. Institutional arrangements determining the access to factors of production and long-run sustainability of the resource system

4.1 Land

Formally, all land is owned by the state but individuals can acquire long-term user rights to the land for 20 and 50 years periods for forestry-related uses. In combination with the Land Law (1993) that guarantees the right to use, inherit, sell, transfer and mortgage land, the 1994 decree (Decree No. 02/CP) allows the transfer of state-owned property to be allocated to farmers and forestry workers for the development of social forestry (Houghton, 1996). Land is becoming a marketable commodity in those areas where land title records are in order. In Ea Tul commune, 80% of the land have titles, and are mostly held by private farmers. According to the Committee Chairman, buying and selling of land are becoming more common. Since very little land is in open access land is mostly acquired through the market. The access to land is highly dependent on the access to credit or own capital.

The proclamation of private property rights and the emergence of a land market do not, however, mean that land is being used in sustainable manner in Ea Tul Commune. According to the Chairman, open access problem is not serious because of the most of the land is in private hands. However, 20% of the land still has no title, and previously, farmers were encouraged to cultivate coffee extensively without any consideration to forest cover and groundwater reserve in the area. Land tax was exempted in the first four years. Our field survey confirms that coffee cultivation has been extended to marginal land with poor soil and water availability. The protection of uplands through restriction of illegal encroachment should have been enforced long before. In the upper area of Cu M'gar, agricultural practices on hillsides or on land with steep slopes toward streams often cause serious soil erosion. In some parts of the commune, reforestation programme is needed instead of coffee cultivation.

There are two more reasons why unsustainable use of forest land (even under private property rights) is taking place. The first is the problem of externality as the coffee producers do not bear all costs of deforestation, soil erosion and water depletion. Secondly, poverty leads to high time preference, and the inability to bear the investment costs of conservation.

The privatisation of communal uplands has intensified poverty among ethnic minorities and infringed their traditional rights. Existing studies on Dak Lak indicate that indigenous ethnic minorities are the ones who sell land (Badenoch, 1999; Gender and Ethnicity Adviser´s Audit, op.cit). Indigenous people in the uplands are traditionally dependent on swidden cultivation that is becoming unsustainable due to increasing population (Rambo 1995). Government policies against swidden agriculture and the increasing demand for land for coffee has led to the conversion of uplands to permanent agriculture. According to the Chairman of the People´s Committee in Ea Tul Commune, poverty among indigenous population is mainly due to the lack of knowledge of good agricultural

practices for sedentary crops, and the problem is compounded with the gradual erosion of traditional knowledge about crops suitable for the ecosystem of the uplands.

The cultivation of coffee on the marginal land has also been encouraged by inefficient institutional arrangements with respect to water.

4.2 Water

The sources of irrigation water for coffee and other crops are reservoirs and dams, running water (streams, springs) and groundwater. The access to surface water depends on the location of the farm and financial means of farmers to invest in water reservoir. Only large coffee companies can afford such investment.

As mentioned before groundwater is mainly used for irrigating coffee. In principle, farmers are allowed to dig wells on their land subject to certain regulations. "Current Provincial Government regulations stipulate that shallow wells producing more than 600 m3 a day are required to have a license. There are a number of licensing regulations relating to exploration for groundwater and utilisation of boreholes. In addition, private companies drilling boreholes should have a license to operate" (DakLak Irrigation Sector Institutional Review Report, 2000, Danida). But groundwater has largely remained an open access resource as the rules for digging wells on the farmland are not enforced. During the dry season, especially in dry years, coffee farmers dig deeper and broader wells to meet the demand for water.

The cumulative effect of such individual actions is the declining overall supply of water that affects everybody albeit not equally. The access to water depends very much on the location of the farm near the water source. We have not noticed any open conflict in water use although everybody was aware of the tight water situation during the dry season. There is no market in the conventional sense, but if any farmer has surplus of water, another farmer can avail this provided he pays for the pumping cost. There is no charge for the water itself.

Existing data indicate that farmers are responding to such scarcities individually through an adjustment of demand against the supply. For example, technical relationship between coffee and water use suggests that maximum output can be attained with 450 cubic m per hectare. However, farmers are applying around 300 cubic m. Recent field survey (Agro-Socioeconomic Survey 2000, op. cit) also indicates that farmers are using water according to its availability, for example, in areas where there is plenty of water more water per hectare is used. Similarly, water use in coffee irrigation is less in dry areas and especially in dry season.

In spite of the general awareness of the problem of water scarcity, no collective solution with respect to groundwater seems to be underway. In Ea Tul Catchment, there are physical, technical and institutional constraints involved in the management of groundwater. Physical constraints for the study area are difficult to define as we have no

data in hand on the hydrological condition of the area. Comments from different stakeholders on the upstream and downstream problem suggest that the size and boundaries of the resource system is quite large. This renders the possibility of finding a local solution difficult. Some information related to the whole Upper Srepok Basin is available in Review and Assessment Report of Danida, 1998.

The management problem is further compounded by the fact that there are no simple techniques known in the community to measure the number of resource units (liters of water) extracted from the resource system. Moreover, the social structure in the area is such that there is no well-defined community who can be considered as the virtual owner of the resource. The absence of community feelings may be attributed to the relatively recent migration of population from other parts and the intervention by external forces such as government policies for sedentary agriculture, resettlement and community development (Crystal, 1995). In the Stakeholder Workshop in June 9, 2000, one of the stakeholders did mention about the lack of community feelings in the study area.

Three cases of enforcement problems are observed

- Reservoirs managed by State farms represent club or toll good with definite rules for exclusion of non-members. However, rules for the users belonging to the club are not clearly set.

- With population pressure and government intervention, there is no respect for traditional community rules.

- There are no clear-cut rules for the facilities created by the government, so that they have also become open access resources. The following passage from the recent report of the Second Workshop on Capacity Building of the Provincial Irrigation Sector reveals the current situation,

> "there are in Dak Lak, 192 schemes under management of the communes, which accounts for the total number, and 41.5% the total area. ….these schemes have very low efficiency; most of the schemes have not organised their irrigation management body; their irrigation system is managed by nobody; no repair and maintenance work is done in favour of degraded schemes: no irrigation schedule is made and no persons are responsible for irrigation work, all of which derives in several conflicts. Irrigation fee is only collected by 5-25%; the scheme protection is bad: the scheme does not show itself to be the owner of the scheme or to mobilise the participation from the farmers or the leadership of the grassroot authorities." (Danida 2000, pp. 42-43)

Summing-up: Government policies towards liberalisation have encouraged coffee production, but existing property rights in land and weak enforcement have led to an over-expansion of coffee area. This in turn has resulted in the high demand for groundwater. Since groundwater is largely an open access resource because no explicit rules for its use are operating, individuals are exploiting the resource system at the cost of

the community. Coffee cultivation also entails negative externalities like soil erosion, deforestation and water depletion that transcend beyond the communal boundaries.

The discrepancy in social and private perspective with respect to optimum coffee area has emerged due to differences in the social and private costs of coffee production. The farmers are not taking into account the social costs of soil erosion, deforestation, etc. Low costs of water and land have also induced farmers to produce coffee beyond the socially optimum level. Water cost is mainly for extraction. The variable and fixed costs of irrigation constitute a small proportion of total costs of production as found in Agro-Socioeconomic Survey, 2000. Our interviews with the coffee farmers on the fragile uplands confirm that they are exempted from the land tax in the initial four years.

Environmental problems are being exacerbated by poverty that causes high time preference among farmers and impairs their ability and incentive to invest in conservation measures. It has been reported by one Danida expert on irrigation, and confirmed by our field observation that poverty has forced upland farmers to grow coffee and other crops in between while coffee plants are not yet mature. Since land is already fragile in the uplands, this practice has exacerbated the problem of erosion. It should be mentioned that the livelihood of poor farmers depends on soil productivity. So they do undertake various conservation measures. However, large-scale conservation measures need investment that is not only beyond the capacity of farmers but also involve positive externalities or create benefits for others outside the community.

5. External responses to the crisis

5.1 The role of the government

Vietnam has gone through changes in property rights with respect to land and water. Before the unification of the country in 1975, forestland and water resources were managed by the community. Since 1975, these resources came under state management. Towards the end of 1980s, there has been a move towards both privatisation and decentralisation of government administration. As mentioned before, private property rights are being established in land, and the responsibility of reforestation and protection of forest is being entrusted to the household. There are, however, uncertainties regarding the role of the household versus the community, as evidenced from the implementation of the Five Million Hectare Reforestation Program (Badenoch, 1999).

Water, on the other hand, has been proclaimed by the government as community resource to be managed in an integrated, multipurpose and comprehensive manner. Central government sets the national rules for water use - the New Water Laws, and central agencies such as Ministry of Water and the Department of Agriculture and rural Development are the implementing authorities. These rules are supposed to be applied at provincial, district and commune levels through DARD´s (Department of Agriculture and Rural Development) Sub-departments and offices. Several other agencies have roles dealing with irrigation such as the Planning and Investment Bureau, Policy Bureau,

Finance Bureau, Forestry Development Sub-department, Rural Drinking Water and Environment Centre, Extension Centre, Resettlement and New Economic Zone Sub-department.

In principle, national laws on water resources reflect an awareness of the central government regarding the importance of treating water as an economic good, the role of democracy and active participation of local people in the management of watershed resources (The Proclamation on Grass-Roots Democracy). The Government of Vietnam through the Ministry of Agriculture and Rural Development expresses the Vietnamese Water Vision as "the integrated and sustainable use of water resources, the effective prevention and mitigation of harms caused by water". The priorities are:

- Clean water for people
- Water for food safety and socioeconomic development
- Preservation of water ecosystems
- Prevention and mitigation of harms caused by water
- Reasonable pricing of water
- Partnership view of efficient and effective integrated water resources management
- International cooperation on shared water courses for mutual benefits

(MARD, National Workshop on Water in the 21st Century – Vision and Action, Hanoi, 7-8 March, 2000)

The organisational structure for the water sector has undergone changes in line with these priorities. So DARD has Sub-departments and offices down to the commune level.

Diagram 2
Organisations and institutions at different levels

Organisation	institution or rules	enforcing authority
Central government	Water Law or forestry land, population	Ministry of water or forestry poor enforcement of laws
Provincial government DARD	Laws specific to provincial land, forest or water	Regional or provincial office
District administration DARD	Rules with respect to Irrigation schemes	District office District irrigation management board
Commune administration DARD	Rules relating to water fees, land tax	Peoples´ committee
Community management	Informal rules for sharing common resources	Village headman chosen by the people themselves

There are, however, several problems with respect to the implementation of the laws and policies.

- Organisations are in place but Provincial DARD offices fail to give clear instructions to district DARD and commune offices. A lack of cooperation and interaction among agencies at different levels has been observed by the Review Team on irrigation Sector, 2000. "There is a lack of detailed regulations to guide the relevant agencies in co-operating with one another to develop and protect water resources and irrigation schemes."

- An integrated approach with respect to groundwater and other sources of water is lacking.

- The overuse of groundwater is intimately related to the use of land. But there is very little discussion on the price or institutional arrangements that govern the use of forestland. The Orientation Plan for the Irrigation sector from now to 2010 produced by DARD in March 2000, focuses on crop area without addressing the problem of water shortage (Irrigation Sector Review, Danida 2000). Although watershed management cuts across many sectors and departments, there is little coordination among different agencies. This is an indication of the lack of any effort to attain the three goals of sustainable development through a common understanding of the tradeoffs involved.

- There is an extensive *general* discussion on water fees/taxes, water rights and water user association. A draft document issued by Dak Lak People´s Committee on temporary regulations on ground water management of exploration and extraction in Dak Lak Province in 1996 indicates that a set of detailed rules and regulations directed to groundwater was prepared. In 1997, MARD also provided Guidelines on application for registration of drilling business and issuing licence to work in drilling for abstraction of groundwater (Decision No. 357-NN-QLN/QD, 13th March, 1997) to the Provincial People´s Committees. But there are no clear instructions how these rules would be enforced, and in fact, they are not enforced as is revealed by the open access nature of groundwater in the study area.

- According to national laws on water, the user group will decide on the fee and manage water use in the community. So far, there is no instance of *people´s own initiative* in water resource management. Participatory Irrigation Management (PIM) is a local-level institution initiated by some donors with the support from the government. Although this is a new institution it can provide some valuable information on the problems of formation of user group and the design of operational rules subject to easy enforcement.

Official documents on water policies reflect an awareness among policymakers about the problem of water scarcity and the need for an integrated, multi-level institutional approach for the management of water. *The importance of community participation is recognised, but no attention is paid to the characteristics of the resource system,*

technology available and the changing social structure that determine the nature of institutional arrangements needed. Discussion at the government level is focused on the issues of privatisation and centralised/decentralised government structure while the main problem lies with the formation of local-level user or appropriator organisations that can devise operational rules with low enforcement costs.

5.2 The role of donors

The donor agencies (Danida, GTZ, WRI) play an important role in watershed management in Dak Lak. Their involvement is related to three broad categories:

- Technical help in the assessment of environmental impact in the watershed of uplands (SWAP Action Plan in the Upper Srepok Basin)

- Assistance in building institutional capacity for the management of watershed resources (SWRM Project, Danida)

- Assistance in the irrigation sector (SWRM Project)

Two important contributions of the SWRM Project (Danida) relate to assessing the economic value and pricing of water, and Participatory Irrigation Management. There is an extensive discussion on the need to treat water as an economic good, and to value it in terms of its opportunity cost. It is recognised that charging farmers on the basis of opportunity costs may create the problem of inequity between coffee and rice farmers because the economic return to coffee per unit of water is much higher than it is for rice, and rice farmers cannot grow coffee due to agronomic reasons (Review Report on Irrigation Sector Institutions, Danida 2000).

Discussions among stakeholders in different workshops suggest that there are controversies regarding how much small farmers should pay for water. According to some experts, poor farmers should receive a subsidy. In our opinion, it is not advisable to use water fee as an instrument to alleviate poverty. Misuse of resources due to wrong signals to producers can result from such measures. Other measures more targeted to poor people should be applied. While farmers should not be charged for large investment that have external benefits beyond local boundaries, they should pay for operation and maintenance costs for the local irrigation schemes. Water fees should be fixed by users according to *local demand/supply situation*.

It should be kept in mind that while pricing of water is important, the main problem is the enforcement of rules that ensure collection of water fees and socially optimal use of water, as is aptly stated by one of the participants in PIM Workshop in March 2000.

“water fees are high or low is not an issue but whether farmers accept to pay water fees or not. If the services are not good, farmers have not realised their benefits, the schemes have not managed by their own, even the low fees will not be collected. If there is good

management with people´s participation, and farmers understand that water fees serve their own benefits, the high level of fees are also agreed on (Tiep, N. X. Speech delivered at the Workshop on Organisation and Operation of Grassroots Participatory Irrigation Management (PIM) Hanoi, March 13, 2000).

Studies on institutions in the water sector (Danida reports) reveal the awareness among donors about problems of implementation and the importance of local-level participation. However, institutions are generally viewed as organisational frameworks at different levels that have some impact on the management of the watershed. This gives only a partial view of the problem. *The analytical framework that considers institutional arrangement as a set of rules needed for the management of common pool resources with public good characteristics enables us to understand the incentive structure underlying a system and thereby the management problem more effectively.*

PIM of the SWRM Project (Danida) in irrigation sector is the right approach towards collective action by users. Also, the Draft Statute of Water User Association of Canal System Ea Ne, Ea Bar commune, Buon Don district (SWRM, Danida/PC of the commune) takes up the enforcement issues more explicitly than any other document.

More attention needs to be directed to the local situation - on the characteristics of the resource system, the community structure and existing decision making arrangements. As recognised by the donors, PIM approach should be extended to groundwater. Technical assistance is needed in assessing the size and boundaries of the groundwater system in a given community. Information about resource availability and the physical characteristics of the resource system, for example, the data generated through Action Plan for Water Resources Development in Upper Srepok Basin in Vietnam, need to be shared with local users.

6. Local-level responses based on field surveys and stakeholder workshop

As mentioned before, efficient management of common pool resources requires coordinated action of the users that in turn depends on the awareness and common understanding of the problem. In addition to interviews with the farmers, the officials of Ea Tul Commune and donor agencies, a Stakeholder Workshop was organised by TNU/UAF on June 9, 2000 to find out the perception of local people about the problem and possible solutions. The stakeholders represented Ea Tul Commune office, sub-departments of DARD, Irrigation Management Company, coffee farmers, sub-department of forestry development and State Farm for rubber.

6.1 Stakeholders´ perception of the characteristics of goods and services produced and their effects on the watershed

Coffee is considered as mainly a private good but has both positive and negative externalities. Negative externalities are pollution of ground water that depend on the location and bio-diversity losses. Positive externalities are viewed as the prevention of soil erosion and the regulation of the atmosphere.

Rice is mainly a private good with negative externalities of water pollution and soil erosion. The stakeholders realise that individual overexploitation of water leads to reduced supply for general use, etc. Positive externalities are considered to emerge from the regulation of groundwater and air. No explanation was given about the mechanism how it could occur.

Rubber is a private good but takes a long time to generate income or benefits. Negative externality is associated with water pollution through fertiliser use. Positive externalities mentioned are improvement of the environment, protection of the watershed, increase in groundwater quantity, prevention of erosion and regulation of air.

Black pepper is a private good that gives quick returns but involves heavy investment, uses low quantity of water. Negative externalities are created through deforestation (under poor enforcement of land rights).

Cocoa, a private good, exerts positive externality through improvement of the soil.

Reforestation:

Many advantages are mentioned that are purely externalities because institutions for the internalisation of benefits are non-existent. The low private economic benefit of reforestation is also mentioned.

6.2 Perceptions about the causes of water shortage and inefficient management

- Coffee cultivation enhances water scarcity directly through the production process, and indirectly through deforestation. Deforestation leads to losses of potential benefits of forest that are related to its hydrological function. Deforestation also degrades the reservoirs.

- The reservoirs are degraded due to the lack of awareness among users and official stakeholders i. e. management bodies, and the lack of capital. The two factors cause low participation in maintenance and new investment.

- Another cause of water problem is the lack of rules about water use and conservation.

- The lack of compliance of the rules related to resettlement and zoning of forest land is recognised.

- Water shortage is caused by population pressure through immigration and natural growth of population. The demand for water for both consumption and production purposes increases with increasing population. Immigration is being induced by high profitability of coffee production as seen by the villagers.

- There is a lack of knowledge about the total supply of water in relation to individual demand and about efficient techniques for water extraction.

According to the stakeholders, consequences of water shortage are conflicts regarding the use of water that the government agencies fail to mediate. The low level of water supply is said to lead to low productivity of crops. This works through the effects of water on the use of fertiliser and other inputs. On the other hand, inefficient use of inputs leads to low productivity, poverty and difficulties in the collection of water fees.

6.3 Solutions suggested by the stakeholders

- Strengthen enforcement of rules related to water, land and resettlement.
- Achieve balanced structure of crops especially for perennials.
- Consider economic, social and environmental goals in an integrated manner.
- Acquire knowledge about water availability and its ability to recharge itself.
- Manage water resources through local participation.

The results of the workshop indicate that local stakeholders (mainly farmers) are quite aware of the economic, social and environmental consequences of changes in land use pattern, and the causes underlying the problems. They strongly feel the need for collective action. The main constraints towards collective solution seem to be the lack of knowledge about the characteristics of groundwater (its availability, recharging capacity, boundary). techniques for measuring and monitoring the use of resource units, and the absence of a cohesive community that can fit the boundary of the resource. In view of the weak potential for collective action within the local community, some intervention by external forces, both government and non-government, is needed.

7. Summary and conclusions

The objective of this study is to analyse the institutional response to changes in land use pattern and water scarcity in Dak Dak province with a focus on Ea Tul catchment. The root causes of degradation of the watershed and specifically, water scarcity in Dak Lak are found to be property rights problems of common pool resources (land and water) exacerbated by exogenous factors such as population growth and commercialisation of agriculture. Vietnam is facing conflicts among the three objectives of sustainable development. The liberal economic policies and market institutions that are behind economic progress in Vietnam have failed to promote equity and preserve natural resources. The focus of the paper has been on the property rights regimes for common

pool resources, land and water, in Ea Tul Commune in Dak Lak, and the responses of different stakeholders in avoiding an open-access problem.

Secondary data on Dak Lak Province and Ea Tul catchment and primary data collected through interviews, field observations and workshops, suggest that farmers are responding to market forces, and economic efficiency in the production of agricultural crops has largely been achieved at farm-level. Some improvement may, however, be made through improved extension services.

Individual strategies for achieving economic goals have caused environmental damages and social conflicts because of the lack of clearly-defined and enforced property rights, and externalities even when land is privately owned and managed. Groundwater that is mainly used for irrigating coffee is largely an open access resource because institutional arrangements for the enforcement of stipulated rules are weak. There is also a lack of efficient techniques to monitor the use of resource units by individual users and to measure the total availability of water.

Given the absence of well-functioning property rights regime, the changing circumstances that hinder community action, and the integrated nature of the resource system in the watershed, a polycentric/nested approach may be a solution to open access problem. One positive aspect in Dak Lak is that there is an awareness among stakeholders - local community, the government and donors about the integrated nature of the problem that needs a multiphase approach. *But the institutional analyses so far carried out by different agencies do not adequately and explicitly consider the public good characteristics of common pool resources and externalities. The effects of exogenous forces like population growth, migration and economic policies on the land use pattern have also received scanty attention.*

Policy recommendations:

- It is important for the government to take a long-term perspective and recognise the environmental costs of coffee production. A reconsideration of macropolicies that affect land use pattern and the watershed is urgently needed.

- Coffee production should be banned in fragile areas. Strict enforcement by local authorities is needed.

- Let private costs of coffee production reflect the social costs through taxes/fees on land and water.

- Let private benefit of reforestation equalise social benefit through subsidies.

- Mobilise environmental concern among local community through workshops where quantitative estimates on the resource system, damages to the system are presented, links are clarified, and it should be explained why coordinated strategy is better than individual strategies.

- Strengthen formal rules and the enforcement mechanism through cooperation between local government bodies and the local community.

- Adopt sound population policies through education, health and poverty alleviation measures.

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