Managing Groundwater Access in the Central Highlands (Tay Nguyen), Viet Nam

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Natural resources, institutions and livelihoods in Dak Lak, Viet Nam

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NATURAL RESOURCES, INSTITUTIONS AND LIVELIHOODS IN DAK LAK, VIET NAM

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1 INTRODUCTION

Changes in natural resource systems are caused in part by the extent to which these resources are employed in human production and consumption activities. When a scarce resource is in demand and cannot be readily substituted for other inputs, competition for the resource occurs within society. Conditions for potential social unrest are created unless resource allocation can be made on a basis justifiable to those impacted. If allocations are not justifiable, the probability that the allocation rules implemented will be successful may be reduced. This is especially the case where the resource is ‘fugitive’, that is demonstrating physical characteristics that make it difficult to monitor and enforce allocation rules.

This research paper provides a detailed overview of the issues and challenges relating to water scarcity and allocation in Dak Lak, Viet Nam. Dak Lak now faces temporal and areal water shortages, a result of three decades of agriculturally driven population and economic growth. There is evidence that groundwater resources are being over-exploited and that the regional hydrological system is being fundamentally disrupted. Water resource over-exploitation has lead to government intervention, with this process in its relatively infancy. These interventions will be influential to achieving water resource allocations that improve water use efficiency and sustain the hydrologic system in Dak Lak. Given groundwater’s fugitive status and limited resources for governance, any water sector intervention must be viewed as justifiable, procedurally fair and administratively uncomplicated by those impacted if meaningful compliance levels are to be achieved.

The paper is made up of four sections. In section two the socioeconomic programs and legislative reforms that initiated Dak Lak’s growth are described and the social, economic and environmental impacts of this growth are outlined, with a focus on hydrological impacts. Local and national initiatives to improve water resource management in Viet Nam in general and in Dak Lak specifically are addressed in section three. An analysis of these initiatives is provided in section four of the paper.
2 DEVELOPMENT BACKGROUND

2.1 A brief overview of Agrarian Development in Viet Nam, 1975-2004

Since the mid 1980’s, Viet Nam has undertaken institutional and policy reforms that have resulted in rapid economic growth and poverty reduction. Reforms to the agricultural and forestry sector have been cornerstones in this process. After reunification in 1975, the Communist government banned individual land ownership and collectivised agriculture, forestry and the means of production under a centrally administered system. New Economic Zones and state farms were established, supported by a program for long-term population de-urbanisation and re-distribution from the North and urban centres in the South to rural areas through sponsored mass migration (Ha et al., 2001; Zhang et al., 2001). Throughout Viet Nam, collectivisation and population redistribution policies failed to produce the outcomes expected by the Vietnamese government. Collectivisation resulted in economic stagnation, hyperinflation, falling food production and food shortages beginning in the late 1970’s. These factors prompted radical reforms including de-collectivisation of agricultural lands, commencing in the early 1980’s.

Following adoption of the Doi Moi economic liberalisation principles at the Sixth Party Congress in 1986, collective ownership of agricultural lands and production capital were removed through Central Committee Resolution 10 ‘Renovation of Management of the Agriculture Sector’ in 1988. Under the Resolution, quasi-private land rights were established by providing farmers with long-term leasehold entitlements. Individual access to credit and marketing systems were developed. In 1989 all price controls over production inputs and outputs were lifted and internal and external trade liberalised. The introduction of the country’s Land Law in 1993 furthered land tenure security by extending the lease period to twenty years for annual croplands and fifty years for perennial and other longer-term crops, including forestry. The 1993 Land Law also established the commodity basis of land by providing households with five rights to land: the right to be lease, transfer, exchange, inherit or use land as collateral (Jamal et al., 1998).

Land reforms provided the basis for the household to become the basic unit of
agricultural production in Viet Nam, with individually determined investment and farm planning decisions driven by newly freed markets. Although implementation of the land decrees were slow (by the beginning of 1995 only 31 percent of households had been granted formal rights (Nguyen, 1995)), the combination of quasi-private land ownership, a fall in inflation in 1989 and the devaluation of the Dong around the same time provided sufficient stimulus for rapid national growth in the agricultural sector, particularly in exports (Jamal et al., 1998). At current prices, between 1985 and 2001 GDP from the agriculture, forestry and fishing sector grew from VND 47 billion to VND 115,412 billion (van Arkadie et al., 2003). Livelihood improvements were also evident. Between 1985 and 2002 Viet Nam’s Human Development Index (HDI), a composite index measuring average achievement in three measures of human development – life expectancy, literacy and educational enrolment and standard of living - increased from 0.582 to 0.691, placing Viet Nam in the third quartile of countries with medium levels of human development (United Nations Development Programme (UNDP), 2004).

2.2 Policy reform, economic development and natural resources in Dak Lak 1975-2004

2.2.1 Policy reform and economic development in Dak Lak, 1975-2004

Development in the Central Highlands (Tay Nguyen) of Viet Nam following reunification responded directly to the nation’s institutional and policy reform process. Characterised by low production levels, low population density and abundant natural resources following independence, the region was regarded by the government as a key frontier for economic development (Ha et al., 2001). Development potential was especially pronounced in Dak Lak, the largest of Central Highlands’ provinces (Figure 1). Approximately 40 percent (750,000 hectares) of the province is covered with plateaus of rich, well-draining and friable Rhodic Ferralsols (red basalt) that are particularly well suited to intensive agriculture. Dak Lak is characterised by two distinct seasons: the rainy season occurring between May and November and the dry season from December to April. Rainfall intensity is highest between July and September. Ranging between 400 and 800...
meters above sea level, the climate is substantially milder than the Vietnamese lowlands, averaging 23.7°C annually, with 82 percent humidity and annual rainfall of approximately 1,650mm.

The national reforms of demographic resettlement, socioeconomic liberalisation and tenure privatisation summarised in Section 1.1 stimulated rapid population and production growth in Dak Lak province. In 1976 Dak Lak’s population was 360,000 with a population density of approximately 18 persons per square kilometer. About 300,000 of these people lived rurally, cultivating approximately 93,000 hectares of primarily coffee plantation remaining from the French colonial period and subsistence crops (Mueller, 2003; Thanh, 2004). Following independence, Dak Lak was designated a New Economic Zone and state organised mass migration of lowland Viet (Kinh) to hundreds of newly established state farms and cooperatives in the area occurred (Ha et al., 2005). Between 1976 and 1996 between 300,000 and 340,000 people migrated to Dak Lak under these government planned programs (Dak Lak Peoples’ Committee, 2001; DANIDA, 1999; Ha et al., 2005; Mai, 1999).

**Figure 1: Dak Lak, Viet Nam**

Source: (D’haeze et al., 2004). Note: The approximate areal extent of Dak Lak’s basaltic strata is shown in white.

1 Covering approximately 1,960,000 hectares
Doi Moi reforms included the abolishment of travel restrictions within Vietnam and in turn resulted in large increases in unplanned migration to Dak Lak. Spontaneous migration was driven primarily by economic opportunity in response to increased international demand for coffee, further stimulated by a four-year land tax deferral for new plantations (Nguyen, 1995). In the early to mid 1990's coffee prices climbed rapidly generated by crop loss and damage in Brazil caused by severe frosts. The average annual composite indicator price climbed from a low of US$3.35 cents kilogram\(^{-1}\) in 1992 to a high of US$138.42 cents kilogram\(^{-1}\) in 1995, sparking a surge in spontaneous migration between 1991 and 1995 that exceeded planned migration by a factor of approximately 12:1 (Figure 1). Between 1976 and 1999 un-sponsored migration resulted in the influx of approximately 360,000 people, although this figure is difficult to verify given the nature of the migration\(^2\). The majority of these settlers established smallholder farms producing robusta coffee (\textit{Coffea canephora}), a crop better suited than the arabica variety to the warmer growing conditions but earning a lower international market price. The combined impact of planned and spontaneous settlement resulted in annual population growth averaging 7.7 percent between 1977 and 1990 and 6.6 percent between 1991 and 2001, the highest rates in Viet Nam. In 2001, Dak Lak's population was estimated by official sources at 1,950,000, with approximately 1,500,000 of these people living rurally (Dak Lak Peoples' Committee, 2001; Mueller, 2003). Population density has increased to approximately 110 persons per square kilometre, a figure that does not reflect the uneven population distribution, which is concentrated in the more productive basalt plateau regions.

\(^2\) Estimates of spontaneous and planned migration should be viewed as coarse estimates. The Department for Fixed Cultivation and Sedentarisation did not track numbers leaving the new economic zones converting into unplanned settlers to take up economic opportunities and could not accurately estimate the number of unplanned settlers from the lowlands.
Figure 2: Planned and Spontaneous Migration to Dak Lak, 1976-1999

Source: (Dak Lak Peoples’ Committee, 2001; Mai, 1999; Tan, 2000)

Figure 3: International Composite Indicator and Robustas Group Price and Coffee Area in Dak Lak, 1985-2004

Source: (D’haeze et al., 2004; International Coffee Organisation, 2005; Tan, 2000)

By 2001, Viet Nam had become the second largest coffee producer in the world behind Brazil, producing 847 thousand tons of Robusta coffee and contributing 10 per cent of
Vietnam’s annual export earnings. By 2001, coffee plantations in Dak Lak alone accounted for approximately 55 percent of Viet Nam’s annual robusta output, approximately 465 thousand tons. Whereas increases in agricultural gross output throughout Viet Nam resulted from both expansion and intensification (Jamal et al., 1998), the increase in coffee production in Dak Lak has been dominated by expansion, driven by the establishment of new small-scale farms by immigrants (Figure 2). Between 1976 and 2001 coffee plantations in Dak Lak increased from 20,000 hectares to between 260,000 and 285,000 hectares, approximately 50 percent of all coffee plantation in Viet Nam (Dak Lak Statistical Department, 2002; Lenin Babu et al., 2003). Immigrant farmers own an estimated 80 percent of these plantations with the balance held by the state-owned Vietnam National Coffee Corporation (VINA CAFE). Approximately 75 percent of these smallholders operate on areas less then one hectare (Lenin Babu et al., 2003; Ministry of Agriculture and Rural Development (MARD), 2003). Although assessments are not available for the full period since Doi Moi, between 1990 and 2000 growth in gross coffee output in Dak Lak was estimated at 30.4 percent per annum with approximately 70 percent of this growth attributable to expansion in planted area (ICARD et al., 2002).

Despite their small areal scale of operations, the economic rewards of producing coffee have been substantial for many farmers. This is especially true of early migrants who benefited from high prices prior to the international price slump in 1998 that resulted from market over-supply. Poverty rates in the southern coffee growing districts of the Central Highlands (which includes Dak Lak) are markedly lower than those in northern districts, where less coffee development has occurred (Minot, 2000 in (Ha et al., 2005)). Average annual household incomes in Dak Lak were approximately 32 million VND (USD2,340) in 1999 and 46 million VND (USD3,364) in 2003, compared to national per capita income of USD360 in 1999 and USD480 in 2003 (The World Bank, 2005).

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3 GNI per capita, Atlas method
2.2.2 Development impacts on natural resources in Dak Lak, 1975-2004

Areal expansion of agricultural land in Dak Lak has resulted primarily from forestland conversion. Between 1976 and 2001 forest cover decreased by approximately 235,000 hectares to approximately 1 million hectares, a figure that neatly offsets the officially reported increase in coffee plantation area (Dak Lak Peoples’ Committee, 2001; D’haeze et al., 2005). Actual deforestation may be greater than this level however, given that central planning authorities classify converted and disused grasslands as forestland.

Agricultural expansion has occurred in a largely uncontrolled manner, especially since Doi Moi. Early expansion under the New Economic Zone program was heavily controlled, with the creation of 225 planned agro-forestry state farms and cooperatives primarily on flat land areas near developed infrastructure (D’haeze et al., 2005; Hardy, 2000; Mueller, 2003). While the majority of these lands were redistributed following reforms of the early 1980’s, it was insufficient to meet the demand for land created by immigration, both planned and spontaneous. Additionally, because land entitlement could not be transferred until the enactment of Resolution 10 in 1988, untitled forestland conversion was the only real option for the majority of spontaneous immigrants seeking to establish farming operations.

Uncontrolled farmland expansion has caused depletion and degradation of Dak Lak’s natural resource base and there is evidence of spatial mismatches between land use and natural resource availability (Ahmad, 2000; Dak Lak Peoples’ Committee, 2001; D’haeze et al., 2005; Ha et al., 2001; Mai, 1999; Mueller, 2003; Nghi, 2002; Tinh, 2003). These outcomes have lead some analysts to suggest that the extent and intensity of agricultural practices in Dak Lak are not sustainable, especially on more marginal lands (Ahmad, 2000; D’haeze et al., 2005; Ha et al., 2001). Deforestation and forest fires from land clearing have resulted in flora and fauna biodiversity loss, propagation of extensive grasslands and desertification in some areas (Bergeret, 2002; Cramb et al., 2004; Dak Lak Peoples’ Committee, 2001). High levels of soil nutrient depletion are evident in areas of the province, which has lead to reduced yields (D’haeze et al., 2005; Ha et al., 2001).
Deforestation may also have unnecessarily increased crop demands for water due to the diminished capacity for remaining forests to slow down wind and contribute to air humidity (Riddell, 1999). In addition to soil nutrient depletion, soil erosion has become a problem in areas of Dak Lak (Ahmad, 2000; United Nations Environment Programme (UNEP), 2001). In high sloping denuded areas landslides are prevalent. In catchment areas erosion is contributing to high sediment loads in waterways and causing accelerated silt build up in small dams and reservoirs used for irrigation (Riddell, 1999).

A key concern is that the current level of demand for agricultural water in Dak Lak exceeds supply availability and that large expanses of existing land use are mismatched to their local water availability (Ahmad, 2000; D’haeze et al., 2005). Estimates suggest 21 percent of irrigation water in Dak Lak is extracted from surface water stored in artificial ponds and water reservoirs, 29 percent comes from natural rivers, streams and lakes and 57 percent is extracted from ground resources (D’haeze et al., 2005). Such estimates are highly variable, being dependant on the time of year and whether the region is experiencing dry, normal or wet conditions. Irrigators generally extract from the shallow unconfined aquifers consisting of layered red soil, weathered basalt and inter-layered compact / porous basalt using dug wells. Depending on location, average annual rainfalls between 1,308 mm and 1,857 mm replenish Dak Lak’s aquifer system. Mean annual recharge to unconfined aquifers in the Dak Lak plateau which makes up about 40 percent of the province has been estimated at between 480 and 500 mm per annum during a normal rainfall year; this also represents the amount of water that can be abstracted from the aquifer system without mining the resource (COWI-Kruger Konsult, 1996). Abstraction at this level would result in a stabilised aquifer with no discharge, and a sustainable yield approach based on the difference between the mean annual recharge and a specified minimum baseflow has been recommended as an abstraction path that would avoid stream, spring and water-dependent ecosystem degradation (Croke et al., 2004; D’haeze et al., 2004). Recharge to the deep aquifer is estimated at approximately 10 to 20 percent of total recharge, corresponding to 500 to 1000 cubic meters per hectare per annum.
During a normal wet season water supplies are generally abundant, however dry season water shortages are occurring with increasing frequency and severity in catchments of Dak Lak province, indicating these basins are either closed or closing (Molle et al., 2004). These shortages are primarily caused by the increasing rate of groundwater extraction and are fundamentally altering the region's hydrological system. The adverse impacts of increased groundwater use are evident through regional exhaustion of unconfined aquifers during the dry season, declining water table levels in the upper unconfined and lower confined aquifers and baseflow reduction resulting from lower rates of groundwater discharge (Ahmad, 2000; Dak Lak Peoples’ Committee, 2001; D’haeze et al., 2003; Riddell, 1999). Intensive groundwater abstraction is reported to have lowered the groundwater table under the Dak Lak plateau by four to five meters on average over the past 20 years (Ha et al., 2001). Groundwater table levels under the provincial capital Buon Ma Thuot, also in the Dak Lak plateau, have declined by 2.5 meters between 1997 and 2003, from –31 to –33.5 meters, indicating that mining of the confined aquifer may be occurring (The World Bank, 2003).

Increasing irrigation water demands are occurring in an environment of increasingly frequent and severe drought conditions, here defined as water availability that falls below the statistical requirements for the region. The Central Highlands has the highest drought index in Viet Nam. Since 1980, droughts have occurred annually during the dry season with high severity every five years (1983, 1988, 1993, 1998, 2003) and in consecutive years between 2003 and 2005. Drought impacts in Dak Lak are severe. In 1998, 200 reservoirs ran dry and underground water supplies were overexploited, with shallow aquifers in some catchments running dry. During the drought, it was estimated that 90 percent of families in Dak Lak did not have access to sufficient water. As water prices rose by 25 percent, small farming families lost over 70,000 hectares of coffee produce (Lenin Babu et al., 2003). In 2003, water flows in all rivers in the Central Highlands were reduced by between 20 and 50 percent on 2002 levels. The drought conditions resulted in a water supply shortage for 100,000 households in the Central Highlands (The World Bank, 2003). Similarly, in 2004 approximately 70,000 hectares of coffee was either lost or damaged. Baseflows decreased
in large rivers by 30 percent and 45 percent in smaller river networks and approximately 20,000 households experienced severe water shortages (Vietnam News Agency, 2004).

2.2.3 Farm level practices contributing towards water shortages in Dak Lak

Crop selection, farm management and irrigation practices are key farm level drivers of the potentially unsustainable levels of agricultural water consumption. Robusta has a low tolerance to water stress relative to other perennials such as rubber and cashew, tolerating only 21 to 30 days of mild water deficit during its 270 to 300 day growing cycle (Bannister, 1986; Food and Agriculture Organization of the United Nations, 2005a). Irrigation requirements for robusta in Dak Lak is estimated to between 340 and 600 mm per annum during the dry season in order to break flower bud dormancy and induce fruit setting (COWI-Kruger Konsult, 1996; D’haeze et al., 2003). These figures show that coffee’s upper irrigation requirement exceeds the normal year average groundwater recharge rates in Dak Lak, implying the potential for spatial and temporal water shortages in the province, especially during dry and very dry years. Spatially, evidence suggests those hardest hit by water shortages are more recent migrants who have converted more marginal forestland outside irrigation systems, characterised by poorer or unsuitable soils and lower water availability. Water shortage impacts these farmers particularly hard as they generally also have higher levels of indebtedness (Riddell, 1999).

Robusta coffee is the dominant crop in Dak Lak, however perennial commercial crops including rubber, cashew and black pepper and annual crops including wet rice, dry rice, cotton, maize, soybean, other bean varieties and cassava are also grown (Table 4). Dry and wet rice have water demands between 950 to 1,235 mm and 445 to 600 mm per annum respectively over their 120 growing cycle (COWI-Kruger Konsult, 1996; Dak Lak Department of Agriculture and Rural Development (DARD), 2005). The Food and Agriculture Organization of the United Nations (FAO) recommends irrigating cotton between 700 and 1300 mm to achieve maximum yield under ideal growing conditions, with critical water requirements during the flowering period when leaf area is at its maximum. For maximum production, a medium maturity maize crop requires between 500 and 800...
mm of water depending on growing climate. Greatest decreases in grain yields are caused by water deficits during the flowering period including tasselling and silking and pollination. Soybean has a total growing period is 100 to 130 days, requiring between 450 and 700 mm to achieve maximum production, depending on climate and length of growing period. Growth periods most sensitive to water deficits are flowering and yield formation, particularly the later part of the flowering period and early part of the yield formation. Cassava’s critical water requirements occur during the rooting, early tuberisation and tuber development stages; cassava has water requirements between 400 and 750 mm (Food and Agriculture Organization of the United Nations, 2004). It is evident from these data that the average recommended water requirements for all of these crops exceed Robusta coffee’s requirement.

Exacerbating the groundwater depletion problem, there is evidence farmers use plant management practices that lead to unnecessary over-irrigation of coffee and other crops. Field experiments in Dak Gan district of Dak Lak have demonstrated that smallholder farmers over-irrigate coffee by a factor of 2.3 times the amount required to maximise coffee yields in the belief that linear yield increases are achievable from irrigation (D’haeze et al., 2005). The development of national and provincial electricity networks has supported over-irrigation by providing increased access to groundwater through installation of farm-level electric powered water pumps. Government subsidisation of pumping costs for both electric and diesel powered pumps further encourages over-irrigation (The Asian Development Bank, 2003). Surveys from Ea Tul in the Dak Lak plateau in 1999 (Ahmad, 2000) found all surveyed farmers had dug at least one well for irrigation purposes and 87 percent had their own pump. Results also suggested that on average, farmers had to invest one pump and one well for irrigating one hectare of coffee.

Increasing water scarcity in Dak Lak during the past three decades has created potential for large-scale socio-economic instability, particularly between traditional landowners, migrants and the state (Ahmad, 2000; D’haeze et al., 2005; Kerkvliet et al., 1995). Competitive and myopic consumption strategies are evident in the province, including
extensive early over-irrigating of crops and water hoarding during the dry season when
water shortages are anticipated. These strategies exacerbate the negative environmental
impacts of a disrupted and depleted hydrologic system, primarily through baseflow
reduction. Myopic water consumption strategies are understandable when the economic
stakes are high for farmers, most of whom have a heavy reliance on a single crop that takes
several years to recover from a severe water shortage event. The impact of dry season water
shortages has substantial social and economic impacts on the region, including the potential
to devastate economically the majority of the province’s indebted farms (ICARD et al.,
2002). Large-scale disruption to the hydrology system also creates potential for downstream
flow disruptions and consequential environmental, social and economic impacts.

3 WATER RESOURCE MANAGEMENT IN VIET NAM: PROMISES AND
CHALLENGES

3.1 Provincial government responses to water scarcity in Dak Lak

3.1.1 Supply-side responses

Local government responses to increased water demand and water shortages in Dak Lak
have shifted from a supply side approach to encompass both supply and demand side
approaches. Since 1975, 580 reservoirs and dams have been constructed in the province
with infrastructure purportedly distributing to 60 percent of Dak Lak’s total crop area
(Vietnam News Agency, 2005). Two major irrigation projects at Boung Yong and Ea Sup
Thuong, are currently being undertaken at a combined cost of USD33 million, due for
completion in 2007-2008. These projects will supply irrigation water to approximately
23,000 hectares or farmland in Cu M’gar and Buon Don districts (Embassy of Viet Nam
(USA), 2004).

3.1.2 Demand-side responses

Demand side management focuses on reducing use of existing water sources through
conservation and efficiency measures as opposed to expanding supply (Molle et al., 2004). In
2001/2002, provincial authorities initiated demand side management by targeting a 70,000-
hectare reduction in coffee plantation area by 2005. Two primary mechanisms were employed to achieve this objective. Provincial government banned the planting of new Robusta trees in 2002, ostensibly through enforcement of land use certificates and bank loan policies requiring stipulation of the crop planted (STAT Communications Ltd., 2002). Limited agricultural extension programs were also reportedly initiated to encourage farmers to shift out of coffee into other crops (Dak Lak Department of Agriculture and Rural Development (DARD), 2005). Cashew trees inter-cropped with cassava plants were recommended, as were cotton and corn as alternatives to coffee. There is limited evidence that some conversion has occurred, however no firm data are available on the areal uptake of these programs. Very low conversion levels have been observed in many areas of Dak Lak. Many farmers have retained their coffee trees in the hope that prices will eventually improve. Further, it is possible that farmers are using the current drought to remove coffee plants that have passed their period of maximum productivity, leaving this land fallow or cropping with lower value, lower risk annual crops until the existing water scarcity situation improves and coffee seedlings can be planted.

3.2 National water resource legislation, institutions and policy

3.2.1 Water resources legislation, institutions and policy pre-1998

In response to natural resource degradation concerns and pressure from international development agencies and governments, during the past two decades the national government of Viet Nam has enacted legislative and administrative laws4 protecting the status of key strategic natural resources including water. A re-structuring of resource management institutions and management devolution to the district and household levels has also occurred. General provisions for environmental protection were established with the 1993 National Law on Environmental Protection and laws governing strategic natural resources have been enacted under separate subsequent legislation.

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4 Legislative law is comprised of statutory law where the legislature passes laws that regulate water, and administrative law, where the legislature may enable administrative bodies to write rules and regulations that have the power of law.
Prior to legislative and structural reforms in the 1990's the focus of rural water resource management was on water supply to achieve national production objectives and to prevent natural disasters such as floods. Agricultural water supply was collectivised following reunification in 1975 with local management responsibilities given to state, provincial and district water control authorities. These supply schemes were largely inefficient and resulted in infrastructure deterioration (Fontenelle et al., 2002; Ministry of Agriculture and Rural Development (MARD), 2003). Growth in agricultural water demand following from the Doi Moi reforms could not be met through a centralised rotational water allocation system using degraded infrastructure, establishing the need for reform. This reform was commenced in the mid-1980s with drafting of the first Law on Water Resources. Although some practical water sector reforms took place prior to the 1990's, the majority of important water resource management reforms did not occur until the 1990's. Most notably, Decree 112/HDBT in 1984 partly devolved water control services to the district level through the creation of irrigation management enterprises (IME's). Concurrent enactment of irrigation water fee legislation required all organizations and individuals benefiting from irrigation and other hydraulic public services to pay a water use fee to their IME (Fontenelle, 2000).

In the 1990's more substantive devolution of water resource management occurred. In 1991, IMEs were consolidated as subsidiaries of semi-autonomous provincial irrigation and drainage management companies (IDMC) controlled by the Provincial People's Committees (PPC) (Small, 1996). Under this devolved rural water supply management structure, national ministries, primarily the Ministry for Agriculture and Rural Development (MARD), retained responsibility for planning, implementation and financing of major water infrastructure programs. At the provincial and district levels, the PPC assumed responsibility for the operation and maintenance of provincial irrigation schemes, minor infrastructure, sanitation and drainage services. The provincial sub-departments for water management under the PPCs were assigned responsibility for operation and maintenance of rural infrastructure, including the planning and design of new works under 150 hectares (Ministry of Agriculture and Rural Development (MARD), 2003). Through the IDMCs, PPCs also became responsible for negotiating, purchasing and contracting to
deliver water supplies from state-owned bulk water supply companies to irrigators. In addition to local water distribution, district level IMEs became responsible for managing irrigation headworks and the main and secondary canals within their boundaries. Communes assumed responsibility for water management at the tertiary level and below through ‘voluntary’ agricultural cooperatives and water management groups (Turral et al., 2001). These arrangements assigned ownership of the local IME to the people in that district and commune, and the IMEs were supposed to achieve financial self-sufficiency through collection of irrigation fees.

3.2.2 Water resources legislation, institutions and policy post-1998

The finalisation of the Law on Water Resources (LWR) in 1998 and its enactment through Decree 179/1999/ND-CP in 1999 formally marked a shift in focus from the mechanisms of water supply to integrated water resource and watershed management at the national government level. The LWR defines water exploitation and utilisation rights and establishes general conditions for the resource’s protection. Protection conditions include the development of forestry programs supporting watershed management, conservation projects and the restoration of depleted and degraded water sources. Water conservation and management is encouraged through economic and rational use of water resources in general and through specific obligations for different sectors of the economy, as defined in Articles 14-16 and 26-31. Further, Article 20 requires that water resource extraction is based on the “real” potential of the water source. Rational use is further encouraged by recognition of individual entitlement to the economic benefits of water exploitation, including scope to claim compensation for the loss of these benefits (Article 22). The LWR is therefore clear in establishing the legal basis for private water rights in Viet Nam. Devolution of responsibility for water resources is extended to all people by requiring the active participation of the state, provincial and other local authorities and individuals to implement the LWR (Article 4).

Article 20 of the LWR establishes a preferential right of use over water resources subject to assessments of availability. Priority is given to exploitation and utilisation of
water for domestic consumption. In cases of water shortage, the LWR requires priority allocation to domestic consumption. For other uses, regulation and distribution during shortage events is based on the percentage allocation defined in the planning of the river basin and the principle of ensuring ‘fairness’ and ‘reasonability’. Where water demand exceeds assessments of supply, sectors and localities are required to adjust the size of settlements and socio-economic planning in accordance with actual water capacity.

To support the implementation of the LWR a National Water Resources Council (NWRC) and the Agency of Water Resource Management (AWRM) within the newly created Ministry of Natural Resources and Environment (MONRE) were established in 2001 and 2002. Three River Basin Organizations were established in 2001 within the major river basins of Viet Nam and the process is now underway to establish a Sre Pok RBO incorporating Dak Lak by the end of 2005 (Petersen, 2004). The NWRC’s purpose is to advise the Vietnamese Government on important decisions on water resources, encompassing all activities dealing with national water strategies and policies, major river basin plans and inter-basin diversions, exploitation and disaster control projects and to oversee the resolution of conflicts regarding water resources between ministries and branches, ministries and provinces and cities directly under the central control (Lai, 2004; Socialist Republic of Vietnam, 2000).

Decree 91/2002/ND-CP assigns responsibility for “regulation, direction and supervision of the implementation of measures used for the protection of water resources” to MONRE (Socialist Republic of Vietnam, 2002). Water resources regulation, direction and supervision includes the development of national water policy strategy and activities to survey and licence water resource allocation, to conduct inventories of national water resources and to implement measures to protect water resources. Additionally, AWRM within MONRE is responsible for any revisions to the Law on Water Resources. The 2001 establishment of MONRE creates an important management division between water resource management and water service and supply functions within the national government, with both
functions previously being controlled by MARD (The World Bank, 2003).

The LWR establishes the legal foundation for water rights, allocation and protection in Viet Nam, but requires by-laws for enactment. Decree 179/1999/NC-CP enacted in 1999 provided articles for the implementation of the LWR including articles for granting permits for the exploration and exploitation of water resources. These by-laws were repealed and re-enacted through Government Decree 149/2004/ND-CP of July 2004 following the transfer of these responsibilities to MONRE. The 2004 Decree notably relaxes compliance requirements by increasing the volumetric thresholds for requiring a permit, but is otherwise the same as the 1999 Decree. Under Article 13 of the effected but yet to be implemented 2004 Decree, permits are now required for the exploration and exploitation of surface and underground water for:

- Exploiting, using water resources for important national projects already approved by the Prime Minister,
- Exploring and exploiting underground water for projects with the flow of 3,000 cubic meters per day and night or more,
- Works with a flow capacity of 3,000 cubic meters per day or more,
- Exploitation of surface water for agricultural production with a flow of two cubic meters per second or more,
- Exploitation and use of surface water for electricity generation with a capacity of 2,000 kilowatts or more
- Exploitation and use of surface water for other purposes with a flow capacity of 50,000 cubic meters per day and night or more,
- Discharge of wastewater into water sources with a flow of 5,000 cubic meters per day or more.
At the provincial level, permits are to be granted, altered and withdrawn by the PPCs with support from the AWRM at the national level and provincial Department of Natural Resources and Environment (DONRE). The permits for exploitation and use of surface water are valid for 20 years at most and may be extended for no more than 10 years. Permits for exploration of underground water are valid for three years at most and may be extended for no more than two years. The permits for exploitation and use of underground water are valid for 15 years at most and may be extended for no more than 10 years. The PPC, DONRE and AWRM are vested with the authority to extend, change the validity duration, adjust the contents or suspend the validity of, and withdraw the permits.

Currently, the fee charged for the exploration and exploitation permits is a nominal amount that is meant to cover government permit processing fees and does not reflect the economic value of the extracted water at all. MONRE is reportedly planning to increase the fee to reflect some of the asset’s option value, however it remains to be seen whether this initiative is followed through (Ministry of Natural Resources and Environment (MONRE), 2005). Planned compliance requirements for permit holding groundwater extractors have been drafted but not yet implemented (Andersen, 2003). These include requirements to install flow meters, piezometers for water level measurement, and to carry out water quality analysis. Additionally, permit holders will be required to submit annual reports on the amount of water exploited, the aquifer water level and water quality.

4 ANALYSIS OF NATIONAL LEGISLATION AND OTHER INITIATIVES

4.1 Land and water resource planning issues in Dak Lak

Water scarcity in Dak Lak has an institutional, managerial and economic basis (Molle et al., 2003a). Institutional scarcity results from the failure to manage imbalances between supply and demand to all use sectors including the environment. In Dak Lak, scarcity results from aerial and temporal imbalances between supply and demand combined with inadequate technological and institutional innovation to address the imbalance. Under-management of water storage and delivery infrastructure contributes towards scarcity through system losses, as does the economic infeasibility for small farmers to access
locally ‘available’ water, such as groundwater in confined or deep aquifers, in some cases. From the preceding sections of this paper several key issues can be identified that may prevent water reform in Dak Lak from occurring or limit its effectiveness to overcome institutional and managerial scarcity in particular.

4.1.1 Water resource planning and coordination

Water resource planning continues to be a largely uncoordinated process between a large number of agencies with highly vertical coordination and limited evidence of lateral intra- and inter-agency collaboration (Table 2). For example, the Sre Pok RBO is currently being established by MARD, which is consistent with MARD’s mandate under section 8.b of Decree 86/2003/ND-CP on the functions, tasks, authorities and organizational structure of MARD that requires it to “manage river basin, exploitation, usage and river integrated development per approved plans in a unified manner” (Socialist Republic of Vietnam, 2003). Under Section 6.c of 91/2002/ND-CP, however MONRE would also appear to have some claim to authority over these RBOs, as this arguably can be considered a regulatory and directional activity towards implementation of a measure used for the protection of water resources. To date, MONRE and MARD have not initiated an inter-ministry collaborative approach towards RBO management, with MONRE currently preparing its own independent decree on integrated river basin management (Lai, 2004) and MARD proceeding to enshrine responsibility for RBOs within MARD’s Department of Water Resources (DoWARE) via Decree 93/2003/QD-BNN (Su et al., 2003). Given the functional specialisation of the Departments, such a collaborative approach would appear to make intuitive sense.

4.1.2 Land and water planning

As recently as 2003, it was recognised that regional administration in Dak Lak lacked the capacity to administer free migrants, implement land planning and prevent the potential deforestation that occurs through new unplanned land settlement (Tinh, 2003). Although the national government expressly recognises the importance of land management
planning and settling new migrants in a planned way (Socialist Republic of Vietnam, 1996), the extent to which this objective can be practically achieved will be critical to the future of Dak Lak’s watershed health and the stability of the hydrologic system. Natural population growth will also create further demands for new agricultural land.

Land planning authorities have not assessed the regional hydrological and socio-economic impacts of shifting out of coffee into other crops, with such an assessment probably being the responsibility of the provincial Agricultural Extension Centre within Dak Lak’s Department of Agriculture and Rural Development (DARD) (D’haeze, 2005). As noted in Section 2.2 of this paper, based on FAO data, average irrigation water demands for cotton, cassava, maize and soybean equal or exceed coffee’s average annual requirement. Following FAO guidelines for optimal rainfall requirements for rainfed crops, it is evident that the lower bound and average rainfall requirements for black pepper and rubber are higher than Robusta coffee, despite these crops being more drought tolerant (Food and Agriculture Organization of the United Nations, 2005b). Further, both crops’ minimum rainfall requirements for optimal yield exceed the 1,308 mm to 1,857 mm of rainfall received in Dak Lak during an average rainfall year. Combined, these figures imply that higher total water demands for optimum agricultural yields are required. Given evidence that demand already may be exceeding supply capacity within Dak Lak, there is a need to assess the potential spatial and temporal impacts on water availability of different cropland allocations. There is also need to analyse the socio-economic impact of these allocations and to assess the production revenue and crop loss exposure that may result from drought conditions.

4.2 National water resource legislation issues

While the LWR and subsidiary Decrees establish the operating procedures for a common national system of provincial water exploration and exploitation, implementation of these policies can be expected to face substantial challenges in Dak Lak. Local

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5 Optimal annual rainfall (mm): Robusta coffee 1700-3000; black pepper 2500-4000; rubber 2000-4000; cashew 750-1600
administrative offices will implement the permit system, however these offices generally have limited capacity to manage, monitor and enforce such a complex scheme. History is instructive. Local authorities in Dak Lak have previously attempted to control water use with both permit and pricing approaches, but these attempts have failed to achieve their objectives (Ahmad, 2000). In Dak Lak prior to the 1999 and 2004 Decrees on groundwater permits, irrigators were required by provincial regulations to obtain a pumping permit for shallow wells producing more then 600 cubic meters per day\textsuperscript{6}. Provincial regulations were also established for groundwater exploration and use (DakLak Irrigation Sector Institutional Review Report, 2000, DANIDA in (Ahmad, 2000)). Neither of these local regulations have ever been implemented by local authorities.

4.2.1 The limiting potential of prohibitive compliance requirements

Introduction of a permit system that establishes compliance requirements in return for economic benefits from water can be anticipated to encounter substantial implementation problems, given the region’s history of limited success with attempts to implement these sorts of reform. Unless substantial investments are made in developing the capacity of Dak Lak’s administrative institutions these initiatives will probably be ineffective. While bilateral programs have been initiated in Dak Lak and other provinces to address these capacity issues, they are in their early stages and the extent to which they will achieve their ambitious objectives is unclear. Even if institutional capacity is rapidly developed, ongoing compliance costs may be substantial for both the compliers and enforcers of a permit system. Potential transaction costs resulting from compliance and monitoring activities for both pumpers and monitoring agencies discussed in section 3.2 appear prohibitive, requiring installation of flow meters and piezometer for water level measurement, regular water quality analysis and annual reporting on the volume of water exploited, water levels, and water quality. Monitoring of groundwater abstraction volumes by local government will also be more difficult then for surface water where allocation is generally more

\textsuperscript{6} Notably, this permitting requirement was far stricter then the new nationally decreed limits, which require permits for wells producing more then 1,000 cubic meters per day under the 1999 Decree by MARD and 3,000 cubic meters per day by MoNRE in 2004.
controlled and measurable within irrigation schemes. While increased monitoring may improve enforcement of permit requirements and provide information on non-permit pumping activities, these activities will also increase local government costs. Under these conditions, there is potential for non-enforcement or under-enforcement.

4.2.2 Potential limitations with ‘top down’ water management approaches

The devolution of control of local irrigation systems to Dak Lak PPC and district IMEs has failed to achieve significant improvements irrigation system infrastructure and delivery efficiency. This suggests these institutions may also be ineffective in assisting to implement broader water resource policy, unless capacity support is provided. Despite the IMEs theoretically being owned by the people, the communes ‘Peoples’ Committees, through the local agricultural office actually control many. These have had inconsistent success with irrigation management in Dak Lak. At the Commune level, the Peoples’ Committee is responsible for setting irrigation water prices for IMEs, however these fees do not reflect the economic value of the irrigation water. While central planning authorities recommend fees be based on the marginal cost of water delivery, local price setting is generally based on the crop planted and planted area (Ministry of Agriculture and Rural Development (MARD), 2003). This approach reflects untested assumptions about crop water consumption and is not directly targeted at encouraging water use efficiency.

Weakness in local water management institutions is also evidenced by the level of irrigation fee collection in Dak Lak’s communes which runs between 5 and 25 percent (Dupar et al., 2002). The absence of effective sanctions for non-payment encourages free riding by irrigation system members. Without fee income, local IMEs generally do not perform irrigation system maintenance work, nor can they recruit individuals and local organizations to work on them. As a result, in many areas of Dak Lak, individual irrigators reportedly perform irrigation system maintenance on their own plots and collectivise as groups of farmer households and commune irrigation groups to perform larger scale work independent of the IMEs (Ministry of Agriculture and Rural Development (MARD), 2003).
The result of this ad-hoc approach is the continued degradation of irrigation works.
<table>
<thead>
<tr>
<th>Ministry / Agencies</th>
<th>Responsibility</th>
<th>Department / Institution / Sub-agency</th>
<th>Staff at Central Level</th>
<th>Staff at Local Level Nationally</th>
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</thead>
<tbody>
<tr>
<td>Ministry of Natural Resources and Environment (MONRE)</td>
<td>Overall water resources protection and management</td>
<td>Department of Environment</td>
<td>12</td>
<td>1100* (including District officers)</td>
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<td></td>
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<td>Vietnam Environmental Protection Agency</td>
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<td>National Committee on Clean Water Supply &amp; Sanitation</td>
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<td>100*</td>
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<td>National Center of Meteorology and Hydrology</td>
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<td>2000*</td>
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<td></td>
<td>National Water Resources Council</td>
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</tr>
<tr>
<td></td>
<td></td>
<td>Agency of Geology and Minerals (mineral waters only)</td>
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<td>1000*</td>
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<td>852</td>
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<td></td>
<td>Office of Flood &amp; Storm Prevent**</td>
<td>80</td>
<td>1000</td>
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<td></td>
<td></td>
<td>Centre for Rural water supply and sanitation</td>
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<td>550*</td>
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<td></td>
<td></td>
<td>Forest protection Department (wetland related)</td>
<td>5</td>
<td>60*</td>
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<tr>
<td></td>
<td></td>
<td>Forest Development Department (upstream catchment afforestation)</td>
<td>5</td>
<td>60*</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Agriculture Extension Centre (AEC)(?)</td>
<td>-</td>
<td>-</td>
</tr>
<tr>
<td>Ministry of Fishery (MoF)</td>
<td>Protection and exploitation of aquatic resources</td>
<td>Department of aquatic resources protection</td>
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<td>980</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Department of fishing</td>
<td>17</td>
<td>56*** (in 25 provinces)</td>
</tr>
<tr>
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<td>Responsibility</td>
<td>Department / Institution / Sub-agency</td>
<td>Staff at Central Level</td>
<td>Staff at Local Level</td>
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<tr>
<td>Ministry of Industry (MoI)</td>
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<tr>
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<td>Department of Vietnam inland waterways transport</td>
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<td>Management of drinking water</td>
<td>Vietnam maritime department</td>
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<td>Planning and investment for the water investment sector</td>
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<td>-</td>
<td>-</td>
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<tr>
<td>Ministry of Finance</td>
<td>Development of policies for taxation and fees for water resources</td>
<td>-</td>
<td>-</td>
<td>-</td>
</tr>
</tbody>
</table>

Source: (The World Bank, 2003)

Notes: * Estimate; **Alliance organization; *** Only 25 provinces have fishery department; - Data not available
inefficiencies in water allocation and over-consumption.

The limitations of the ‘top down’ PPC controlled approach also creates a fundamental conflict between the objectives of the LWR and agricultural water management in Dak Lak. While the LWR recognises entitlement to water and the derived economic benefits and defines specific compliance requirements for the agricultural sector, the existing State controlled structure limits the ability of individual actors to realise these aims (Fontenelle, 2000). The question posed by Fontenelle (2000) therefore is whether the actual objective of water resource management devolution is to achieve more efficient and sustainable resource use or simply to transfer cost and responsibility to the local level without providing the possibility to properly manage the resource. In this sense, the difference between decentralisation in administration and decentralisation in decision-making needs to be recognised (Ahmad, 2000).

4.2.3 Experience with ‘bottom up’ approaches in Dak Lak and future challenges

‘Bottom up’ participatory governance approaches for poverty reduction and natural resource management have been encouraged in Viet Nam and Dak Lak, mainly by international development agencies (Burns, 1999; The Asian Development Bank, 2003, 2004; The World Bank, 2003). Such approaches reflect the principle of subsidiarity, which suggests decisions about water management should be made at the lowest appropriate level (Petersen, 2004). Although there has been some coordination among national authorities, the role of local communities for managing water resources has yet to be highlighted in Government policies (The World Bank, 2003). Within some communes in Dak Lak, Water Use Associations (WUA) based on participatory irrigation management (PIM) principles were established during the late 1990’s to overcome local limitations with the PPC led approach. Water User Associations in Viet Nam are recognised as legal economic entities under the Law on Cooperatives, which was thought would provide some legitimate power and control over irrigation system maintenance and development and water distribution (Dupar et al., 2002).

In Dak Lak, WAUs were credited by some to be viable management alternatives for irrigation schemes and were anecdotally reported as being more successful at collecting irrigation fees than their local government counterparts, thus improving chances at
achieving self-sufficient (Ahmad, 2000). Despite optimistic sentiments at the outset, all of these WUA’s have since failed in Dak Lak and reports of their early successes may more reflect political motivations, in the form of the current preference of international agencies and development banks for participatory resource governance, then actual demonstrated efficacy. The most frequently cited reason by former WUA members and Commune leadership for WUAs’ failure was that they attempted to wrest authority away from the Commune, and were consequently not recognised as an authority by the Commune. Lacking Commune support, farmers were unwilling to participate in the WUA program. Despite their failure, some form of localised participatory approach may still present an effective water management regime in Dak Lak, both within and beyond the irrigation system. Prior to their failure, some WUAs in Dak Lak had reportedly extended their scope of responsibility to include watershed management, working with local government agencies to achieve improved environmental states, although this never extended to managing groundwater (Dupar et al., 2002).

Developing local participatory water management institutions (PWMI) to manage water resources or enforce extraction regulations would be consistent with the LWR, which encourages increased stakeholder participation. There are several possible avenues for implementing a participatory approach using existing local institutions with some established legitimacy and direct links to commune leadership. These include approaches through the provincial Agriculture Extension Centre (AEC), which has Agriculture Extension Stations in each district and a network of commune extension officers. These officers are in some instances supported by Commune Agriculture Extension Clubs and volunteer extension farmers at the village level (Gallen, 2004). Local Women’s Union networks and Farmers’ Associations are also currently involved in participatory farm management programs in Dak Lak, focusing on improved land management and irrigation practices (D’haeze, 2005; Gallen, 2004).

Potential limitations of regional water management based on a PWMI approach should be considered in any future development. Among the dissenting voices of participatory
approaches to water management in Viet Nam, Plusquellec (2000) has suggested that ‘real’ participatory WUAs do not exist in the south of Viet Nam or that existing groups do not match the accepted definition. Instead, WUAs are run by cadres acting in the interests of the IME responsible for the management of the tertiary systems and not on behalf of scheme members. This is not a real participatory model. He suggests commune leadership as the appropriate farmer representative group, however this approach means the state still effectively controls the irrigation scheme and there is no guarantee that a truly participatory system will eventuate. Legislative ambiguity may also limit the potential for participatory approaches to managing local water resources. While the LWR encourages stakeholder participation, it has nothing prescriptive to say about the mechanisms for achieving this, nor does the 2004 Decree on permitting. Additionally, while WUAs are recognised legal entities, their scope of authority is not clearly defined by any legislation, making it difficult to institute a water resource management role outside the irrigation scheme and their relationship with local government (Dupar et al. 2002). Finally, the high levels of private pump ownership in Dak Lak may discourage farmers from collectivising groundwater management through PWMI. This could occur if self-sufficiency in capital has reduced farmers’ perceived need to make collective decisions over water allocation (Molle et al., 2003b; Rawal, 2002).

Localised politics will also play an important role in determining the effectiveness of any PWMI approach to water management in Viet Nam. Local non-government institutions are often viewed as challengers to local government legitimacy and here the potential for conflict is evident. This potential is elevated by the fact that any PWMI may put local government irrigation service staff out of jobs where management is transferred. Membership eligibility in PWMI may also create social unrest if the individual is required to hold either a land title or a water delivery contract as a membership basis. If membership exclusivity exists, user associations may be less effective than the government in controlling water resource degradation caused by shifting and unplanned agriculture by untitled settlers, uncontracted farmers and ethnic minorities. Potential for social conflict is worsened by evidence that WUAs have not historically cooperated to achieve equitable
water distribution in other areas of Viet Nam (Turral et al., 2001). Extending these same
risks to a basin scale, the strategic importance of water in Dak Lak may create a myopic
focus among WUAs on very local water resource security and watershed health, ignoring
the welfare impacts of their decisions on areas outside their administration. A more
fundamental issue with WUAs is that they have no experience with managing groundwater.
It is unclear whether these institutions would be capable or willing to manage these
resources, especially when these resources or the impacts of decisions over groundwater
resources fall outside the boundaries of the WUA’s irrigation command area.

4.2.4 Time-lagged legislative reforms vs. immediate water scarcity

Continued regional growth and the challenges associated with implementing the LWR
highlight the critical importance of time in the reform process. It has taken ten years to
draft and enact the LWR and six years to progress from the 1998 Law on Water Resources,
through the MARD enacted Decree 179/1999/NC-CP to the MONRE Decree 149/2004/ND-
CP establishing water permits at a national level. It is unclear how long it will take for
provincial by-laws to be passed to enact the Decree 149/2004/ND-CP in Dak Lak, as is the
time path for further national legislation. The legislative approach requires a long planning
horizon in Viet Nam as national legislation is, in general, interpreted extremely literally
and provincial authorities are hesitant to take initiative to establish supporting local
legislation (Turral et al., 2001). The risk presented is that the legislative process to enact the
LWR will become bogged down by lengthy national formulation of Decrees, which the
provincial administration will fail to implement due to their generality, thereby requiring
further rounds of by-law enactment. In an environment of increasing water depletion and
watershed degradation, a lengthy government based process will do little to arrest the very
immediate water resource concerns in Dak Lak.

4.2.5 Other issues

The proposed water reform approach contains several other important limitations
specific to Dak Lak that may endanger the realisation of its sustainability, efficiency and
fairness objectives. While the 2004 Decree allows for direct identification of high
volume water resource explorers and exploiters through registration and provides scope for reducing water entitlements in the case of water shortages or changed hydrological conditions (Article 8), it provides no direct mechanism for encouraging increased water consumption efficiency. Establishing prices for water that reflect the economic value of the good normally encourages water consumption efficiency when such rights can be defined and defended. Decree 149/2004/ND-CP includes no pricing provisions (other than the nominal fixed fee for permit processing) to achieve this objective. While MONRE is currently in the process of drafting a circular to legislate volumetric groundwater fees (Phuc, 2005), it is unclear when this legislation will be enacted and how it will be practically implemented. In the meantime, the potential for rent-seeking behaviour exists with anyone allowed to apply for an exploration and extraction permit at a nominal cost and subsequently charge for the supply of extracted water to third parties.

The majority of small-scale farmers in Dak Lak will also fall below the threshold requirements for permit issuance for groundwater extraction, with the result that these users will remain unregulated. Article 6 of Decree 149/2004/ND-CP provides exemption to small-scale exploiters (farmers, foresters, aquaculture operations, hydropower and other cottage industries) and households from requiring an extraction permit (Article 6.1.b). Small-scale water users cumulatively account for over 80 percent of all coffee plantations in Dak Lak, making a large, if not the largest, water user group exempt from this regulation. Persons receiving diverted surface water and groundwater pumped into diversion systems are covered by the Decree, but small-scale farmers with private pumps are not. The exemption therefore establishes a gap for water resource management in Dak Lak, given the high concentration of small-scale farmers in the region with private boreholes and pumps. These small-scale irrigators are also potentially the least efficient water consumers, substituting water for other price based production inputs such as fertiliser and employing poor irrigation practices. Failure to regulate small-scale groundwater use in Dak Lak through Decree 149/2004/ND-CP creates the potential for failed water resource conservation and management.
Decree 149/2004/ND-CP does require that groundwater extractors register with local authorities in areas where the total exploited water volume exceeds the total volume of average underground water flow in the dry season. While this article does provide some scope for small-scale groundwater regulation it also establishes complex information requirements in order to define water exploitation volumes and average underground flows, as well as defining the boundaries of an “area”. Problematically, information on total groundwater exploitation cannot be established without all water users in an area reporting their individual extractions, and if most of these users are small-scale and therefore exempt from reporting obligations, this information may not be established without comprehensive farm surveys. Additionally, to determine average underground flows, hydrology surveys must be completed, however the issue of how this work will be completed and by whom remains unresolved.

Article 20 of the LWR requires that regulation and distribution of water during shortage events is based on a percentage allocation defined “in the planning of the river basin and the principle of ensuring fairness and reasonableness” (Socialist Republic of Vietnam, 1998). Consistent with the LWR, planning allocations should be based on the principles of allocative efficiency, fairness and sustainability. To determine the ‘best’ allocation based on efficiency, fairness and sustainability criteria requires an understanding of the spatial and temporal benefit of water for different uses in Dak Lak. Furthermore, this understanding should extend beyond the benefits of water for productive, marketable uses to consider the value of water for non-marketed, but welfare impacting allocations such as household consumption and environmental service delivery. The LWR and existing Decrees are silent however on how these allocations should be determined, including the assessment and review process. They are also silent on the national government’s explicit meaning of the terms ‘fair’ (which may be different to ‘equitable’), ‘reasonable’ (which may be different from ‘rational’) and ‘sustainable’ (which can take on several hundred meanings – see (Pezzey, 1992)), which can be fundamentally conflicting objectives.

Finally, while a key underlying principle of the LWR is water and watershed health, the
existing legislation does not explicitly state how water should be allocated for ecosystem protection, focusing instead on how ecosystems (watersheds) can be employed to strengthen water resource management. This is a limitation that requires addressing. From a sustainability and efficiency perspective this analysis requires knowledge of the impacts of different hydrological regimes as determined by overlying land use on environmental states and the assessment of the economic value of the environment in these alternative states.

5 CONCLUSION

The objective of this paper has been to provide a comprehensive background to the issues, challenges and responses to water resource scarcity in Dak Lak, Viet Nam. Water scarcity is an issue of great importance in Dak Lak given that scarcity acts as a fundamental constraint on the productive capacity and sustainability of agriculture in the region. Dak Lak faces imminent challenges in managing its water resources, compounded by continued population growth and economic growth, which is expected to average 8.6 percent per annum between 2006 and 2010 (Dak Lak Peoples' Committee, 2001). With the legislative and administrative structures to address these issues still in their infancy, it remains to be seen whether the efficiency, fairness and sustainability objectives underlying the legislation will be achieved in Dak Lak, especially given issues raised in this paper. The participation of local extractors to defend local rights and obligations over groundwater will be fundamental to the success of these objectives.
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