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Mixed Land Use and Equity in Water Governance in Peri-Urban Bangkok

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Abstract

This article addresses a dearth in the literature on environmental equity in water governance in the desakota*, the extended metropolitan region of the great cities of Southeast Asia. Through a case study, the authors describe how, in an intensive mixed land use situation, the actions of new urban users of irrigation canals have degraded the water, unfairly prejudicing low-income farmers' entitlement to irrigation water of appropriate quality and harming their livelihood. It is argued that certain characteristics of existing land- and water-sector-related management institutions in Thailand encourage a disproportionate shift of the environmental burden to small farmers. This phenomenon also involves the violation of procedural equity — the farmers' right to be informed, to be able to assert a right to and negotiate for appropriate water, and to participate meaningfully in strategic decisions related to water governance in the peri-urban area. The problem is mediated by administrative separatism, ambiguity and multiplicity in the functional jurisdiction of water-related government bodies, and the general lack of a participatory culture in the bureaucracy. The authors further argue that, without state acknowledgement of this form of injustice, establishing appropriate mechanisms and public institutions that will purposively address concerns of environmental equity is a remote possibility, and that this inequity will likely continue to be patterned and inscribed in the peri-urban geography of the mega-cities of Southeast Asia.*

Introduction

Since the final decades of the twentieth century, a distinct form of urbanization has arisen in several countries of Southeast Asia (SEA). It has come to be popularly known as the *desakota* or extended metropolitan region (McGee, 1991; McGee and Greenberg, 1992). What has characterized these countries' urban landscapes is the rapid growth of mega regions around their national capital cities, encompassing nearby provinces. McGee (2003), revisiting the concept of *desakota*, later termed these areas 'peri-urban', as their one defining element is the juxtaposition of the larger city cores with heavily populated intensive agricultural regions.[1] This form has created a mixture of agricultural and non-agricultural activities and a marked heterogeneity of land use, putting in question the widely accepted notion of the spatial separation of rural and urban activities. In the early

1 Many scholars have attributed the development of this distinct urban form to the effects of globalizing forces such as foreign direct investment (FDI) operating in partnership with domestic capital in export-oriented manufacturing and residential, commercial and leisure projects in a context of highly liberalized and supportive national policies (Parnwell and Wongsuphsawat, 1997; Kelly, 1999; Firman, 2000; Goldblum and Wong, 2000; Marcotullio, 2003.

1990s, this characteristic prompted urban geographers and planners to ask important questions regarding its implications for resource use competition and environmental pollution (McGee, 1991; Greensberg, 1994; Linn, 1994). Since then, several authors have noted various forms of environmental degradation in the peri-urban areas of Southeast Asia, for example in the Jabotek metropolitan region in Indonesia (Firman, 1997), Bandung metropolitan region (Firman, 1996), Bangkok metropolitan region (Ross and Poungsomlee, 1995; Setchell, 1995; Arghiros and Wongserkiarttirat, 1996), and Manila's mega-urban region of CALABARZON (Kelly, 1998).

While the issue of environmental damage resulting from intensive mixed land use in peri-urban development has been touched upon incidentally in the aforementioned studies, putting the focus on *desakota* as a distinct urban regional form has logically limited in-depth investigations of *desakota's* ecological costs and the equity dimension of these costs at the local level. This handling of environmental issues is, of course, inadequate when put in the perspective of present-day dynamics and the complexity of problems in the fringe. McGee (2003) persuasively argues that in mega-urban regions city–hinterland relationships have become not only more spatially extended but also more intense at the local level. While probable trends in environmental burdens at the regional scale can be inferred logically and preliminary evidences found, their severity is never predetermined because local factors are extremely important and predominate. There is a need for locally grounded studies and policy responses to address environmental problems and associated equity issues at the peri-urban level (Tacoli, 1998: 153; McGranahan *et al.*, 2004).

One problem area in peri-urban SEA deserving closer examination is the conflict-laden situation arising from mixed land use and irrigation water use. Except for a couple of ground-level studies (see, for example, Kelly, 1999; Askew, 2002), this has up to now only been discussed in generalized terms (see, for example, Mekvichai 1990; Firman, 2000). Further, the distributive aspect of the water pollution burden arising from the juxtaposition of agricultural and non-agricultural activities and the heterogeneity of land use has not been dealt with centrally. A key issue that needs examination is: how are consequent pollution burdens distributed at the local level and under what conditions do they happen?

There are two important reasons why this question remains salient and urgent.

First, despite the general decline in the relative importance of the agricultural sector in the national economy, the presence of irrigation water and canals has remained a major support to farming in localities on the fringe of SEA urban metropolitan regions. In these regions, urban development has encroached into wide plains, irrigated by an intricate network of canals, which historically were planted with wet-rice. Over the last two decades or so, however, the remaining farmers have often shifted to fruit orchards in order to take advantage of the large premium market offered by the core urban center nearby (Kelly 1999; Firman, 2000; Askew, 2003). Mega urbanization in Southeast Asia entails the persistence of farming communities and the agricultural use of irrigation water at the fringe alongside spasmodic land conversion processes for urban uses.

Second, in many SEA mega-urban regions, localities on the fringe have become sites of contestation not only over land use, but also over irrigation water use *after* urban land development has encroached into agricultural fields. The rise in importance of non-agricultural users of traditional irrigation water is a major development in recent decades (see, for example, Flatters and Horbulyk, 1995; Molle, 2003). Industrial and domestic water use, of course, not only comprises withdrawals from irrigation sources, but also includes the use of irrigation systems for waste disposal.

This article addresses the current dearth of locally grounded studies regarding the socio-environmental dynamics in peri-urban areas and the need to understand the equity dimension of the water pollution burden resulting from intensive mixed land use characteristic of the peri-urban or *desakota* form in SEA. It presents a case study describing and examining the conditions and nature of the conflict and equity issue arising between industrial and residential water use on the one hand, and irrigation water

use of mostly low-income and poor farmers on the other hand, in mixed land use in the peri-urban area of Bangkok Metropolitan Region.

Water degradation and environmental equity in mixed land use areas

Cities are commonly notorious for polluting bodies of water. This is especially true for cities in low-income and middle-income developing countries that discharge contaminants from domestic and industrial sources. Domestic sources include storm-water runoff, septic systems, sanitary sewer overflows and combined sewer overflows, livestock and poultry waste, vehicle washing, and turf and garden fertilizer application. Industry discharges contaminate water streams with heavy metals such as cadmium, chromium, lead and hydrocarbons, which are commonly beyond the assimilative capacity (dilution) of streams (Wescoat and White, 2003: 186–217). Mapping pollution sources, however, is not simply a matter of drawing a dichotomous profile — with the municipal and industrial sectors as the water polluters, and farming communities as good water users and non-polluters. Indeed, the agriculture sector and farmers themselves also commonly discharge selenium, fertilizer and pesticide-contaminated water into bodies of water, damaging riparian, estuarine and coastal marine habitats (*ibid.*: 72).

However, the actual and potential adverse impacts of particular pollution sources and contaminants, particularly on the health and livelihood activities of specific local communities, depend not only on the volume and type of pollutants, but on a host of other factors such as scale, proximity to or distance from point-source return flows bearing contaminants, pollutant pathways, and the assimilative (dilution) capacity of receiving water bodies. These are important considerations in identifying the source and determining the actual and traumatic impact on given localities.

The extent of urban pollution of bodies of water in developing countries has become increasingly critical. To a large measure this is due to an extreme lack of minimum municipal facilities for the disposal of waste water. Estimates of untreated urban waste water dumped into nearby bodies of water stand at 87% and 90% of total liquid disposals (Sadeq, 1999; UNEP, 2003). Equally important is the lack of effective controls of point-source return flows from industries. As shown by experiences in many developed regions in the world, point-source pollution by industries is relatively easy to measure, regulate and physically control. This is not the case, however, in many developing countries where waste water is commonly not treated before discharge into water bodies. Incidentally, the most visible and traumatic environmental impacts of untreated waste discharge occur at such point-source outlets (Wescoat and White, 2003: 211).

Pollution from point-source discharges is a problem whose cause is not reducible to technological and economic resource deficits alone. Serious institutional constraints, such as bureaucratic and socio-political obstacles at the national and local levels that impede progress in pollution regulation and water resource development, are another major factor (Maitra and Krishan, 2000; Hardoy *et al.*, 2001; Varis, 2005).

In particular, water for agricultural use becomes degraded as rivers and irrigation canals are used as sinks for waste discharges (Lee, 2000; Hardoy *et al.*, 2001: 187; Heimlich and Anderson, 2001). Accounts abound of how farmers' crops or fish farming have been damaged by untreated industrial chemical pollutants nearby (e.g. Amarnanth and Krishnamoorthy, 2001; O'Rourke, 2002). Seriously degraded irrigation water reduces the quantity of appropriate water available for agriculture (Molle and Berkoff, 2005). This translates into a loss of food production and livelihood opportunities for affected farming communities.

In intensive mixed land use such as that found in SEA peri-urban areas, it is common for point-source discharges from industry and domestic sources to immediately and directly prejudice the farming livelihoods of local communities nearby. The severity and directness of the impact of this pollution on the farming and resources of nearby

communities contrasts with that of non-point contaminant discharges coming from agriculture — such as from fertilizers and pesticides — which are characteristically diffused and more distant.[2]

The socio-spatial and ecological characteristics of the peri-urban areas of SEA — where domestic and industrial pollution discharges degrade local irrigation water and cause harm or losses to agricultural livelihoods and resources in nearby local farming communities — are at the heart of the distributional equity issue in changes that bring environmental advantages and disadvantages. The situation in the peri-urban areas raises important questions of environmental justice or equity in relation to benefits and burdens: who gets what, where, and why? (Bullard, 1990; Dobson, 1998). This is because it involves the issue of environmental quality, which is inextricably linked to that of human equality and of environmental despoliation and degradation that, in turn, 'is always linked to questions of social justice, equity, rights and people's quality of life in its widest sense' (Agyeman *et al.*, 2003: 1).

At the core of the concept of environmental justice (also referred to as the equity dimensions of sustainable development[3]) is the question of fair treatment and meaningful involvement of all people, regardless of certain descriptive attributes (such as race, color, ethnic, gender or socio-economic grouping) in the development, implementation and enforcement of environmental laws, regulations and policies. Fair treatment means that no group of people should bear a disproportionate share of negative environmental consequences arising from development policies, programs and actions (Bullard, 1990).[4] On the other hand, meaningful involvement means 'greater public participation in evaluating and apportioning [environmental] goods and bads' (Shrader-Frechette, 2002: 4). Swyngedouw and Kaika (2003) argue, however, that the notion of a just socio-environmental perspective needs sensitivity to the political ecology of urbanization, considering the question of who gains and who pays, and asking serious questions about the multiple power relations through which these deeply unjust socio-environmental conditions have been produced and maintained.

The concept of environmental justice or environmental equity has been gaining wider relevance and expanding its agenda and concerns. While it originated in the US and was concerned originally with facility siting, an issue directly affecting colored minority communities, its scope has become global and now includes situations in developing countries and societies as well as international relations (Agyeman *et al.*, 2003). It has been applied to the normative framework of the sustainable city (Haughton and Hunter, 1994; Satterthwaite, 1997; Haughton, 1999) and to urban planning (Campbell, 1996). It has also been stressed as a fundamental normative framework in discussions of conflicts between city and agriculture in water use (Molle and Berkoff, 2005).

Two particular principles of environmental justice are of especial relevance to our examination of the tension between M&I (municipal and industrial) use of water and agriculture. These are (a) the intra-generational or contemporary social equity principle

2 Generally, non-point-source return flows carrying pollutants — common types of agricultural pollution — can return to wetlands, lakes and streams through diffuse surface runoff. Non-point-source return flows can also seep into the soil, enter aquifers and eventually return to a surface water body or the ocean at a great distance from the actual sources. Thus, detection and treatment problems become even more difficult and pose a greater scientific challenge as compared with those associated with point-source domestic and industrial pollution (Wescoat and White, 2003: 211–12).

3 Environmental justice or equity in sustainable development can be regarded as a thematic area within the broader field of development ethics, which is defined as 'the normative or ethical assessment of the ends and means of Third World and global development' (Crocker, 1991: 457) . On the emerging field of development ethics, see also Gasper (2004) and Sen (1999).

4 In the US, the concept of fair treatment has been further officially elaborated by the EPA's Office of Environmental Justice to mean 'no disproportionate share of the negative environmental consequences resulting from industrial, municipal, and commercial operations or the execution of federal, state, local, and tribal programs and polices' (Liu, 2001: 15).

(often referred to also as social justice), and (b) the procedural equity principle (Haughton, 1999).[5] The first relates to the freedom of any social sector from discrimination and bias and recognition of this as a foundational principle in public policy on water use. Applied to the farmers' case, this principle includes their protection from toxic and hazardous waste generated by M&I operations that threaten their fundamental right to clean and appropriate water, including the right to full compensation and reparations for damages incurred.[6] This principle has found resonance in the *integrated* approach to water resource management (or IWRM) which has come to be the official international discourse in the water sector development since the 1990s (Biswas, 1991; 2004; Braga, 2001).

On the other hand, the principle of procedural equity refers to regulatory and participatory systems that should be devised and applied to ensure that all people are treated openly and fairly. Operationalizing this principle requires equal access to information and upholding citizens' rights to participate as equal partners in decision-making processes relevant to the distribution of environmental burdens and resource use, including needs assessment, planning, implementation, enforcement and evaluation (see Haughton, 1999; Doyle and McEachern, 2001: 70). This particular principle of environmental justice has been incorporated in integrated water management through the elements of multiple stakeholder consensus building and public participation (Hooper *et al.*, 1999; Margerum, 1999.) Participation has indeed become one fundamental ethical dimension of water management (Priscoli, 2004).

It is through the lens of the two above-mentioned equity principles of environmental justice that we will assess the conditions and dynamics of the conflict between intensive mixed land use and the use of irrigation water by farmers in the peri-urban area of Rangsit Field in the Bangkok Metropolitan Region. In what follows, we will first discuss the degradation of irrigation water in the Bangkok peri-urban area and the burden borne by local farmers and agriculture, tracing the genesis of this problem to land conversion and intensive mixed land use in the last three decades. We will discuss next the absence of a social equity focus in existing land and water management institutions in Thailand. We then describe how procedural equity has been negated by administrative separatism, top-downism, and a lack of participatory culture in state institutions and practices related to water governance at the local level. In the conclusion we discuss the complexities and the major challenge to equitable water governance and urban land development created by the *desakota* form in SEA.

5 Haughton (1999) identifies five central equity principles for sustainable development: (1) intergenerational equity or the principle of futurity; (2) intragenerational equity or the principle of social equity or social justice; (3) geographical equity or trans-frontier responsibility; (4) procedural equity; and (5) interspecies equity.

6 This particular equity principle upholds the primacy of one general criterion of equality, which is equality with respect to the recognition of human dignity and human entitlements (Gasper, 2004: 108; see also Sen, 1985a; 1985b; 1999). Any assessment of equity, of course, would confront the problem of having different criteria (e.g. utilitarianism, Pareto criterion, economic cost-benefit analysis, etc.). The issue of equality can also be assessed or proposed at input level, at activities level and at impact level. (For a discussion of various strands and criteria related to equity in development, see Gasper, 2004). By logic, the particular human entitlement-based equity criterion used here is oppositional to the notion that, to be valid and significant, a charge of environmental injustice or inequity has to be weighed against the polluting behavior of poor communities or grassroots people, a notion based on a differential, contributive justice criterion. Based on the aforementioned criterion, the presumed fact that low-income and poor farming communities also discharge forms of pollution eventually affecting aquifers and surface water bodies does not illegitimize their claim to environmental justice nor invalidate their equity issue in relation to industrial polluters damaging their basic livelihoods. This claim can be anchored on an entitlement-based equity criterion. (For a discussion of main arguments against or strands of denial of environmental injustice charges, see Shrader-Frechette, 2002).

Methods and data collection

This research primarily used qualitative techniques of data gathering — a records review, field observation, and individual key informant interviews — and combined these to validate and triangulate data and information. Land use data in Rangsit Field were collected from the records of the National Statistics Office, the Department of Town and Country Planning and the Department of Agriculture. This was combined with on-site observations of land use in the study area. Record reviews were also conducted with the Offices of the Royal Irrigation Department and the Office of Environmental Policy and Planning with respect to relevant data on irrigation water use and pollution. Specifically, water contamination data in the study area were triangulated with, and augmented by, field data on an ongoing water research project in another field of study at the Asian Institute of Technology.[7] The authors also conducted field observational boat trips along the main canals in the area on different days of the week. Furthermore, we conducted qualitative in-depth interviews with 34 key local informants regarding water use, conflicts and pollution and effects. Our informants comprised mostly tenant and lessee farmers (20), elder citizens of the two municipalities (5), village headmen (4) and informal settlers (5) along the canal.

Information on the relevant administrative structure and government offices' mandate and functions and official policy discourses was gathered through document research at the National Economics and Social Development Board and concerned government agencies. Information on implementation practices was gathered by individual qualitative interviews with provincial- and municipal-level officials and field outreach personnel from the provincial agencies of the departments of environment, industrial works, agriculture and the Rangsit Branch of the Royal Irrigation Department and the local governments. A total of 18 qualitative interviews with this particular set of informants were conducted. Primary field data gathering was done from January to July 2003. Subsequently, two more follow-up field data gathering exercises were carried out in 2005 and another one in December 2006. Secondary data research, which started in 2003, was continued on various occasions in years 2004 through 2006.

Land use in Rangsit Field

One of the places in Bangkok's periphery where dramatic urbanization has occurred is Rangsit Field, an area within Bangkok Metropolitan Region[8] which is composed of four districts on the eastern side of the lower delta of the Chaophraya River in Pathumthani province and part of Nakorn Nayok province (see Figure 1). (Rangsit Field in the following study will refer only to the four districts of Khlong Luang, Thunyaburi, Lum Lukka, and Nong Sua, which are all located in the province of Pathumthani.) This place has historically played an important role in the rice export production of Thailand ever since the construction of the Rangsit-Prayurasak Canal in 1900.[9] Like other canal

7 See Footnote 16.

8 The Bangkok Metropolitan Region (BMR) is a 7,758 sq. km area in central Thailand, located adjacent to the Gulf of Thailand. It includes Bangkok and its five surrounding provinces: Nonthaburi, Pathumthani, Samut Prakan, Samut Sakhon and Nakhon Pathom. It has a population of 7.1 million (1995), which is expected to grow to 10 million by the year 2015 (United Nations, 1999). Approximately 55% of the national urban population of Thailand lives in the BMR, which also accounts for 50% of the country's GDP and about 80% of its manufacturing output (Setchell, 1995; see also Parnwell and Aghiros, 1996). The urban portion of the BMR, roughly an area of 1,600 square kilometers has grown by more than three-fold since 1974. Although the prime region of Thailand, BMR is not an administrative territory under the jurisdiction of one regional authority; it falls under the administration of various provincial and municipal governments, and national and local line agencies.

9 The Rangsit Canal project was undertaken by a private company that was granted a concession by King Rama V. Altogether 43 canals were dug; the main one, the Rangsit Canal, is 16 meters wide,

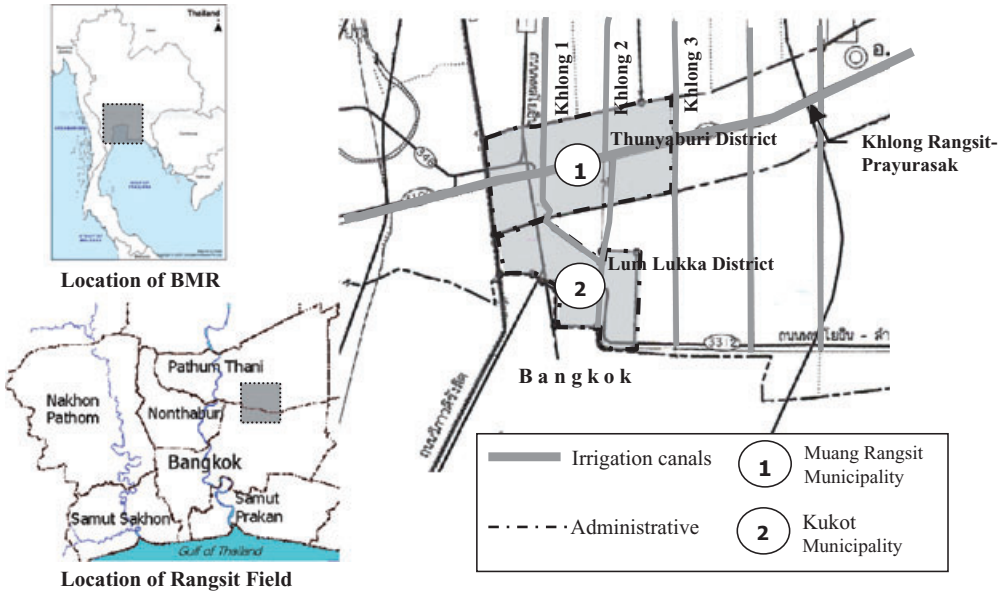

Figure 1 Map of the case study area (sources: 1, Department of Town and Country Planning [Provincial Office], 2002; 2, http://www.thaiappraisal.org [accessed March 2006]).

projects in the lower delta during this period, the project intensified mono-culture rice farming in the area, bringing about 3,200 sq. km of land under paddy production (Orapan and Warin, 2000).

Rangsit Field today largely overlaps with Pathumthani Province, one of the most dynamic peripheral provinces of BMR, which is around 30 km north of Bangkok. (Ten out of the 13 total municipalities of Pathumthani are located in the Rangsit Field.) The province had a total registered population of 625,901 and a registered household population of 273,113 in 2000. It is administered by three levels of local government: one provincial administrative organization, 13 municipal governments, and 52 tambon administrative organizations (TAOs). In addition, various national departments provide facilities and services and line supervisions in the province. Altogether there are 55 agencies of the central government operating in the province.

The farmers of Pathumthani generally belong to low-income groups in the mega-urban region of Bangkok. They too have become spatially diffused and unorganized, and thus do not have a significant voice in claim-making and government lobbying activities, a situation much unlike, for instance, that of the export-oriented big farmers in the shrimp industry sector of Thailand. Compared with landowners and developers, these farmers are politically disadvantaged in terms of influence and connections with powerful politicians. The province has been reported to have the highest concentration of tenancy farming in Thailand (Srisawalak-Nabangchang and Wonghonchao, 2000). Based on the data from the Provincial Agricultural Office in 2000, Pathumthani has a total area of 953,660 *rai* or 1525.9 sq. km. Of this 66.82% or 637,303 *rai* is classified as agricultural land, agriculture being the major type of land use in the province. The farming sector of the province is composed predominantly of non-landowning, low-income farmers who make up 68% of the total (lessee and tenant farmers, 46%; non-owning, non-rent-paying

while the secondary and tertiary canals are 12 meters and 6–10 meters in width, respectively (Orapan and Warin, 2000; Cheyroux, 2003; Kaida, 2003).

users, 22%). While 32% are classified as small owner cultivators (Pathumthani Provincial Agricultural Office, 2000).

Up to 1970 Rangsit Field was about 80 to 90% paddy, and its population was largely composed of farmers engaged in mono-culture rice cropping. Dramatic changes in land use and farming activity began in the mid-1980s, characterized by two major trends (Rachaniwan *et al.*, 2000). First, there was a dramatic increase in the proportion of the land area devoted to non-agricultural use, and a leap in the built-up density in the four districts of Rangsit Field. This shift to urban land use was strongly influenced by developments in the transport and road system, and an associated rise in land prices in the area which, based on median price increases in selected locations in the four districts of Rangsit Field, typically rose by 98% between the 1991–1995 and 1996–2000 periods (Department of Land Development, 1995; 2000). Second, farm lands were also transformed from paddy fields to orange tree plantations, and orchard and vegetable farms. From the 1980s onwards, paddy area density was in sharp decline in all of the four districts while fruit-tree plantation densities rose sharply in the first half of the 1980s and basically stayed at this new level during the 1990s.[10] This strategic shift in farming, which took advantage of local farmers' proximity to the large market of Bangkok's urban portion, fits the behavior of other Thai farmers investigated by a number of studies in Bangkok's other peri-urban municipalities (see, for example, Askew, 2002; Cheyroux, 2003; Srijantr, 2003).

On average, built-up area density rose from 10% in 1985 to 35% in the four districts of Rangsit Field in 2000 (Orapan and Warin, 2000). The number of factory establishments increased, from 104 in 1989 to 1,786 in 2000, a 17-fold increase in 10 years (Pathumthani Provincial Industrial Office, 2000). Housing projects also mushroomed. A survey by the Department of Land Development in 1994 noted that there were already 114 housing projects in the three districts of Thunyaburi, Khlong Luang and Lum Lukka, with the bulk concentrated around the major highway and canal. Booming housing projects also spurred construction of commercial complexes, supermarkets and department stores. Presently, there are nine department stores in Rangsit Field, five of which are concentrated in Thunyaburi alone (Pathumthani Chamber of Commerce, 2000). Hence, the aggregate proportion of agricultural land in its four districts diminished from 75% to 69% and 61% in the years 1980, 1990 and 2000, respectively. On the other hand, figures from the Department of Land Development and the Provincial Agricultural Office show that the total proportion of land devoted to non-agricultural use gradually increased from 25% to 31% and 39% respectively in the same years. According to the Provincial Agricultural Office's data in 2002, out of a total land area of 1,237 sq. km, 50% (or 564 km^2) of present-day Rangsit Field is classified as agricultural land (Pathumthani Provincial Agricultural Office, 2002). The other half is used for residential, industrial, commercial, recreational and educational purposes.

Farm lands for urban use, waste water for farmers' use: a micro case

Nowadays it is not uncommon to find in Rangsit Field at least two, if not more, different land uses (commonly, farming and industrial and/or residential use) co-existing side by side within one small contiguous area. It is also not uncommon to find two different uses

10 Paddy area density in Khlong Luang fell from 80% in 1980 to 45% in 2000; in Nong Sua, from 85% to 42%; for Thunyaburi, from 80% to 50%; and for Lum Lukka, from 85% to 60% during the same years. On the other hand, fruit-tree plantation density in Khlong Luang rose from 3% to 7% from 1980 to 2000; in Nong Sua, from 5% to 32%; in Thunyaburi, from 7% to 22%; and in Lum Lukka, 2% to 5% during the same years. From 1990 to 2000 the percentage change in fruit-tree plantation density had a range just of 0% to 5% increase in the four districts (Pathumthani Provincial Agricultural Office, 1980; 1990; 2000).

of the same canal system — as water source for farming and as a discharge point for waste water.[11] Multiple intersections of competing uses of land and water merely reflect two major transformations that have happened in this peri-urban area: from a mono-culture paddy rice farming area into an area of intensive mixed land use; and from a mono-purpose to a multi-purpose water canal system. In the following, we will present a micro section of the Rangsit Canal where such dynamics in intensive mixed land use and canal utilization have been inscribed in local space and become part of the local people's everyday experience.

In the mid-south section of Rangsit Field lies an area where two municipalities belonging to two different districts lie adjacent to each other along the north-south axis: the Muang Rangsit Municipality, which belongs to Thunyaburi district, and the Kukot Municipality, which belongs to the Lum Lukka district, the southernmost district in Rangsit Field. Thunyaburi district hosts the main canal of Rangsit Field, the Khlong Rangsit-Prayurasak, which runs horizontally on the map forming a middle line running east to west across Muang Rangsit Municipality. Several parallel secondary canals branch off on both the north and south sides of this canal. Two of these (Khlong 1 and Khlong 2) extend southward to cover the adjacent municipality of Kukot in Lum Lukka district (see Figure 1).

Muang Rangsit Municipality covers an area of 20.80 sq. km. Like the other parts of the province of Pathumthani, land here was utilized mainly for paddy farming until the transformation of land to commercial and residential projects and the shifting of the remaining farmland from paddies to fruit orchards and fish ponds. Today, land near the intersection of the major highways in the municipality is mostly for commercial use, with concentrations of shop-houses and the location of a number of major commercial service centers. On the other hand, the major road *Rangsit-Nakorn Nayok*, which runs parallel to *Khlong Rangsit-Prayurasak* (the main canal), has given rise to many housing development projects catering to middle- and high-income groups, whose members commonly work in white collar jobs in the inner core city of Bangkok. Paddy cultivation and orchard farming remain very significant in Muang Rangsit Municipality as the total agricultural area of 52.4% of Thunyaburi District suggests.

Kukot Municipality, on the other hand, has an area of only 12.47 sq. km. But it has the highest population density in the province of Pathumthani. Being closer to and directly adjoining Bangkok, the municipality has been the receptacle in the north of the BMR's industrial expansion since the mid-1980s. Today, it has a total of 61 factories, mostly small- and medium-size factories engaged in varied types of production: furniture, food processing, plastic electronic equipment, dairy products, textiles and ironwork. It has also 18 housing subdivisions. All are located right beside or close to the canals. There is also a private industrial estate in the municipality, between the highway and one of the canals (Khlong 1), hosting mainly electronics factories.

Prior to intensive mixed land use, the dense canal network of the Rangsit Irrigation Project in Muang Rangsit and Kukot municipalities mainly functioned to distribute water to paddy fields (more or less) evenly and regularly during the wet and dry seasons. Competition in water then was over quantity and distribution. Today, however, water conflict is not only over quantity allocation, but also over quality. While the remaining farmers in both municipalities still use the canals to water their fruit orchards, the new users, factories and households in middle- and upper-income residential subdivision projects, utilize the same canals as sinks of waste water, creating levels of pollution that are incompatible with agricultural use. This is not to claim, however, that these farmers contribute nothing at all that can possibly lead to the eventual degradation of irrigation water canals. They are responsible for agricultural contaminants. But, as discussed

11 Residential, commercial and industrial consumers of water in the core and periphery of Bangkok use pipe water or water pumped from underground aquifers. The former is supplied by diverted water from the upstream part of Chaopraya River. Irrigation water canals are utilized by these non-agricultural users mainly as drainage ponds.

earlier, such pollution consists of non-point-source discharges whose adverse impact on water quality generally is diffused, and whose location is distant and indeterminate compared to that of point-source discharges from domestic and industrial sources purposely using the local irrigation canals as sinks.[12]

Conflict between different sets of users over the maintenance of appropriate water quality in the canal is most evident in the border area between the two municipalities. Kukot, as earlier mentioned, is a concentration of many factories and high-end residential projects located along the canals. Direct waste water discharges to the two secondary canals in the municipality have spread pollution up to the main canal (Rangsit-Prayurasak) and to the other three secondary canals in Muang Rangsit. According to the local irrigation authority,[13] pollution caused by untreated liquid wastes from factories and residential subdivisions easily spreads to other secondary canals, including the main canal, since water is deliberately controlled to flow to and from the bigger canals and smaller laterals at various times to respond to demands for irrigating spatially dispersed fields. Furthermore, during the dry season, water in the canals is still, making it difficult for liquid waste concentrations to be diluted or washed away. Industrial liquid wastes easily combine with the domestic waste water discharges coming mainly from the new middle- and high-income housing subdivisions concentrated in Muang Rangsit Municipality.

Water quality in the aforementioned canals has degraded to a level basically inappropriate for agricultural use. Latest water quality indices (2006) measured from several points in the study area yield values of 1.3 for dissolved oxygen (DO) and 10.6 for biological oxygen demand (BOD). These measures are far below the standard water quality suited for agriculture.[14] The water has been in this degraded state there at least since 1996, based on the earliest monitoring data of local agencies (see Table 1). Water samples regularly taken from selected points along the Rangsit-Prayurasak Canal and Khlongs 1-3 in the case study area during a 7-year period (1996 to 2002) mostly had values that were inappropriate for agricultural use (in italics) and instead fit only for industrial activity (Class 4) or for transportation purposes (Class 5). Heavy metal indicators (Mn, Pb, Cd) also reveal a consistent and strong pattern of untreated industrial effluent discharges into these canals during the period.

The increase in the number of middle- and upper-income residential subdivisions, and the general rise of household density and factories along the Khlong Rangsit-Prayurasak (the main canal) have contributed directly to the irrigation water degradation. As in most towns in Thailand, M&I wastewater in the case study area is generally discharged without proper treatment into canal waters or other water bodies. Although factories and real estate projects are required by law to install treatment facilities before they operate, installed systems often have insufficient capacity and become ineffective after a period of

12 See footnote 2. This point would apply to cadmium (Cd) a heavy metal contaminant that is discharged directly by certain industries (such as battery recharging or manufacturing plants) in Rangsit Field irrigation canals, but which can also be traced or related to the use of phosphatic fertilizers and rock phosphate. In acid sulphate soils such as those in Pathumathani province, which have nutrient phosphorus deficiency, this is often recommended and indeed used by farmers for enhancing their soils for better crop/fruit production. However, this particular farming practice's contribution to the accumulation of Cd contaminants in local irrigation water requires long-term application to render the cadmium soluble and enable it to possibly find its pathway to the canals. Moreover, its critical impact point/s, scale and sources are also indeterminate. (The authors wish to acknowledge their indebtedness to Dr Preeda Parkpian, a soil-crop toxicologist faculty member of AIT, for this technical point.)

13 Interview with Chief of Water Supply Division, South Rangsit Irrigation Office, Royal Irrigation Department (RID) (February 2003).

14 We are grateful to Dr Oleg Shipin and his research associate, Ms Buyan Chulun, of the School of Environment, Resources, and Development, AIT, for allowing us to use their latest 2006 water quality monitoring data in our case study area, which happened to be within the scope of their research project on the occurrence of water-borne pathogens in wastewater and surface water.

Table 1 Water quality in the canals in the study area, 1996–2002

Water quality index*	unit	Surface Water Quality Std. (Class 3*)	Year			
			1996	1998	2000	2002
Dissolved Oxygen	mg/L	>4.0	*0.2–4.7*	*1.1–1.8*	*0.1–3.3*	*1.1–2.0*
Biological Oxygen Demand	mg/L	<2.0	0.9–*4.5*	1.8–*4.0*	1.0–*4.0*	*4.0–6.0*
Heavy Metal — Mn	mg/L	<1.0	0.5	0.1–0.2	*1.25*	N.A.
Heavy Metal — Pb	mg/L	<0.05	*3.3*	*2.0*	*1.5*	N.A.
Heavy Metal — Cd	mg/L	<0.005	*0.7*	*3.7*	*7.3*	N.A.

*According to the official Water Quality Standard of Thailand (PCD, 1995), surface water is categorized into five classes: from Class 1, which is best quality water, suitable for ecological conservation and immediately potable, to Class 5 which can be used only for transportation purposes. Class 3, the standard used for this study, is officially considered as a quality category safe for agricultural use.
Source: Environmental Research and Training Center, Department of the Environmental Quality Promotion (DEQP, 1996; 1997; 1998; 1999; 2000; 2001; 2002)

neglect and lack of maintenance.[15] There is also no centralized water treatment plant which services this particular area.

In-depth interviews with low-income farmers whose orchards are located along the Khlong Rangsit-Prayurasak between Khlongs 1 and 2, strongly articulate the insecurity of their livelihoods and the perceived damage to crop cultivation from industrial pollution in the irrigation canals. Low-income farmers' own accounts generally fit well with the characteristics of water degradation based on chemical contaminant parameters earlier presented. More importantly these accounts or testimonies provide a prima facie case of environmental injustice.[16] In one case, a small owner-operator mango grower clearly expressed difficulties and insecurity arising from the deterioration of water quality in Khlong Rangsit-Prayurasak, the main canal, from which he pumps water to his own reserved pond that in turn supplies the water pipe system used for his orchard. He has often found the water in his pond to be unsuitable for his trees. He then has to wait therefore for several days until the color of the water in the main canal improves. He is also worried that waste water discharge from a factory adjacent to his field has been leaking into his farm and will damage his fruit trees in the long run. In another case, a lessee-farmer banana grower, whose family has farmed in the place for the last 30 years, has also been pumping water direct from the main canal to use in his orchard. According to him, when the irrigation gates are closed — a necessary response to water allocation demands — water quality in the canal commonly gets worse since the factories and housing projects nearby continue

15 According to key informants in South Rangsit Irrigation Office, it is not uncommon that after factories and residential projects have been granted permits to operate, owners deliberately cease to operate their equipment or neglect to maintain it so that it simply conks out. A check by one of the authors in Kukot municipality's records shows that only 6 out of the total of 61 factories and 18 housing projects have undergone the required bi-annual regular inspection procedure of their waste water equipment.

16 This conforms with the principle of prima facie political equality (PPFPE) which, as scholars have argued, is a necessary and fundamental element to improve principles and operations of environmental justice and equity, particularly distributive and participative components. The PPFPE presumes 'that equality is defensible and only different or unequal treatment requires justification, and that the discriminator bears the burden of proof'. This puts the burden of proof, therefore, on the possible discriminating party instead. In addition, the PPFPE principle enhances participative justice by giving equal weight to stakeholders and expert deliberation in environment-related decision making and evaluation. It 'guarantees citizens and environmental stakeholders both equal decision-making voice with experts and the same rights to consent, due process and compensation that medical patients have' (Shrader-Frechette, 2002: 27–29).

to discharge their waste into the stilled water. In an incident that happened two years ago, the water became so polluted that it emitted a bad smell and his own and other neighboring farmers' plants died. Farmers interviewed in the area believe that they are still able to maintain their level of crop productivity despite deterioration of water quality only by intensifying fertilizer use to compensate for the ill-effects of polluted water.

According to farmers in Muang Rangsit Municipality, while it is true that water pollution from agricultural and domestic sources was already occurring in the canals before the 1980s, the low density of settlements and the absence of factories and commercial and residential complexes then allowed the *khlongs* to easily dissolve or wash away low-level pollution discharges.[17] Higher volumes and new types of waste discharges taking place today in the context of the dramatic increase of non-agricultural polluters of the canals have overwhelmed the absorptive capacity of these canals.

Land and water management institutions and social equity

The legitimate interest of the existing agriculture sector did not in any way constrain, nor figure as a major concern in, the haphazard and rapid urban expansion that occurred in the Bangkok periphery in the 1980s and the 1990s. This particular form of urban expansion is the spatial expression of the Thai economic boom from 1986 to 1996. As noted by several scholars, this boom occurred in the context of the transformation of the Thai economy from an agriculture-based to an export-oriented manufacturing and service economy. The rise in foreign direct investment and ballooning exports played a major role, expanding and diversifying the market in Bangkok and other urban centers into real estate, construction, and wholesale and retail trade. In particular, the real estate sector became one of the hottest investment areas and eventually reached over-capacity (see, for example, Hewison, 2001; Jansen, 2001; Phongpaichit and Baker, 2002). This globally linked investment trend translated into massive land conversions in peri-urban Bangkok and consequent water degradation.

The protection of irrigation water and small farmers' livelihoods should have been a major socio-environmental concern of institutions for integrated and equitable land planning and management covering the peri-urban area. But, in the absence of an effective planning mechanism, this issue does not have a regular and established forum in which it can be articulated as a legitimate public interest agenda. Historically, Bangkok and its periphery's land development proceeded largely outside the influence or regulation of an existing plan and planning system. Bangkok had neither an official city plan in operation until 1992 nor, subsequently, any effective control of land use (Setchell, 1995; Krongkaew, 1996; Plumb, 1999).

Further, the actual development trajectory of Bangkok's extended metropolitan region in the last two decades has been dominated by the interests of international capital and national and local business elites, with the state largely relegated to the role of facilitator rather than a leader in promoting general public welfare, and a regulator of socio-environmental inequities stemming from the narrow pursuits of particularistic private interests. Thus, factories have spontaneously spread farther from the central city into the periphery where regulatory framework and mechanisms are weaker (Parnwell and Wongsuphaswat, 1997). Official efforts to relocate highly-polluting factories into the BMR's roughly 25 industrial estates, where infrastructure is marginally better, have proven to be both very costly and poorly organized (Setchell, 1995).

On the other hand, for its part the real estate development industry sector has continued to regard land planning as a negative and undesirable constraint on its

17 A case in point is the use of *paraquat*, the most popular chemical herbicide used by farmers in Rangsit Field. A recent field impact study of this chemical pollutant in the same area confirms an insignificant effect on irrigation canal degradation, since the hydraulic regime of extensive irrigation canals in the area (as well as the remaining rice paddies) effectively act as natural treatment systems mitigating the impacts of agricultural runoff (Pradidwongkool, 2004).

activities. This resistance converges with a number of powerful developers' vested interests in a way that seriously undermines professionalism in land development planning and management and the continuity of sound policies and programs (Ruland and Ladvalva, 1996; Plumb, 1999). In the absence of the state's regulatory role and effective applications of land planning tools, environmental, livelihood and appropriate water concerns of farmers in peri-urban localities have been conveniently set aside, and, in effect, prejudiced in land conversion or urban development projects.

In Thailand, the institutional framework necessary for integrated water sector development is also basically undeveloped. The traditional and obsolete single-purpose (irrigation only) water governance regime has remained in place, especially for the peri-urban area. By tradition, the issue of water quality has not been a major policy and governance concern in the sector. This situation persists, despite the current reality in localities in the Bangkok peri-urban area that irrigation systems are no longer solely used by farmers and for farming, and despite the fact that the water quality issue is increasingly coming to the fore as an issue as important as water quantity and allocation itself. Lack of an integrated focus in the water sector — one that includes the protection of water quality and multi-sectoral uses — renders invisible the fact that agriculture and small farmers have a major and legitimate stake in today's policy arena of water for agriculture.

What has been happening at the local level in administering water is embedded in and structured by the macro-historical context and the forces of water sector management in Thailand. For a period lasting more than 30 years, from 1962 to 1996, the country's first seven national plans had supply-side-oriented management as their water strategy. This emphasized the building of 'hard' infrastructures to fulfill the defined principal goal of meeting the needs of expanding agriculture and industries. The central focus was on water supply and distribution. In this strategy, water quality and pollution control did not figure at all as a management focus. Furthermore, a comprehensive framework for water management and the development of appropriate institutional mechanisms for effective governance was absent from these plans. It was only in the Eighth National Plan (1997–2001) and, later on, in the Ninth National Plan (2002–2006) that the agenda of having a comprehensive management of water resources was recognized, involving, among other things, a decentralized river basin management approach, supervision of water quality, and pollution control and drainage (Thailand Development Research Institute, 1990; Sacha *et al.*, 2001).

However, the river basin management approach, whose expanded and more comprehensive concerns include water quality management and pollution control, has not taken off.[18] It is still the Royal Irrigation Department (RID) that is entrusted with the duty to oversee and administer water in the peri-urban area. While the recent institutional discourse of this agency has indeed explicitly recognized solving water pollution as part of its mandate (in addition, to water allocation and flood control), this official function is under-operationalized and, in practice, merely an incidental concern of this traditional water allocation body.[19]

Obstacles to procedural equity for farmers

As mentioned earlier, procedural equity in environmental justice is concerned with the ways and mechanisms that will ensure that all people, even the weak and marginalized, are treated openly and fairly in the regulatory and participatory systems for environmental management. It therefore includes the need for jurisdictional clarity regarding pubic obligations, functions, and decision-making and people's access to this decision-making body/ies (Haughton, 1999). A number of authors have stressed

18 For a recent study on the experiments in river basin management initiative in Thailand, see the information of the Office of the National Water Resources Committee (ONWRC) in Anukularmphai (2004), Hirsch (2004), and Kaewkulaya (2004).

19 Interview with the Chief of Water Supply Division, the South Rangsit Irrigation Office (February 2003).

that multiplicity of administrative units, rigidity of administrative boundaries, and fragmentation of functions by separate agencies are anathema to the principle of procedural equity and participation (see, for example, Carley, 2001; Perry, 2000).

In Thailand, line function fragmentation, overlaps and conflicts between government ministries and agencies in their water-related functions and programs[20] (Gupta, 2001; Office of Natural Water Resources Committee, 2001; Hirsch, 2004) combine with administrative separatism based on territorial jurisdiction. In the study area, for instance, overseeing the installation of water treatment equipment by factories and commercial or housing projects that intend to discharge their liquid wastes into the canals is the responsibility of the Rangsit Irrigation Office (RIO). But this is not the agency chiefly or solely in charge of checking pollution treatment by factories. The Provincial Industrial Office (PIO) of the Department of Industrial Works is also responsible for giving permits to factory establishments for their operations in Pathumthani Province, including direct responsibility for keeping their waste water discharges within the legal standard. In addition, the local office of the Department of Sanitation and Environment at the municipal level is a third relevant agency which has a general responsibility for maintaining a clean environment within its administrative boundaries. Just like the RID and PIO, however, this office is merely reactive to complaints from residents and farmers and does not regularly and proactively monitor discharges at source or water quality in the canals. A fourth relevant line agency is the Provincial Agricultural Office (PAO) under the Ministry of Agriculture, officially responsible for supporting all agricultural activities in the province, including monitoring and assistance to the farmers' crops and productivity. However, the PAO has only incidental involvement in water issues. According to a key informant in this line agency, the office only contacts and cooperates with the RID on the particular matter of the *level* of canal water to ensure its adequacy for farmers during the dry season.[21]

Hence, the irrigation canal's pollution seemed to be most line agencies' concern but not one particular agency's own chief or clear responsibility. This problem is compounded by inter-municipality jurisdictional fragmentation.

Administrative fragmentation, and ambiguity and multiplicity of jurisdictional boundaries prevent farmers from having access to decision-making mechanisms and redressing their grievances. Under these conditions, they are often given a bureaucratic run-around. For instance, farmers in Muang Rangsit municipality have complained to their local government office about the deteriorating water quality in their nearby canals. They are simply told that nothing can be done about it since the industrial pollution sources affecting these canals are located in Kukot Municipality. But even if a complaint is relayed to the adjacent municipal authority, identifying and mobilizing the principal local line agency in Kukot, accountability is also a major difficulty. According to a key informant on the side of Kukot Municipality authority: 'It is not our obligation to maintain the cleanliness of the canals that run through our municipal jurisdiction; rather it is the RID who should be responsible since they own the entire irrigation project'. Administrative fragmentation both in line agencies and in territorial jurisdiction for Rangsit Field water canal users is illustrated in Figure 2.

Moreover, irrigation canal management in Rangsit Field has been too far from being participatory for people to expect that such a governance culture can easily be adopted in state and society interactions in water quality issues. On the contrary, farmers in the area have not been consulted regularly, nor are there opportunity structures for their participation in major decisions over water allocation. Water allocation is decided by the RID and the Electricity Generating Authority of Thailand (EGAT) at higher levels without any field-level consultation. Individual farmers do, however, complain or

20 At present Thailand has at least 30 water-related departments overseeing water issues in eight ministries, and two national boards and one committee for planning and coordination at the national level.

21 Interview with the Director of Pathumthani Provincial Agricultural Office, Department of Agricultural Extension, Ministry of Agriculture and Cooperation (February 2003).

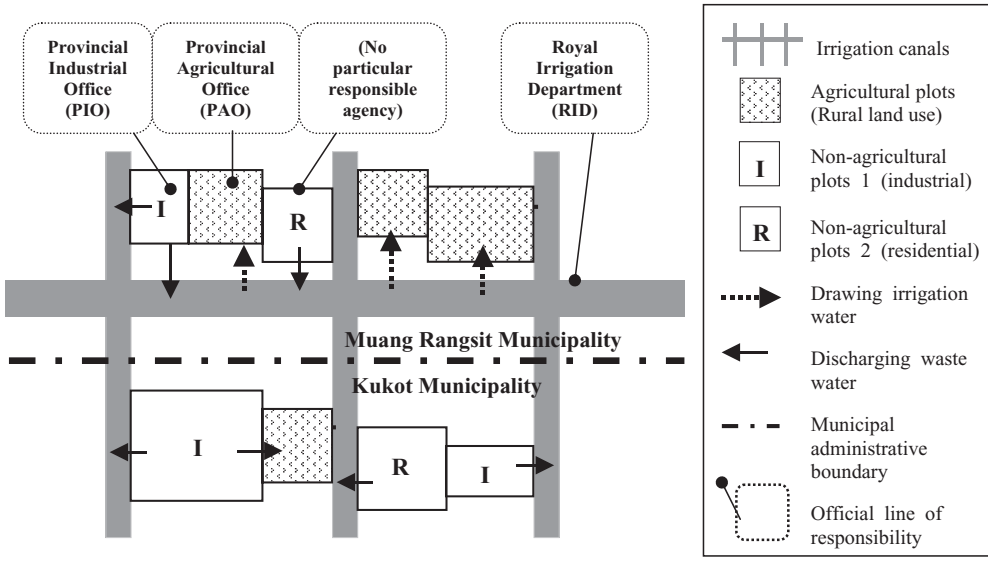

Figure 2 Administrative fragmentation by line and territorial jurisdictions related to canal water management

negotiate case per case with field personnel of RID in charge of lateral canals in order to have adequate water during critical shortages in their fields. The relationship between state agencies and farmers in Rangsit Field is similar to that obtaining elsewhere in the Chaophraya river basin, which has been marked by paternalism on the part of the government and a mixture of clientelism and passivity on the part of the farmers. Attempts to institute participatory irrigation management in the past are still seen as state-initiated and state-oriented, and as not accruing any real benefit to the farmers in terms of improved access (Molle, 2003). This traditional and deeply seated pattern of relationship between the bureaucracy and the farmers in the irrigation system in Thailand is becoming a major drawback in several pilot formations of the river basin committee, undermining the public participation and multi-stakeholder partnership that are supposed to be essential ingredients in the approach (Anukularmphai, 2004; Hirsch, 2004; see also Rigg, 1991). Equally important is the issue of gender equality in the putatively participatory approach in these pilot projects where farmers and users of water resources are assumed to be only male, and where women who are also legitimately farmers and users themselves are largely excluded at practically every level of consultation and participation (Resurreccion *et al.*, 2004).

Conclusions

Locally grounded studies such as the case of Rangsit Field capture not only the ecological costs of intensive mixed land use in *desakota* but, more importantly, who bears these costs and how these burdens are unfairly passed on to others. In the foregoing, we have described how intensive mixed land use has brought into a formerly homogenous farming landscape new urban agents of pollution, leading to water degradation and discrimination against low-income farmers' entitlements to appropriate quality irrigation and their livelihoods. In Thailand, existing institutions of land management, dominated by powerful real estate interests, have not taken account of these farmers' basic social equity concern in development projects. On the other hand, a water-sector-related public institution that traditionally solely focuses on quantity and supply issues has further muted these farmers' and agriculture's own rising concern for

water quality appropriate for farming. In addition, land and water resources as major planning and policy arenas have always been treated as two separate, stand-alone domains, which precludes an integrative and multi-stakeholder approach to land and water development. Moreover, administrative separatism, ambiguity and multiplicity of functional jurisdiction of government bodies at various levels, and a general lack of participatory culture in the bureaucracy and at the grassroots militate against procedural equity for farmers to assert and negotiate their right to appropriate water.

Without glossing over the need to look into and carefully study particularities of every local situation, the Rangsit Field case can arguably represent how environmental justice is commonly violated in the peri-urban areas of Southeast Asia. It demonstrates how farmers bear the cost of environmental degradation without their informed consent and in the absence of fair procedural mechanisms. The irony of the case of peri-urban Bangkok — and which arguably is also true in Manila, Jakarta and other cities — is that these legitimate equity concerns over irrigation water have continued to be ignored in official planning and development discourses, and in public management practices during the last three decades, the period when the periphery underwent transformations in the context of an aggressive linking with the global and an opening up to foreign and domestic capital flows and investments. It would seem that this form of environmental injustice has become patterned and inscribed in the *desakota* form of urban mega-regions of Southeast Asia. Without state acknowledgement of the environmental injustices occurring in the peri-urban area, it seems far-fetched to suppose that appropriate mechanisms and public institutions for purposively addressing equity concerns and problems can be established.

In Southeast Asian countries institutions for participatory planning and for fair negotiations in environmental conflict situations are non-existent or undeveloped to date. Moreover, present-day governments and the main socio-political landscapes in the region are dominated, among other things, by rigid administrative separatism and by an elitist, paternalistic, non-participatory ethos in state officials' practices and interactions with people. Optimism, therefore, that things might improve in the near future is certainly not well-grounded. Unplanned and unsound heterogeneity of land use in the peri-urban area is bound to further intensify. And its associated negative environmental and social costs will continue to be unfairly distributed until policies and regulatory and participatory mechanisms evolve that recognize and allow low-income farmers to have a voice in peri-urban development.

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References

Agyeman, J., R.D. Bullard and B. Evans (2003) *Just sustainabilities: development in an unequal world*. Earthscan Publications Ltd, London.

Amarnath, J.S. and S. Krishnamoorthy (2001) Study on relationship between productivity, inputs and environmental quality in tannery effluent affected farms of Tamil Nadu. *Water Resources Management* 15.1, 1–15.

Anukularmphai, A. (2004) *Putting IWRM into practice: a case study of Thailand*. Presentation at the First General Meeting of the Network of Asian River Basin Organizations (NARBO), ADB, Malang, Indonesia, 24–26 February 2004 [WWW document]. URL: http://www.adb.org/water/narbo/2004/Training-Program/presentation-IWRM-Case Study-THA.pdf (last accessed 15 May 2004)

Arghiros, D. and W. Wongsekiarttirat (1996) Development in Thailand's extended metropolitan region: the socio-economic and political implications of rapid change in Ayutthaya District, central Thailand. In M. Parnwell (ed.), *Uneven development in Thailand*, Avebury, Sydney.

Askew, M. (2002) *Bangkok: place, practice and representation*. Routledge, London.

Askew, M. (2003) The cultural factor in rural-urban fringe transformation: land, livelihood, and inheritance in western Nonthaburi. In F. Molle and T. Srijantr (eds.), *Thailand's rice bowl: perspectives*

on agricultural and social change in the Chao Phraya delta, White Lotus Press, Bangkok.
Biswas, A.K. (1991) Water policies in the developing world. *International Journal of Water Resources Development* 17.4, 489–99.
Biswas, A.K. (2004) Integrated water resources management: a reassessment. *Water International* 29.2, 248–56.
Braga, B.P.F. (2001) Integrated urban water resources management: a challenge into the 21st century. *Water Resources Development* 17.4, 581–99.
Bullard, R. (1990) *Dumping in Dixie: race, class and environmental quality*. Westview Press, Boulder, CO.
Campbell, S. (1996) Green cities, growing cities, just cities? Urban planning and the contradictions of sustainable development. *Journal of the American Planning Association* 62.3, 296–312.
Carley, M. (2001) Top-down and bottom-up: the challenge of cities in the new century. In M. Carley, P. Jenkins, and H. Smith (eds.), *Urban development and civil society*, Earthscan Publications Ltd., London.
Cheyroux, B. (2003) Fruits and vegetables in Thailand's rice bowl: the agricultural development of ponded raised bed systems in the Damnoen Saduak area. In F. Molle and T. Srijantr (eds.), *Thailand's rice bowl: perspectives on agricultural and social change in the Chao Phraya delta*, White Lotus Press, Bangkok.
Crocker, D. (1991) Toward development ethics. *World Development*, 19.5, 457–83.
Dobson, A. (1998) *Justice and the environment. Conceptions of environmental sustainability and dimensions of social justice*. Oxford University Press, Oxford, New York.
Department of Land Development (DLD) (1995) *Land price assessment 1991–1995*. An official report, Office of Land Price Assessment, DLD, Bangkok (in Thai).
Department of Land Development (DLD) (2000) *Land price assessment 1996–2000*. An official report, Office of Land Price Assessment, DLD, Bangkok (in Thai).
Doyle, T. and D. McEachern (2001) *Environment and politics*. Routlege, London and New York.
Firman, T. (1996) Urban development in Bandung Metropolitan Region: a transformation to a Desa-Kota region. *Third World Planning Review* 18.1, 1–22.
Firman, T. (1997) Land conversion and urban development in the northern region of West Java, Indonesia. *Urban Studies* 34.7, 1027–46.
Firman, T. (2000) Rural to urban land conversion in Indonesia during boom and bust periods. *Land Use Policy* 17, 13–20.
Flatters, F. and T.M. Horbulyk (1995) Economic perspectives on water conflicts in Thailand. *TDRI Quarterly Review* 10.3, 3–10.
Gasper, D. (2004) *The ethics of development*. Edinburgh University Press, Edinburgh.
Goldblum, C. and T.-C. Wong (2000) Growth, crisis and spatial change: a study of haphazard urbanization in Jakarta, Indonesia. *Land Use Policy* 17, 29–37.
Greensberg, C. (1994) Region based urbanization in Bangkok's extended periphery. PhD Dissertation, Department of Geography, Faculty of Graduate Studies, University of British Columbia, British Columbia.
Gupta, A.D. (2001) Challenges and opportunities for water resources management in Southeast Asia. *Hydrological Science Journal* 46.6, 923–36.
Hardoy, J., D. Mitlin, and D. Satterthwaite (2001) *Environmental Problems in an urbanizing world*. Earthscan Publications Ltd., London.
Haughton, G. (1999) Environmental justice and the sustainable city. *Journal of Planning Education and Research* 18.3, 233–43.
Haughton, G. and C. Hunter (1994) *Sustainable cities*. Jessica Kingsley Publishers Ltd, London.
Heimlich, D.R. and D. Anderson (2001) *Development at the urban fringe and beyond: impacts on agriculture and rural land*. ERS Agricultural Economic Report No. 803.
Hewison, K. (2001) Thailand's capitalism: development through boom and bust. In G. Rodan, K. Hewison and R. Robison (eds.), *The political economy of South-East Asia: conflicts, crises, and change*, Oxford University Press, Singapore.
Hirsch, P. (2004) Water management: case study of Thailand. Working paper presented at the SEA Geography Conference: Water Governance in Context, Khon Kaen (November).

Hooper, B.P., G.T. McDonald and B. Mitchell (1999) Facilitating integrated resource and environmental management: Australian and Canadian perspectives. Journal *of Environmental Planning and Management* 42.5, 747–66.

Jansen, K. (2001) Thailand: the making of a miracle? *Development and Change* 32, 343–70.

Kaida, Y. (2003) Agrarian versus mercantile deltas: the Chao Phraya delta in the context of the great deltas of monsoon Asia. In F. Molle and T. Srijantr (eds.), *Thailand's rice bowl: perspectives on agricultural and social change in the Chao Phraya delta*, White Lotus Press, Bangkok.

Kaewkulaya, J. (2004) *Water resource development and management in Thailand*. Conference Proceedings, Tsukuba Asian Seminar on Agricultural Education (TASAE), 9–15 November 2004, Japan.

Kelly, F.P. (1998) The politics of urban-rural relations: land use conversion in the Philippines. *Environment and Urbanization* 10.1, 33–54.

Kelly, F.P. (1999) Everyday urbanization: the social dynamics of development in Manila's extended metropolitan region. *International Journal of Urban and Regional Research* 23.2, 283–303.

Krongkaew, M. (1996) The changing urban system in a fast-growing city and economy: the case of Bangkok and Thailand. In F.-C. Lo and Y.-M. Yeung (eds.), *Emerging world cities in Pacific Asia*, United Nations University Press, Tokyo.

Lee, T.R. (2000) Urban water management for better urban life in Latin America. *Urban Water* 2, 71–8.

Linn, G. C.-S. (1994) Changing theoretical perspectives on urbanization in Asian developing countries. *Third World Planning Review* 16.1, 1–23.

Liu, F. (2001) *Environmental justice analysis: theories, methods, and practice*. Lewis Publishers, Washington, DC.

Maitra, A.K. and A. Krishan (2000) Agenda 21 and urban India. In N. Low, B. Gleeson, I. Elander and R. Lidskog (eds.), *Consuming cities*, Routledge, London and New York.

Marcotullio, P.J. (2003) Globalization, urban form and environmental conditions in Asia-Pacific cities. *Urban Studies* 40.2, 219–47.

Margerum, R.D. (1999) Integrated environmental management: the foundations for successful practice. *Environmental Management* 24.2, 151–66.

McGee, T.G. (1991) *The emergence of desakota region in Asia: expanding a hypothesis*. University of Hawaii Press, Honolulu.

McGee, T.G. (2003) *Distinctive urbanization in the peri-urban regions of East and Southeast Asia: renewing the debate*. Working paper for The 7th International Congress of Asian Planning Schools Association, September 2003, Hanoi.

McGee, T.G. and C. Greenberg (1992) The emergence of extended metropolitan regions in ASEAN. *ASEAN Economic Bulletin* 9.1, 22–44.

McGranahan, G., D. Satterthwaite and C. Tacoli (2004) *Rural-urban change, boundary problems and environmental burdens*. Working Paper No. 10, Working Paper Series on Rural-Urban Interactions and Livelihood Strategies, International Institute for Environment and Development.

Mekvichai, B. (ed.) (1990) *Urbanization and environment: managing the conflict*. Research Report No. 6, The 1990 TDRI Year-End Conference, Thailand Development Research Institute, Bangkok.

Molle, F. (2003) Allocating and accessing water resources: practice and ideology in the Chao Phraya river basin. In F. Molle and T. Srijantr (eds.), *Thailand's rice bowl: perspectives on agricultural and social change in the Chao Phraya delta*, White Lotus Press, Bangkok.

Molle, F. and J. Berkoff (2005) Cities versus agriculture: revisiting intersectoral water transfers, potential gains and conflicts. *Comprehensive Assessment Research Report 10*, IWMI, Colombo.

Office of Natural Water Resources Committee (ONWRC) (2001) Chao Phraya river basin, Thailand. In United Nations, *UN World Water Development Report*, United Nations, New York.

Orapan, S. and W. Warin (2000) *Evolution of land-use in urban-rural fringe area*. Proceedings of the International Conference 'The Chao Phraya Delta: Historical Development, Dynamics and Challenges of Thailand's Rice Bowl', Kasetsart University, Bangkok, December 2000.

O'Rourke, D. (2002) Community-driven regulation: toward an improved model of environmental regulation in Vietnam. In

P. Evans (ed.), *Livable cities? Urban struggles for livelihood and sustainability*, University of California Press, Berkeley and Los Angeles.

Parnwell, M. and D. Arghiros (1996) Introduction: uneven development in Thailand. In M. Parnwell (ed.), *Uneven development in Thailand*, Avebury, Sydney.

Parnwell, M. and L. Wongsuphasawat (1997) Between the global and the local: extended metropolitanisation and industrial location decision making in Thailand. *Third World Planning Review* 19.2, 119–38.

Pathumthani Provincial Agricultural Office (PAO) (1980) *Annual Report Year 1980*. An official report, Pathumthani Provincial Agricultural Office, Pathumthani (in Thai).

Pathumthani Provincial Agricultural Office (PAO) (1990) *Annual Report Year 1990*. An official report, Pathumthani Provincial Agricultural Office, Pathumthani (in Thai).

Pathumthani Provincial Agricultural Office (PAO) (2000) *Annual Report Year 2000*. An official report, Pathumthani Provincial Agricultural Office, Pathumthani (in Thai).

Pathumthani Provincial Agricultural Office (PAO) (2002) *Annual Report Year 2002*. An official report, Pathumthani Provincial Agricultural Office, Pathumthani (in Thai).

Pathumthani Chamber of Commerce (PCC) (2000) *Annual Report Year 2000*. An official report, Pathumthani Chamber of Commerce, Pathumthani (in Thai).

Pathumthani Provincial Industrial Office (PIO) (2000) *Annual Report Year 2000*. An official report, Pathumthani Provincial Industrial Office, Pathumthani (in Thai).

Perry, A. (2000) Sustainable legal mechanisms for the protection of the urban environment. In C. Pugh (ed.), *Sustainable cities in developing countries*, Earthscan Publications Ltd, London.

Phongpaichit, P. and C. Baker (2002) *Thailand. economy and politics*. Second Edition, Oxford University Press, New York.

Plumb, C. (1999) Bangkok. In J. Berry and S. McGreal (eds.), *Cities in the Pacific Rim: planning systems and property markets*, E&FN Spon, London.

Pradidwongkool, A. (2004) Natural treatment systems as potential vehicles for mitigation of environmental impact of pesticides in Thailand: Pathumthani Province case study. Unpublished Masters Thesis, Asian Institute of Technology, Bangkok.

Priscoli, J. (2004) What is public participation in water resources management and why is it important? *Water International* 29.2, 221–27.

Rachaniwan, V., K. Porntip and D. Sripen (2000) *A regional study of Klong Rangsit, its historical development from rural characteristics into urban areas in northern Bangkok*. Proceedings of the international conference 'The Chao Phraya Delta: Historical Development, Dynamics and Challenges of Thailand's Rice Bowl', Kasetsart University, Bangkok, December 2000.

Resurreccion, B.P., M.J. Real and P. Pantana (2004) Officializing strategies: participatory processes and gender in Thailand's water resources sector. *Development in Practice* 14.1, 521–33.

Rigg, J. (1991) Grass-roots development in rural Thailand: a lost cause? *World Development* 19.2, 199–211.

Ross, H. and A. Poungsomlee (1995) Environmental and social impact of urbanization in Bangkok. In J. Rigg (ed.), *Counting the costs: economic growth and environmental change in Thailand*, Institute of Southeast Asia Studies, Pasir Panjang, Singapore.

Ruland, J. and B. Ladvalva (1996) Managing metropolitan Bangkok: power contest or public service? In J. Ruland (ed.), *The dynamics of metropolitan management in Southeast Asia*, Institute of Southeast Asian Studies, Singapore.

Sacha, S., T. Suwit, K. Ladawan and P. Surapol (2001) Thailand's water vision: a case study. In the United Nations, *The FAO-ESCAP pilot project on national water visions: a synthesis of experiences in SEA*, United Nations, Bangkok.

Sadeq, H.T. (1999) A rare and precious resource. The UNESCO Courier, February 1999 [WWW document]. URL: http://www.unesco.org/courier/1999_02/uk/dossier/txtll.htm (accessed 22 August 2002)

Satterthwaite, D. (1997) Sustainable cities or cities that contribute to sustainable development? *Urban Studies* 34.10, 1667–91.

Sen, A. (1985a) The standard of living: lecture I, concepts and critiques. In G. Hawthorn (ed.), *The standard of living*, Cambridge University Press, Cambridge.

Sen, A. (1985b) The standard of living: lecture II, lives and capacities. In G.

Hawthorn (ed.), *The standard of living*, Cambridge University Press, Cambridge.
Sen, A. (1999) *Development as freedom*. Oxford University Press, New York.
Setchell, C. (1995) The growing environmental crisis in the world's mega-cities: the case of Bangkok. *Third World Planning Review* 17.1, 1–18.
Shrader-Frechette, K. (2002) *Environmental justice: creating equality, reclaiming democracy*. Oxford University Press, New York.
Srijantr, T. (2003) Agrarian transformations in the Chao Phraya delta: a case study in tambon Thung Luk Nok. In F. Molle and T. Srijantr (eds.), *Thailand's rice bowl: perspectives on agricultural and social change in the Chao Phraya delta*, White Lotus Press, Bangkok.
Srisawalak-Nabangchang, O. and W. Wonghonchao (2000) *Evolution of land-use in urban–rural fringe areas*. Paper presented at the conference The Chao Phraya Delta: Historical Development, Dynamics and Challenges of Thailand's Rice Bowl, Katsetsart University, Bangkok (12–15 December).
Swyngedouw, E. and M. Kaika (2003) The environment of the city . . . or the urbanization of nature. In G. Bridge and S. Watson (eds.), *A companion to the city*, Blackwell Publishing, Oxford.
Tacoli, C. (1998) Rural-urban interactions: a guide to the literature. *Environment and Urbanization*, 10.1, 147–56.
Thailand Development Research Institute (TDRI) (1990) *Water shortages: managing demand to expand supply*. Proceedings of the 1990 TDRI Year-End Conference, TDRI, Bangkok.
United Nations (1999) *Urban agglomerations 1999. Department of Economic and Social Affairs, Population Division*, United Nations, New York.
UNEP (2003) *Water resources management in Latin America and the Caribbean*. Contribution of the Inter-Agency Technical Committee (ITC) to the Fourteenth Meeting of the Forum of Ministers of the Environment of Latin America and the Caribbean, Panama, 20–25 November 2003.
Varis, O. (2005) Externalities of integrated water resources management (IWRM) in South and South-East Asia. In A. Biswas, O. Varis and C. Tortajada (eds.), *Integrated water resources management in South and South-East Asia*, Oxford University Press, New Delhi.
Wescoat, J.L. and G.F. White (2003) *Water for life: water management and environmental policy*, Cambridge University Press, Cambridge.

Résumé

Cet article comble une lacune dans les travaux sur l'équité environnementale de la gouvernance de l'eau dans un desakota*, prolongement de région métropolitaine propre aux grandes villes d'Asie du Sud-Est. Au travers d'une étude de cas, les auteurs décrivent comment, dans une situation d'occupation mixte intensive d'un territoire, les nouveaux usagers urbains des canaux d'irrigation ont provoqué une dégradation de l'eau, faisant injustement tort au droit des agriculteurs pauvres à une eau d'irrigation de bonne qualité et nuisant ainsi à leur source de revenu. En Thaïlande, certains traits des institutions existantes de gestion du sol et de l'eau encouragent un transfert disproportionné de la responsabilité de l'environnement vers les petits agriculteurs. Ce phénomène implique aussi la violation de l'équité procédurale: droit des agriculteurs à être informés, à pouvoir revendiquer et négocier une eau convenable, à participer véritablement aux décisions stratégiques relatives à la gouvernance de l'eau dans la zone périurbaine. Le séparatisme des administrations, l'ambiguïté et la multiplicité des compétences fonctionnelles des organismes gouvernementaux liés à l'eau, ainsi que l'absence totale de culture participative dans la bureaucratie sont à l'origine du problème. L'article conclut que, si l'État ne reconnaît pas cette forme d'injustice, la possibilité d'instaurer des mécanismes appropriés et des institutions publiques pour traiter résolument les questions d'équité environnementale est improbable, et que cette inéquité va sans doute continuer à s'inscrire dans la géographie périurbaine des mégapoles d'Asie du Sud-Est.*