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Scales and power in river basin management: the Chao Phraya River in Thailand[1]

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Interventions on hydro/ecological systems by different categories of stakeholders characterised by different political, decision-making and discursive power, and varied access to resources, tend to generate costs, benefits and risks that are distributed unevenly across spatial and temporal scales and across social groups. This is due to the interconnectedness of users through the hydrologic cycle entailed by their dependence upon the same resource. As pressure over resources increases and basins 'close', this interdependence becomes more critical, increasing the frequency and seriousness of water shortages and conflicts. A political ecology approach seeks to identify and understand the mechanisms that underpin the transformations of aquatic socio-environmental systems. Basin interconnectedness, with its hydrological, ecological and social dimensions, and three instances of the concept of scale are shown to be relevant to the understanding of these transformations. The paper analyses the case of the Chao Phraya river basin, in Thailand, and shows how land and water resources have been appropriated and identifies the different interest groups and their related discourses and power; it examines how they have adapted to socio-environmental changes, and highlights how risks, costs and benefits have been distributed.

KEY WORDS: Thailand, river basin management, political ecology, water resources, allocation, discourse

Introduction

Unlike other resources like minerals, oil or land, water resources are always in a flux, often hidden underground, sometimes changing in quality, always varying in quantity and timing. Because of the nature of the hydrological cycle and of human capacity to store, dike, divert, drain or pump water, this whimsical resource connects the people who depend on it, for better or for worse. This interconnectedness will manifest itself increasingly as pressure over resources grows and shortages recur. Societies, or particular individuals and interest groups, constantly reshape river basin waterscapes[2] in a way that reflects not only the technology available but also their conception of nature, the labour or the capital they can mobilise, and the distribution of power and agency which defines who can make decisions on how to control, use and share water. Conversely, environmental change brought about by water-related human activities and shaped by particular ecological and physical conditions will impact back onto societies, often in a negative way, affecting particular areas or social groups, as defined by gender, ethnicity, caste or class (Greenberg and Park 1994; Robbins 2004).

Because most of the interactions through the water cycle occur at the river basin level, basins provide, at least initially, a handy spatial unit for looking at interaction between waterscapes and societies. Conventional water management approaches see river basins as rational units where technical ingenuity strives to ensure that supply remains in line with societal demand. Hydrology and hydraulics form the basic knowledge of engineers bent on controlling the unpredictable and changing hydrological

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regime that humans will 'harness' for particular uses and benefits. Suboptimal outcomes are viewed as stemming from a lack of capital or knowledge, imperfect institutions or government failure, all of which can be redressed through a proper combination of capital investment, expert knowledge and bureaucratic reform. In the face of the social and environmental costs brought about by uncontrolled economic development, the concept of integrated water resource management (IWRM) has been promoted as an approach aiming at reconciling economic efficiency, equity and sustainability.

A political ecological approach, however, views river basins as arenas where both water and power circulate and define the pattern of access to water and the way externalities – water shortages, floods, pollution, etc. – are created and travel across scales, space and time to affect particular groups (Bakker 2003; Peet and Watts 1993; Swyngedouw and Kaïka 2002). Focusing on river basins by no means suggests that socio-environmental processes are spatially bounded. Many causes of water-related problems as well as their solutions may indeed lie outside river basin boundaries (Molle *et al.* 2007).

This paper adopts such an approach and is divided into three parts. The first section briefly reviews several common uses of the concept of scale in political ecology and illustrates how river basin interconnectedness plays out in hydrological, ecological and social terms. It briefly describes how societies may respond to water problems and how actors use social, political, symbolic or discursive power embedded in particular scales to elicit specific responses. The second section exemplifies these theoretical considerations by using the Chao Phraya river basin in Thailand as a case study. The final discussion recaps the different types of scalar interactions in the basin, including those initiated from downstream (Bangkok) towards upstream areas and other river basins, and calls for a richer and wider approach to human–environment interactions.

Scale and river basin interconnectedness

The concept of geographical scale has attracted much attention from scholars over the past 15 years. It has been mobilised in analyses of themes ranging from globalisation, restructuring of capitalism, urban expansion, to environmental change (Brenner 2001; Bulkeley 2005). Scale concepts have been used by ecologists, geographers and political scientists with different interrelated meanings. We can distinguish three scalar themes that are both salient in the literature and relevant to river basin development. First, conventionally, spatial (but also temporal) scales are physical measures of space, or 'nested territorial containers' (Bulkeley 2005) that implicitly have boundaries. Second, scalar differentiation is mobilised to extend the analysis of dynamics perceived as local, or pertaining to definite scales, to sociopolitical determinants that frequently lie in wider or distant spheres (Robbins 2004). Influence, power, mobilisation, networks, discourse and knowledge largely circulate through channels that traverse rather than match conventional scalar levels. Third, beyond their apparent naturalness as 'relatively differentiated and self-enclosed geographical units' (e.g. the local, the urban, the river basin, the nation, etc.; Brenner 2001), scales are social and political constructs that are mobilised by individuals, groups or the state in order to frame problems and solutions in particular ways and to favour specific courses of action (Lebel *et al.* 2005; Swyngedouw and Kaika 1992; Delaney and Leitner 1997). This 'politics of scale' is often extended to a *rescaling process*, where scales are hierarchically differentiated and reordered (Brenner 2001).

These three meanings are all extremely relevant to river basin management. First, bio-physical water-based processes add up in specific ways when the analysis moves from a square meter of land, to the farmer's plots, the catchment, the sub-basin and the river basin. These levels are often nested (by the nature of surface water movements) but can also be interlinked through surface/groundwater interactions or interbasin transfers. Second, human–environment dynamics within a river basin (e.g. land use changes, erosion, loss of biodiversity, marginalisation, migrations, etc.) are frequently interlinked with processes or drivers that pertain to the national level (e.g. public policies) or global level (e.g. climate change, market price for commodities, etc.) (Sneddon *et al.* 2002). In other words, both water-related problems and their solutions may lie outside the basin itself (Molle *et al.* 2007). The governance of socio-ecological systems also no longer befits state/national, people/local dichotomies and includes many transversal or multi-scalar networks or coalitions (Adger *et al.* 2005). Third, scales are constructed to favour a particular analysis (e.g. 'water shortages are due to careless farmers'), or to justify (or exclude) certain solutions; different scales are used to legitimise certain actors and strategies: typically, the state is keen to use the national scale (e.g. national security or self-sufficiency, energy needs for economic development, 'modernisation', etc.) as a way of delegitimation of local movements; and the scale of the river basin is used in order to justify particular interventions, patterns of governance, or modes of water allocation. As stressed by Swyngedouw (2004, 133): 'Struggling to command a particular scale in a given socio-spatial conjuncture can be of eminent importance. Spatial scales are

never fixed, but are perpetually redefined, contested and restructured in terms of their extent, content, relative importance and interrelations. The continuous reshuffling and reorganisation of spatial scales are integral to social strategies and an arena for struggles for control and empowerment'.

Local groups of users may also 'jump scales', reframing local problems at a wider national or international scale, associating with multi-scale advocacy networks in order to gain audience (Sneddon 2002).

Geographers promoting accounts and visions based on concepts of connectivity, horizontality and networks identify 'a perforation of scalar and territorial forms of social organization' (Amin 2002), but they mainly deal with objects like cities that are more loosely related to conventional physical scales. When dealing with water-dependent socio-ecological systems with the river basin level as a starting point, it would be unsound to overlook the scalar and material dimension of water flows and land/water/biota relationships. Without discounting other scalar interactions and the sociopolitical nature of scale, it is essential to comprehend the full extent and consequences of the interconnectedness of humans and nonhumans through the hydrologic cycle. This interconnectedness between users, endowed with varying power and degree of access to water, and ecosystems has several hydrological, ecological and social dimensions.

Hydrological interconnectedness is first typified by the well-known upstream–downstream nexus. Even much before conceptualising river basins, humans had recognised how actions on the upper reach of a river could affect its downstream part (Molle 2006). Diverting water or storing it to stifle rice production in downstream enemy states, or to release it on cities to destroy enemies was employed as early as the fourth to third century BC in China (Chinese Hydraulic Engineering Society and Chinese National Committee on Irrigation and Drainage 1991). Parker (1976) presents an almost continuous record of 'river offences' in England from 1318 until 1698. Large upstream diversions for irrigation typically reduce water flows available to downstream users, but this phenomenon can be progressive and less perceptible when flow reduction is the result of a growing number of small tanks, water harvesting structures, or even pumps tapping aquifers and reducing baseflows to rivers. Other less intuitive interactions occur between surface water and groundwater. Overdraft of aquifers may revert groundwater flow contribution to the river, with the river eventually contributing to the aquifer. Such stealthy reallocation shows the complexity of defining water rights that account for all hydrological connections, especially in a context of high inter-annual variability.

Basin interconnectedness also has a socio-political dimension, as individuals and groups that find themselves in interaction do not have the same decisional power and access to water. Conflicts typically pit against each other: agriculturalists and urbanites, subsistence-oriented farmers or fishers and commercial enterprises, and off-stream and on-stream uses. For example, pine plantations in the upper Sand catchment in South Africa affect domestic water availability for high-density rural settlements, and Thai golf courses and orchards used and owned by well-off urbanites deplete water available to nearby rice farmers (Both ENDS and Gomukh 2005). Operators who can afford deep wells and powerful pumps will outdo those relying on shallower wells. Industrialists generally have greater political clout and their water uses severely affect other uses, notably through pollution of waterways. Fishers are often displaced by water projects and are seldom compensated for the loss of their livelihoods [World Commission on Dams (WCD) 2000, ch. 3]. Cities and industries generally get preferential allocation, which adversely affects agriculture (though the reverse also occurs), and the actions of all three groups adversely affect the environment (Molle and Berkoff 2005).

Externalities can also travel across time over a long period, as in the case of the contamination or exhaustion of aquifers, and the loss of wildlife diversity, which will affect next generations; or in the case of inter-basin transfers, by forgoing future development in the 'giving' basin.

Last, interconnectedness has an environmental dimension in that a river basin can be seen as a continuum of interlinked ecosystems where environmental health in one part is affected by actions in other parts of the basin (Molle *et al*. 2007). For example, the functions of seasonal and permanent wetlands are controlled by changes in the flow regime as a result of impoundments and diversions elsewhere in the system. Small dams in upper catchments may delay the onset of the wet season and affect biological cues. Dams have often undermined or destroyed elaborate human uses of ecosystems, at the cost of overall economic losses, declining food security, environmental degradation, and loss of ecosystem services (see the case of the Hadejia' Jama'a river in Nigeria; Barbier and Thompson 1998). The systemic and complex nature of river basin ecosystems has often compounded the direct impact of dams, irrigation, and pumping schemes and has led to a series of destructive effects that were not identified at the outset or have frequently been overlooked. These include the loss of springs (e.g. overdraft of aquifers in the Azraq oasis in Jordan) or wetland productivity, as the connectivity between the river and the floodplain is

diminished by altered flood regimes. Many of the benefits associated with floods – fertility enhancement, replenishment of aquifers, support of wetlands, ecosystem sustainability, flood recession agriculture, and fecundity of fisheries – have been severely curtailed (WCD 2000).

All the interactions described above increase with human pressure over resources. When basins (or sub-basins) cannot produce the flows needed to meet human or ecological downstream requirements (control salinity intrusion, dilute pollution, support estuarine ecosystems, etc.) they are said to be closed (or closing if this happens only during some period of the year) (Molle *et al.* 2007). Closing basins usually exhibit a high degree of water reuse because return flows from one particular use are usually re-diverted somewhere downstream. With this, interactions between humans become paramount.

Conflicts around water interventions are pervasive because these interventions tend to generate externalities that impact on other people, somewhere else and after some time lag. A political ecology approach sees river basins as politicised arenas where different actors who use water and/or are subjected to externalities vie for access to the resource, for protection or compensation, and use their social or political power to elicit or impose regulations and interventions in line with their individual interests (or their wider conception of the common good).

As scale is enlarged, conflict resolution moves from local arrangements between irrigators or communities of one sub-catchment to larger regional or national spheres. With this, the role of the state tends to be more prominent, as the solution to conflicts as well as the design of collaborative arrangements often requires information that is not available locally. In addition, larger basins tend to have large-scale hydraulic infrastructures which are, in general, managed by the state. While states have gradually acquired a capacity to regulate and shape water regimes it is only quite recently that their role has come under closer scrutiny. The lack of clear allocation rules and water rights has left state agencies with a rather large latitude (if not discretion) to manage and allocate water according to criteria open to pressure by various interest groups rather than to those either resulting from negotiations or sanctioned by the society at large.

Water problems (scarcity, flooding, pollution) have no single solution: options to deal with scarcity include supply augmentation through the mobilisation of more resources through capital-intensive projects; efforts to conserve water; or redefining allocation to users (Molle 2003). All these options have political and financial implications. They all come with risks, costs and benefits, private or public, which strongly shape what solutions particular stakeholders are likely to push for. Controlling or influencing the policy discourse that provides overarching justifications of why certain options should be preferred (or not) is therefore paramount (Swyngedouw and Kaika 2002). This discourse is influenced not only by ideologies (e.g. market- or community-based solutions), worldviews (e.g. production/livelihoods vs. conservation) and global hegemonic concepts (e.g. IWRM, river basin management) but also by political clout (rural vs. urban), the relative influence of the various stakeholders or interest groups, and the relative weights of the state and the civil society.

In sum, the interaction between the landscape and its hydrologic regime (with its temporal and spatial variability), and spatially situated actors with varied levels of financial and political power will greatly determine how resources will be used and what the implications in terms of both environmental and socioeconomic change will be. These changes, in turn, will continuously work to redefine the power structure and reshape the basin waterscape.

Surprisingly, although water has inspired a number of political ecologists (e.g. Zimmerer 2000; Waller 1994; Worster 1985), large river basins and systems have remained relatively understudied (Sneddon 2003; Molle 2003) and most theoretical discussions have come from studies of urban water systems (Swyngedouw and Kaika 2002; Swyngedouw 2004; Bakker 2003). We seek here to contribute to the study of aquatic socio-ecological systems by exploring the development trajectory of the Chao Phraya river basin in Thailand. We build on Sneddon *et al.* (2002, 665) who analyze the ways in which 'human social relations – mediated by political-economic, cultural, and ecological contexts that themselves interact across multiple spatial scales influence the long-term sustainability of aquatic ecosystems and lead to situations of conflict and/or cooperation among and within social groups'. This case study highlights how greater consideration of river basin interconnectedness and of the three notions of scale reviewed above can provide a richer insight on the evolution of human–water environments systems.

The example of the Chao Phraya river basin, Thailand

The Chao Phraya basin is the largest river basin in Thailand (160 000 km^2, or 30% of the area of the country) and is also the most important in economic terms, as it encompasses the bulk of the irrigated area as well as the Bangkok Metropolitan

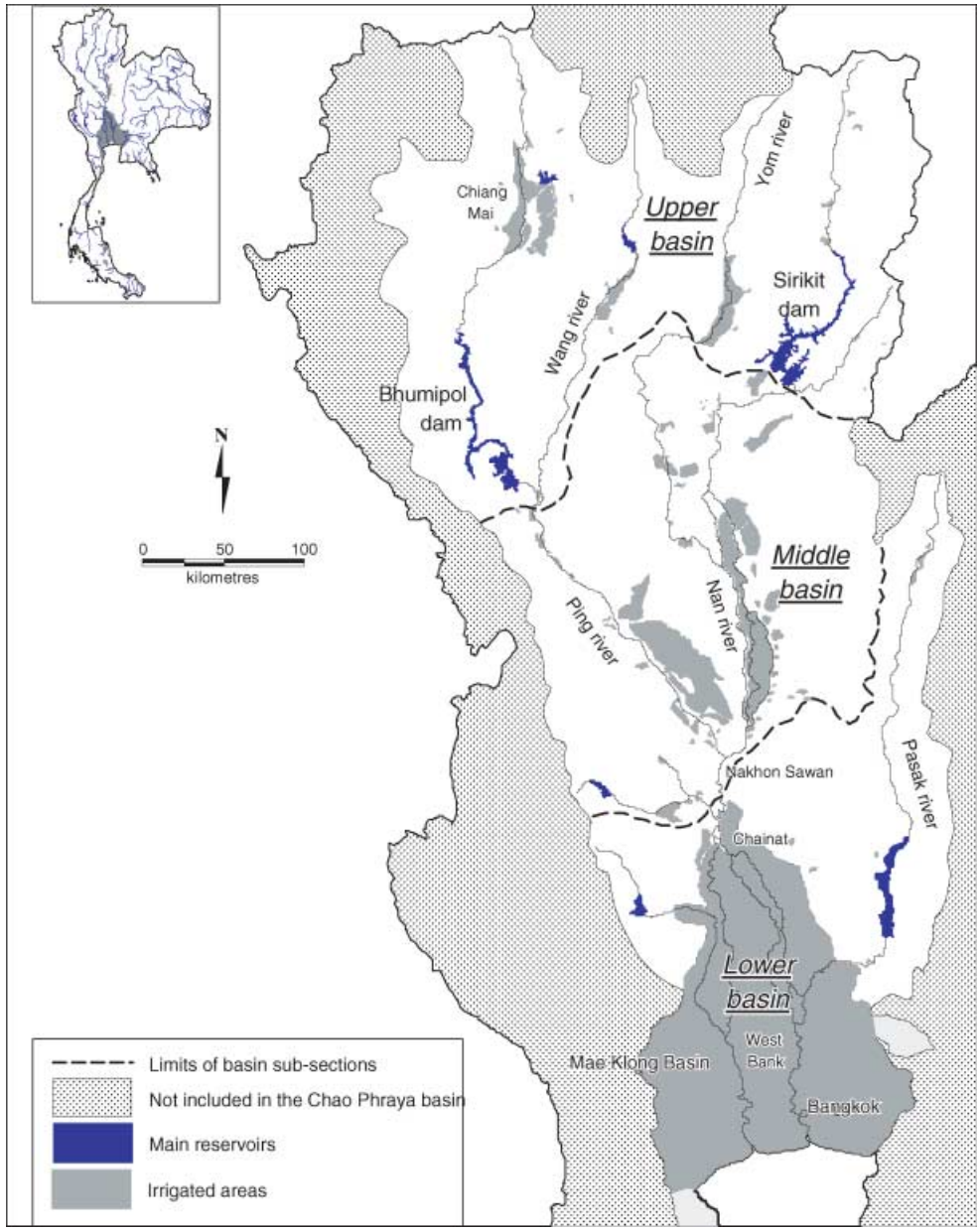

Figure 1 General layout of the Chao Phraya basin

Area (BMA). During the twentieth century the basin shifted from the status of an uncontrolled basin, where rice cultivation was attuned to the natural hydrologic regime, to a status of a highly developed basin, with multipurpose storage dams, extensive canal infrastructure serving around 2.2 million ha of irrigated land, a complex mix of economic activities, and sprawling urban areas.

The basin can be divided into three sub-areas: the upper basin comprises the four main tributaries, the Wang and Yom rivers, and the upper Ping and Nan rivers, upstream of the Bhumipol and Sirikit dams built on these two rivers (Figure 1). The middle basin comprises the lower reaches of these two rivers and the Chao Phraya main stem, down to the apex of the delta. From this point, materialised

by a diversion dam sited at Chai Nat, starts the lower basin which includes the delta proper and a few lateral tributaries, notably the Pasak river on the eastern side.

Water use in early times, although probably occurring in many of the basin lowlands, was most prominent in the inter-montane valleys of the north of the country, home to the flourishing Lanna ('one million paddy fields') kingdom 700 years ago. Paddy cultivation expanded southward as the Thai successively established their capital in Sukothai, Ayutthaya and later Thonburi-Bangkok (1767), until the signature of the Bowring treaty with the British in 1855 (soon followed by other treaties with other western powers) heralded the transition of the rice economy from subsistence to integration into world markets (Ingram 1971; Ishii 1978). The development of the delta between 1860 and 1930 can be seen as the result of a struggle between the king, the nobility and a gradually emancipating peasantry around the transformation of the modes of control of land, capital and labour (Pasuk and Baker 1997). The consumption of space and the spatial patterns of settlements will directly reflect not only this struggle but also the ecological diversity of the delta (Molle 2005).

Despite the early excavation of canals in the delta flats and some attempts to establish gravity irrigation schemes (Ishi 1978), the effective development of large-scale irrigation schemes and water control dates from the 1950s. It first consisted of the construction of 400 000 ha of irrigated areas served by a diversion dam located at the apex of the delta (and connected with an additional 500 000 ha in the delta flats), later followed by two main storage dams, the Bhumipol dam in 1964 and the Sirikit dam in 1972 (Figure 1).

After the completion of these two dams, approximately 12 Bm^3 (or km^3) of the total run-off could be captured every year on average. This capacity was later incremented only marginally, with the construction of several dams, each with a capacity of approximately 0.25 Bm^3, but these resources were mostly committed to nearby irrigated areas that were expanded concomitantly. A boost to dry-season cropping in the lower delta was also allowed by the diversion of 70 m^3/s of water from the adjacent Mae Klong basin to the lower west bank (Figure 1).

Intensification and interactions in the upper basin

Agricultural water use in the upper part of the basin has long been limited to traditional run-of-the-river communal schemes called *muang fai*. Thai farmers would cultivate paddy in the valley bottoms during the wet season, while ethnic minorities (Karen, Hmong, Lisu, etc.) exploited mountain ridges often through slash-and-burn techniques. In the 1960s, the region faced an agrarian crisis resulting from high population growth and the limited land and water resources available for irrigation. Intensification, including multiple cropping and the development of cash crops, was promoted by the government to raise rural incomes. State penetration into the countryside was reflected by the expansion of bureaucracies to the local level. *Muang fai* systems, which had admittedly rendered services to communities for centuries, were suddenly declared inefficient for controlling water: against all credible scientific account, their 'modernisation' (i.e. their turning into concrete weirs) was decreed, based on the necessity to save water for Bangkok.

In the last 20 years, the region underwent drastic changes. In the agriculture sector, vegetable (cabbage) and fruit cultivation (longan, litchis, etc.) expanded on sloppy uplands, and the small streams were diverted to irrigate these crops during the dry season. This resulted in conflicts not only with downstream users, including Thai farmers in the valleys, but also with tourist resort owners and other non-agricultural investors.

Resentment against hill tribes can be attributed to several causes. First, stereotypes largely disseminated by the media and officials have long associated hill tribes with communist insurgencies, opium production, and with illicit logging and environmental degradation. At the same time, international programmes set up by the government with American support mostly targeted hill agriculture in order to eradicate poppy cultivation and integrate non-Thai ethnic groups. Successful attempts to grow cash crops contrasted with the lack of opportunity for lowland Thai farmers with limited ability to intensify or expand their land (although some of them also got involved in litchi cultivation). Conflicts usually revolve around low-flow and degraded water quality in the dry season and remain confined to the lateral tributaries of the main rivers. In the upper Ping river basin, for example, approximately 20 such catchments can be identified. In several cases, conflicts have ramified to larger scales, involving academics and researchers, NGOs of different stripes, line agencies from the Ministries of Agriculture and Environment, as well as urban-based environmentalism and strands of Buddhism preaching self-sufficiency and nature conservation that also contributed to fuel conflicts between highlanders and lowlanders that have been marked, at times, by physical violence, road blockades and the cutting of trees.

Problems in the Ping river itself, one level up to the basin scale, are only partly linked to those

occurring in the tributaries. Problems in the main river valleys are more prominently linked to problems of flood, notably in cities like Chiang Mai, Lamphun, Chiang Rai or Uttaradit. Other aspects of competition for water include the growth of urban use to the detriment of irrigation schemes, modelled on the conflict between farmers and resorts in lateral valleys. The neatest example is that of Chiang Mai city, which is gradually appropriating water from the Mae Taeng and Mae Kuang irrigation schemes, the two main schemes of the Chiang Mai valley. A huge pump recently set up in the main irrigation canal by the gigantic new Night Safari complex illustrates how powerful actors can re-appropriate water.

Interactions between the middle basin and the delta

In the delta, the agrarian crisis of the 1960s and the early 1970s was first diffused by the development of field crops (cassava, corn, cotton, etc.) onto adjacent uplands. This 'upland boom' was supported by the promotion of agro-industry by the Thai state and relatively high market prices for crops such as maize, cotton, cassava, sugar cane and pineapple, and by the construction of a network of strategic roads by the Americans, in their fight against communist insurrection (Delang 2002; Pasuk and Baker 1997). Many farmers migrated to this new frontier, some permanently, others for a season or for the harvest period only (Molle and Thippawal 2003).

The closure of the upland frontier and the inability to intensify agriculture led to much tension in the early 1970s. It is only after the emergence of dry-season cropping (facilitated by the construction of the Sirikit dam, which regulates supply in the dry season), the increase of rice prices in 1973 and the drop in the costs of fertilisers that farmers gradually adopted the high-yielding varieties of the Green Revolution on a large scale, which eventually became attractive. Farmers invested substantial outlays in on-farm infrastructure, tractors and individual axial pumps. Double and even triple cropping developed and was only constrained by the insufficient water stocks available in the dry season.

With such a situation and the concomitant growth of its urban needs, the delta set itself on a collision course with the other water users in the basin. Due to the anteriority of the massive development of its irrigation infrastructures and to the *de facto* priority granted to Bangkok, the delta claimed the lion's share of the basin's surface water and groundwater and appeared as a direct competitor of the current and future development in upstream areas. Indeed, the monopolising of the basin water resources did not go uncontested from other regions and provinces.

The middle part of the basin also benefited from public investments in irrigation during the 1980s. Claiming a part of this water that they also consider 'theirs', since it traverses their land, these provinces have obtained irrigation infrastructures primarily aimed at securing rice cultivation in the wet season. It is interesting to note that the first feasibility studies admitted that, owing to pre-existing irrigation development in the delta, only a very limited area could be irrigated in the dry season. Fifteen years later, however, these irrigated areas have *de facto* conquered the implicit right to divert a substantial part of the dry-season flow and now exhibit cropping intensities comparable to those observed in the delta. In the case of the lower Ping, some sizeable areas with even triple cropping have been observed, illustrating the limit of Bangkok's centralised control on actual water allocation within the basin.

Projects implemented through the Department of Energy Development and Promotion (DEDP) also allowed groups of farmers to gain access to pumping stations with a 250 l/s capacity which soon dotted the course of the river and its tributaries. The combined abstraction of all these users (small and large irrigation systems) totalled 38% of the amount of water released by the two dams during the dry season of 1998 (Molle *et al.* 2001), which gives a measure of the radical process of spatial re-appropriation of water by the middle basin to the detriment of the delta.

The politics of regional development are anchored in a rhetoric of equity used by poorer regions to claim state investments similar to those received by regions with comparatively better advantages. Regions which support the ruling party also expect retributions in the form of preferential investments. The supply-driven logic of international development banks also goes against serious screening of projects. The logic of water resources development thus goes beyond mere economic rationality and frequently leads to overcommitment of water resources, thereby artificially generating water scarcity. In an internal report, the World Bank, which funded both projects in the delta and the subsequent projects in the middle basin, acknowledged that the basin was now 'overbuilt'. This man-made scarcity will prompt more frequent crises which, in turn, will be instrumentalised by interest groups seeking to further particular agendas in response to water problems. Typically, images of cracked soils and withering paddy making the news are convenient poster children for those calling for supply-oriented capital-intensive solutions (new dams, inter-basin transfers, aquifer recharge, etc.).

Another manifestation of the conflict between the delta and the middle basin is the mismatch

between irrigation and hydropower needs, which results in some water being released for the latter without possible reuse by the former. NGOs have frequently ascribed part of the responsibility of water shortages to careless or untimely releases aimed at the sole generation of power. However, in contrast to this accusation, a careful analysis of dam releases in the 1990s shows that managers have improved management and largely operated the two dams, based on the schedule of irrigation needs (Molle *et al.* 2001). This showed that public scrutiny may prompt improvements in management by line agencies (although the move was also made possible by the drastic reduction of the relative importance of hydropower in the overall national power generation).

Interactions within the agricultural delta: water as the major production factor

Growing diversions by the middle basin (and by Bangkok) have resulted in declining supply to the irrigated land of the delta itself. Because of diminishing average farm size, the need to intensify and to access water in the dry season became a vital objective for economic sustainability of agriculture. The upper delta is irrigated by five main canals branching off the Chao Phraya river at the Chai Nat diversion dam. The partition of the flow of the river at Chai Nat is thus a crucial question when one considers that only half of the potential users will be served in the dry season. The analysis of water allocation over a period of 20 years revealed an uneven distribution that cannot be ascribed to technical difficulties only (the water level upstream of Chai Nat fluctuates and this reverberates on the discharge of the different canals[3]) (Molle *et al.* 2001). The west of the delta received a higher supply and could in some places develop a thriving triple cropping, while other areas were served only exceptionally. The official justification is that the western part has been provided with good on-farm infrastructures and, as a result, has a better control of water and a better economic productivity. Part of the difference may also be explained by direct pumping in the Tha Chin river. These explanations are somewhat circumstantial as it is notorious that the province concerned (Suphan Buri) owes much of its preferential treatment to the influence of its governor, a former prime minister (*Bangkok Post* 2005a 2005b).

Farmers are not passive and respond to water scarcity in many ways: they adopt 3-month duration rice varieties, shift cropping calendars, pump from drains and rivers, dig farm ponds, etc. but they also get organised to 'attract' water. The first way is the commonplace resort to political representatives, notably MPs. For the higher parts of the floodplains, long confined to growing traditional deep-water rice varieties, the strategy is to develop on-farm infrastructures (levelling, bunding, digging of small farm-level canals and drains) in order to be able to grow dry-season rice crops and to lay claims for a share of water. Others chose to start dry-season cropping before the beginning of the official season by using wells or residual water in drains or ponds, thus forcing the Royal Irrigation Department (RID) to later allocate water to them to avoid crop losses which would make the news and would trigger political interventions. Others organise themselves in Water User Groups to strengthen their claim for dry-season water supply.

Another way to secure water is to develop capital-intensive agriculture or aquaculture: for example, shrimp ponds in the Don Chedi area (western fringe of the delta), which require a frequent renewal of water, receive some priority supply because of the investments made and their economic profitability. Similarly, the Damnoen Saduak area, in the south-western part of the delta, receives water from the lower Mae Klong basin and is given priority in times of drought. The Rangsit area, north-east of Bangkok, is located at the upstream part of the lower delta and benefits from better access to water: citruses have been developed there on a large scale (Saha 1993). Capital 'attracts' water and vice versa.

The area of Damnoen Saduak provides another telling example of power struggles around water management. The filling up of the Sri Nakarin dam on the upper Mae Klong provoked a drop in the discharge reaching the estuary, which justified the construction of control structures at the outlet of various canals connected with the sea. The resulting creation of a zone of freshwater in the lower part of the basin prompted the expansion of vegetable farming, orchards and aquaculture on a considerable area (totalling almost 20 000 ha), generating an unmatched agricultural wealth in the country. With the boom of brackish shrimp farming (*black tiger prawns*), some landowners (in particular those who had opted for extensive fish farming) are challenging the water regime that gives priority to freshwater and militate for an opening of the regulators and a mixture of sea water and freshwater. They support their claim by borrowing from environmentalist discourses and by stressing the need to 'restore the ecology of the river' (*Bangkok Post* 2004). A modification of the prevailing regime would only shift benefits from one area to the other, and from some landowners to others.

The hydraulic connectivity of the delta also has an impact at a smaller scale: intensive shrimp

farming, which developed in the east and the west of the lower delta, uses the canals/drains, also used by rice cultivation, and the return flows from rice plots are often loaded with pesticide residues which can provoke high mortality in shrimp populations. Inland brackish water shrimp farming requires addition of sea water shipped by tankers and has, in return, an impact on the surrounding agriculture as well as on the soil quality. The spatial dynamics of this very lucrative – but risky – activity are conditioned not only by ecological factors (water quality) and by the promotion of this activity by large transnational agribusiness groups like Charoen Prokphand (CP) but also by state regulations, which tend to concentrate their action on the areas symbolically valued by environmentalists (mangroves) or the public at large (the delta, symbol of a rice-based nation) (Vandergeest *et al.* 1999). However, farming techniques operating at low salinity levels have been developed recently (Szuster 2003), thus weakening the arguments of opponent groups. Abandoned farms in scarified landscapes, remnants of the viruses which undermined shrimp farming in the past (including on the coastal area of the delta in the early 1990s), do not bode well for the future of this activity that brings not only fortune but also bankruptcy: capital seeks returns based on a short-term mining logic and literally consumes land.

Interactions between Bangkok and the irrigated delta

With a population of over 7 million, the highest concentration of industries and political power in the country, Bangkok appears as the main actor in the delta. The city first developed at the end of the nineteenth century owing to rice exports as the heart of a 'mercantile delta' (Kaida 2003), thriving on maritime commerce. During the Cold War, Bangkok was a strategic centre of American policy in Asia and benefited from the American presence and financial aid, as well as from the investments of the Sino-Thai community and, more recently, from foreign capital investments (notably Japanese). The growth of the city has shifted the city water demand from 0.46 million m^3/day in 1978 to 7.5 million m^3/day in 2000, that is, an increase of 16 times over a period of 22 years (Molle *et al.* 2001). This demand is principally met by a diversion of 45 m^3/s from the Chao Phraya and also by groundwater: 95% of the water used by the 20 000 industries of the metropolitan area comes from the aquifers, and the volume abstracted daily is close to 3 million m^3 (equivalent to 36 m^3/s), as compared with an aquifer recharge estimated at 1 million m^3/day only (Thailand Development Research Institute 1990). The preference of industries for groundwater is because of its cheapness, better quality and reliability.

Through the priority granted to it and its diversions from the Mae Klong river, Bangkok begins to compete with the rest of the delta and with neighbouring river basins. Its impact on the delta is not limited to water quantity but is also manifested by externalities in terms of land subsidence, flood, water quality and environmental degradation.

The federation of Thai industries has been periodically threatened by taxation of wells but has hitherto successfully warded off these threats arguing that international competition did not allow an increase in their costs (*Bangkok Post* 2000). The over-exploitation of aquifers continues and translates into dramatic land subsidence, a third of the capital being presently under mean sea level. Externalities in terms of increased sensitivity to floods, cost of raising and strengthening dykes, cost of pumping stations and instability of buildings are massive and distributed over the whole society. Instead of implementing demand management in the industrial sector, plans to go for costly (but at public expense) recharge of the aquifer by injection of water have been floated in the media.

By raising its protections and embankments Bangkok increases the magnitude of floods and shifts the risk on to neighbouring areas. The lower delta is morphologically a water-spreading area and the gradual expansion of the protected area increases the risk and the potential damages to unprotected areas. Dyking by farmers who diversify their production adds to this shrinking and therefore further increases the risk faced by those who cannot afford to protect their plots, generating a typical shift of externalities onto poorer segments of the society. In 1995, the west bank underwent dramatic flooding with major damage to roads and housing.

The lower delta canal system which serves both for supply and drainage is remarkable in terms of efficiency, since all drained volumes can be reused downstream, but this canal connectivity also contributes to diffusing the pollution generated in one point to a much wider area. The numerous canals that criss-cross the lower delta and radiate from the city have been transformed into open sewers. Since the coastal line of the delta is now closed[4], polluted water tends to stagnate in and around urban areas. This situation not only has a direct impact on public health in a traditionally aquatic urban environment but also impacts on peri-urban agricultural production. In the vicinity of Bangkok, the reuse of huge borrow pits as garbage dumps to stockpile – without any control – all types of urban waste also has a predictable (yet, so far, little studied) impact on the contamination

of aquifers. Fortunes are made in silence behind barbed wires: sites are not accessible to the public and occasional protests have been quelled by intimidation and other means.

Last, the city and agriculture find themselves in competition with the environment since the control of saline intrusion demands a constant minimum discharge of 50 m^3/s in the river estuary (and of 45 m^3/s in the estuary of the Tha Chin river) (Ruangdej 1994). A decrease of the river flow under this threshold, as observed in some critical years (e.g. 1999), entails the destruction of orchards (citrus, durian, etc.) located along the river and a concentration of pollution. The estuary is also heavily contaminated and the river contributes to the pollution of the sea by discharging heavy metals, organic matter, BOD load, and nitrates and potassium originating from agriculture (Wijarn *et al.* 2000; Pornsook and Ekachai 2003). The position of estuarine and coastal ecosystems as the most downstream part of the basin, and also as the weakest area in political terms, makes them highly vulnerable. A large part of the flux, which controls the intrusion of saline water, is now generated by wastewater released by the city. Impacts of environmental externalities generated by the city on human health, agriculture and coastal/marine ecosystems are considerable but have been, to date, the object of only a few measures.

Downstream–upstream connections: the delta and its water sources

Although located at the most downstream part of the basin, the Bangkok Metropolitan Area is able to deploy financial, political, discursive and symbolic power to shape upstream waterscapes and the basin water regime in ways that sustain capital-intensive growth. By doing so, Bangkok extends its power across scales and reverses the logic imposed by gravity to the direction of the water flow. This is predicated upon a control of the narratives associated with problems of flooding, water shortages and environmental degradation. Determining – or pointing to – the causes of both floods and water shortage that bedevil the lower basin and Bangkok is of great significance because it will establish responsibilities, legitimise certain types of interventions, as well as suggest who should pay for them.

Floods are a major threat to urban capital. Common wisdom strongly associates flood problems with the disappearing of forests, the natural 'sponges' that retain water, alleviating floods and sustaining flows in the dry season. Although the causal link between deforestation and run-off at the basin level has been scientifically largely discredited (Alford 1992; Walker 2003), its ubiquity in the media (*Bangkok Post* 2001a 2001b), official declarations and other accounts[5] are striking. Interviews of farmers in the countryside also reveal that the discourse has become ingrained in common wisdom. This discourse reveals a propensity to blame ethnic minorities (see above). It also echoes an urban environmentalist ideology for which northern Thailand, and the countryside in general, must be conserved in order to – in parallel with an idealisation of a pre-modern past – be consumed by an ecotourism in full development (Rigg and Ritchie 2002). This ideology is, ironically, also strengthened by the popular concept of integrated soil and water management, which enjoins us to consider the interactions between upstream and downstream parts of a river basin (*Bangkok Post* 2004).

This ideology is constitutive: it elicited and legitimised programmes of reforestation on a large scale and the design of new 'state enclosures', such as forest reserves, national parks and wildlife sanctuaries (Delang 2002; Sato 2003). These projects have often been, and are still, carried out to the direct detriment of populations whose livelihoods are dependent on these resources: gazetted areas already amounted to 51% of the national land in the late 1980s, although in practice many of these were encroached or used by local people (Hirsch and Lohmann 1989). The discourse depicting slash-and-burn agriculture as nefarious and backward lends support to the eviction of local communities (often Hmong people in the north) to the benefit of afforestation which is presented as modern and productive, thus sanctioning a transfer of benefits to the timber industry (or to tourists, in case of reservations). Ironically, commercial timber (e.g. pinus and eucalyptus) has a well-known depressing effect on local run-off and water availability.

These programmes have not gone unchallenged: NGOs proposed a *Community Forest Bill*, which would recognise the right of communities to manage their own resources. Access to information on legal issues, the support of NGOs and activists, and the Thai citizenship of some ethnic groups have been found to be the main determinant of success in the recognition of community rights on the ground (Johnson and Forsyth 2002). Access to upland resources by local populations is gained through a political struggle pitting agro-industrial interests, activists, rural communities, and the state (through line agencies and local administrative representations) against one another. 'Weapons' are not only money but also information on rights and laws, the media, international NGOs, ethnic stereotypes, and mainstream discourses on the causes of the water crises.

The dominant discourse on flood has had further striking spillover effects. Following heated debates

on illegal logging, concessions granted by the government (Lohman 1995), and the catastrophic inundations of 1988 (Lang 2002) the government decreed a ban on logging. Here again, despite the lack of scientific evidence of a causal link between deforestation and flooding on a large scale (Center for International Forestry Research 2004), the relative success of this ban (followed by a ban in China in 1998 issued for the same reasons) and the vitality of the illicit logging business have resulted in the shifting of tree felling to other countries with weaker state control, including Laos, Cambodia, Myanmar and Indonesia.

Flood has also been a godsend for interest groups that support the construction of more dams. Each event is followed by media declarations of officials explaining the unavoidable necessity of regulating flows through additional dams (Lebel *et al.* 2005). The RID (and a few private companies associated with it) has long seen such development as part of its mission. It has frequently borrowed from the symbolic and political power of His Majesty the King, a long-time supporter of dams as a means to control floods and provide irrigation water. The influence of the King in such issues is linked not only to his sheer interest in rural development and to his personal prestige but also to the traditional perception of the monarch as the provider of water (Kraisoraphong 1995). The Pasak dam, for example, has been justified, based on a call for its construction by the King, and proponents have aptly used this support to *de facto* silence opposition to the dam.

Water shortages have been the other main source of deployment of discursive power, with shifting manifestations of both the politics of scale and the 'politics of blame', depending on whether shortages affect cities or not. In the latter case, farmers are mobilised in a positive fashion and their 'needs', stigmatised by cracked soils and parched fields aired in the media, are emphasised in order to legitimise the construction of new dams or inter-basin transfers. Supplying water to farmers becomes an endless mission, where benefits are obvious but whose costs are hardly mentioned[6]. Blame is put on an exceptionally drought event, El-Niño, or 'growing needs' and the nature of demand is seldom questioned. The overcommitment of water by excessive expansion of irrigated areas mentioned earlier is not an object of debate.

But Bangkok, and other cities, despite the *de facto* priority they enjoy in times of shortage, may also be sometimes subject to restrictions in supply usually compounded by creeping of salinity into the Chao Phraya river. In such cases, the blame for such restrictions is usually apportioned to irrigators, and secondarily to upland hill tribes through the remobilisation of the forest 'sponge' metaphor (forests are natural 'sponges' that retain water and sustain flows in the dry season). Farmers allegedly squander water, insist on growing rice instead of less water-demanding crops, and stick to inefficient irrigation methods. Irrigation efficiency is constantly depicted as dismal ('two thirds of the water diverted to the crops is lost'), recurrently prompting water pricing policies supported by external actors, such as the Asian Development Bank, but never implemented. Insistent and exclusive focus on the farm level diverts attention from other causes and obscures the very different diagnosis that can be made when considering the scale of the delta: because of multiple water reuse (largely allowed by the massive investments in individual pumps made by farmers) very little water reaches the sea in excess of environmental requirements; at this scale, water use efficiency in the dry season has been shown to be as high as 83% (Molle *et al.* 2001).

The solutions found by cities to meet their growing needs generally minimise political costs and maximise gains to decision makers. Spatial redistribution of water or grabbing the resources from neighbouring basins usually proceeds along the 'path of least resistance' (Molle and Berkoff 2005). It is tempting to impose the environmental and economic costs of a water transfer on regions or categories of population with a lower bargaining power, and the financial costs on the country as a whole, while benefits tend to accrue to elites and urban investors whose profits are linked to the continuous growth of urban metabolism. The weakest parties are, in general, the next generations (here affected by the exhaustion and contamination of aquifers), the environment (impact of new dams, pollution of waterways, damage to estuaries and aquatic ecosystems, loss of biodiversity, etc.), weaker populations (rural communities affected by dams), and underpopulated neighbouring river basins.

All these pathways are associated with a supply augmentation logic, not with options such as demand management or the reduction of allocation to agriculture[7]. Bangkok has first gradually increased its diversion from the Chao Phraya and imposed a transfer from the adjacent Mae Klong basin, which constituted the less-stressing options. The 750 million m^3 Pasak dam constructed in 1999 to reduce flood risk in Bangkok could have provided timely additional supply to the capital; but by way of compensation to the provinces affected by the impoundment, an irrigation scheme of 25 000 ha has been planned downstream of the dam[8]. Each new reservoir comes with a new irrigation area and recurring shortages continuously justify the mobilisation of more distant or costly

water. The last project under planning contemplates pumping 3.8 Bm^3 of water from the Salween river (which forms the border with Myanmar) to increase the inflow to the Bhumipol dam via a tunnel which is to be excavated through the mountain range. Several other diversions from the Mekong river or one of its tributaries (the Kok river) have also long been envisaged.

Last, it is interesting to note how the basin water regime is influenced by overarching global discourses on water. The principles of IWRM have been actively promoted in the region by international institutions such as the Global Water Partnership and the ADB (Molle 2005). These principles have been somehow incorporated into local discourses and actor strategies. This promotion of IWRM, for example, inspired the setting up of River Basin Organisations (RBOs) in the 25 river basins of Thailand. This concession to orthodoxy has however not been paralleled by a transfer of power on planning and management from the Ministry of Agriculture to the Ministry of Natural Resources and Environment (MoNRE), which is formally in charge of RBOs, and the achievements of these organisations have remained very modest. The politics of scale are here fully revealed in the attempt by MoNRE to establish the river basin scale as a new layer of decision-making where it could build and assert its power, redefining and reordering the distribution of roles and responsibilities. The basin scale is both an opportunity for the RID to perpetuate its power over infrastructural planning and a potential threat if it is invested by MoNRE and if this ministry is endowed with increased power over management of natural resources; or if room is made for genuine stakeholder participation in issues such as planning and water allocation. This explains why participation has so far been largely confined to scales, namely the tertiary canal level (water user groups) and watersheds that are no threat to these crucial functions.

While IWRM supports inclusive processes of decision making meant to achieve more socially balanced and environmentally sound outcomes, some consultant firms have embraced the concept to legitimise basin-wide master plans[9] that little differ from earlier planning exercises, although they abundantly resort to the participation rhetoric (Molle 2005): participation is measured by the number of meetings carried out at the village or sub-district level at which people are requested to establish lists of desirable projects. These 'local projects' are painted as derived from bottom-up processes and also serve as a fig leaf for the large-scale projects of the plan which, because they are not 'local' in scale and too technical, are not submitted for people's approval.

Discussion and conclusions

This paper has examined how the development of the Chao Phraya basin was staged through the competition of actors as varied as farmers of the various subregions, urban and industrial interest groups, resort owners and illegal loggers, provinces in the basin as well as neighbouring river basins, the hydropower and agribusiness sectors, politicians, line agencies, grassroots and green NGOs, the media and the academia.

Some of the scalar interactions within the basin (and with its surroundings) are summarised in Figure 2. Interactions first occur at a local scale: in small valleys, communal irrigation systems can compete with one another, or with tourist resorts, and all of these may conflict with upland farmers diverting water to their orchards. In the delta, similar conflicts may occur between paddy and shrimp farmers, or between farmers all seeking to 'attract' water in the dry season. Such proximate conflicts are often addressed by people locally but they have also frequently spilled over across scales to involve outsiders (academics, urban-based NGOs, etc.), or the national media (e.g. flood and pollution problems, dam controversies, etc.). When power asymmetries are too large, the externalities generated remain unabated and little challenged (land subsidence from aquifer over-pumping, urban pollution on estuarine ecosystems, contamination from toxic landfills, reallocation of irrigation water to Chiang Mai and Bangkok, etc.).

Interactions between sub-parts of the basin, typically the middle and lower parts, are more complex to apprehend and largely removed from public scrutiny: the power of the (agricultural) delta appeared to be limited since it could not oppose the rhetoric of interregional equity in favour of development of irrigation in the middle basin; the power of Bangkok-based water managers at the RID was also challenged by the uncoordinated development of individual and village-based pumping stations and the difficulty in monitoring actual diversions to some schemes.

At the basin level, the discretion of the state remains high, although attempts to design new dams and inter-basin transfers may be thwarted by opposition from civil society, but dam management improved after public outcry in the media. Basin-scale water allocation, however, remains largely under state control and initiatives aiming at raising participation of stakeholders have been confined to local scales (the tertiary canal in irrigation schemes or the watershed).

Yet, people's agency is displayed at various scales: locally they tap alternative sources of water (aquifers, ponds, drains, rivers), adapt crops and

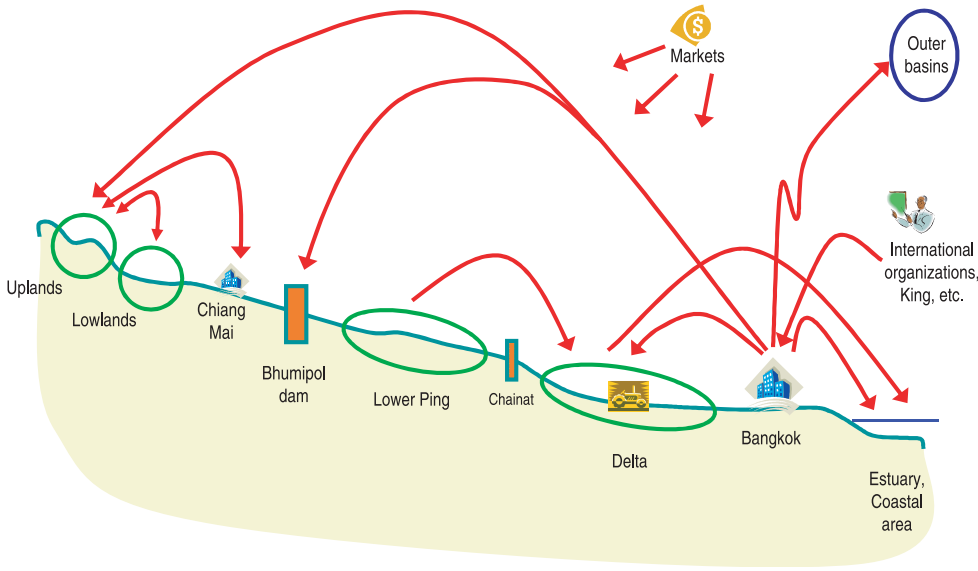

Figure 2 Scalar interactions in the Chao Phraya river basin

cropping techniques, design their own catchment organisations in opposition to top-down government initiatives, resort to a variety of political channels and elicit interventions, associate with academics, use the media or direct demonstrations to project their struggles, and borrow discursive power from environmentalism or wider discourses on grassroots democracy or local knowledge. Conflicts also reveal that the state administration is not homogenous: the shrimp vs. rice farming issue, with its environmental implications, created a rift between the Agriculture Department and the Land Development Department. The river-basin scale became a valuable but contested asset coveted by both the Ministry of Agriculture and the MoNRE, with some officers pushing for more environmentally friendly management of water resources.

Power has been shown to flow and extend across scales in a direction opposite to water flows. Bangkok tends to dominate the delta, the delta tries to maintain (with some difficulties) its privileged access to water in the basin and to impose its logic to ethnic minorities in the north, and the basin tends to expand its grasp on the resources of neighbouring basins and countries. This is accomplished not only by mobilising political and financial power but also by discursive resources: flawed hydrological knowledge used to justify conservationist strategies in the upper catchment in the form of state enclosures (national parks or sanctuaries, forest reservation and afforestation areas), strategies that found common ground with ethnic prejudices and other strategic interests (consumption of nature by urban elites, control of logging, national security concerns on the frontier with Myanmar, control of hill tribe populations, etc.); IWRM best practices, allegedly sanctioned by international experience, are mobilised to adjust to global policy discourses while keeping control on allocation and infrastructural planning, or are hijacked by consultant firms to further business-as-usual strategies under a new guise; control of narratives on the causes of floods and droughts distributes blame at certain scales and allows the promotion of supply-augmentation options that gradually expand the footprint of the basin on neighbouring areas.

This provides a striking example of a multi-scale causal chain: alleged global economic competition is used by the Thai Federation of Industries to oppose regulation of groundwater use, thus compounding land subsidence in the capital, which contributes to the need for further costly dyking, increases damage in neighbouring areas and elicits a ban on logging, and triggers the spread of illegal activities in neighbouring countries with attendant impacts on the poorest rural populations. Although other effects link to each of the 'nodes' of this causal chain, it well exemplifies the multi-scale complexity and linkages of socio-environmental transformations. Such processes constantly generate and/or redistribute benefits (e.g. to urbanites, tourists, industries or shrimp farmers), costs (e.g. to highlanders, rice farmers, ecosystems, or neighbouring countries' rural population), and risks (e.g. higher flood damage

in non-protected areas, contaminated drinking water) in ways that are both spatially and socially uneven.

In sum, in contrast to the view of water resources development and management as a technical issue requiring more capital, expert knowledge and reformed institutions, the Chao Phraya river basin appears as a much more complex arena where knowledge and power asymmetries shape a particular pattern of access to water resources that is constantly challenged and redefined, illustrating the mutually constitutive relationship between socio-economic dynamics and environmental change.

Notes

1 This paper draws on and develops an earlier communication to the 4th Conference of the International Water History Association (Molle 2005). It is partly based on research funded by the Comprehensive Assessment of Water Management in Agriculture (http://www.iwmi.cgiar.org/Assessment/Synthesis/index.htm) and on over 7 years of research in the Chao Phraya river basin.

2 A waterscape is defined here as comprising the surface water and groundwater resources of an area of land and both their relationships with other physical, climatic and biotic elements, and their interaction with human activities. It is an expression of interaction between humans and their environment.

3 These canals do not have the same sill level and, therefore, are not impacted uniformly.

4 The different streams which connect the delta to the sea are controlled by regulators or dykes, which allow the conservation of freshwater inland, avoiding its flow to the sea, together with the intrusion of saline water at high tide.

5 A typical example is the head of Royal Projects who was reported to explain how the forests used to help regulate water flows and to liken the role of forests with that of dams, stating that 'Once the forest grows [back], the need for dams can disappear naturally' (Fahn 2003, 85).

6 Refer to this declaration of an official at the Royal Irrigation Department: 'water distribution doesn't completely cover those irrigation areas; we've lost a balance between storage and distribution'; and the comments of a high-level officer: '. . . We know the problem . . . if water can't be distributed to people, maximum benefits will not be attained' (*Bangkok Post* 2003).

7 Much to the contrary, in 2003, Thailand was considering multiplying its irrigated area by three through the 'Water Grid' project of the Thaksin administration (see Molle 2005).

8 The same situation was observed with regard to the ongoing construction of a dam on the Nakon Nayok river, which also contributes to the delta.

9 Two consulting firms, for example, recently (2003) drew a Master Plan for the Ping river on behalf of the Ministry of Natural Resources and Environment and claimed that 'it was the first time basin management and integrated plans for water resources management were applied to solve the problems of drought, flood and water quality'.

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