ENVIRONMENTAL GOVERNANCE: A MEKONG DELTA CASE STUDY WITH DOWNSTREAM PERSPECTIVES

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1. The Mekong Delta

The Mekong Delta (MD) is the most downstream part of the Mekong River Basin. In this report, MD refers to the section of the delta in Vietnam. With a population of 17 million inhabitants living in four million hectares of land, the MD has great potential for agricultural production. The area supplies more than 50 percent of staple food and 60 percent of fish production for all of Vietnam, and accounts for 27 percent of Vietnam's total GDP. Rice and fish products contribute significantly to the country's export earnings.

The Mekong River is the main water resource, and the only one in most places in the delta, for irrigation, fishing, domestic use, etc. The entire population of the MD now depends and will continue to depend on this resource for its livelihood. With a burgeoning economy heavily based on agriculture, the region is facing more and more severe environmental problems, especially within the past ten years, such as the pollution of water resources by pesticides, herbicides, and fertilizers. While most local farmers depend entirely on surface water for drinking, irrigating their crops, fishing, and aquaculture, protection of water resources is crucial to ensure the sustainable development of the MD.

2. Water Problems

Any upstream activity causes changes in river discharge that might have either negative or positive influences on the MD. The tendency of impacts (+ or -) depends largely on several factors:

- Where the impacts are (acid sulphate soils, salinity intrusion, alluvial soils, flood-prone areas)?
- Under what conditions and through what activities that impacts occur (shrimp culture, rice, mangrove)?
- In whose view are the impacts being evaluated (farmers, fishermen)?

Currently, the MD is plagued by the following problems, whose degree of severity largely depends on upstream activities.

2.1 Shortage of Fresh Water for Irrigation in the Dry Season

The Mekong River is the only source of irrigation for dry season crops, which are the main source of income for local farmers. During the mid-dry season (March-April), the maximum water demand, mostly for irrigating rice fields, coincides with minimum discharges from the river. In 1999, a total area of 1.4 million hectares of spring rice crop (dry season crop) required irrigation. Water demands have increased proportionally with increases in the area under rice cultivation. From 1995 to 1999, newly reclaimed areas available for rice cultivation increased by 105.000 hectares/year (Statistical Yearbook, 2000).

Water use in the Mekong Delta in 1995 was more than 210 mm^3 of a total of 534 mm^3 used by all of Vietnam (Phan Xuan Su, 1996).

It is obvious that any activities that reduce river discharge in dry seasons will increase the degree of severity of this particular problem. In the future, as a consequence of irrigation development in upstream riparian countries, it is likely that water resources left for the MD will be more restricted (Hoang Tho Dien, 2000)

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2.2 Flooding

An area of 1.2 to 1.9 million hectares of the MD is affected by annual floods. Both the degree of severity and the frequency of the floods have increased. Within the past forty years, four substantial floods occurred in the following years: 1961, 1978, 1991, and 2000. This year, Vietnam is experiencing one of the largest and most damaging floods in 70 years. Presently, 54 districts and towns are under water; 760,000 houses are submerged; 67,000 families have been evacuated; 319 lives have been lost, of which 236 were children; and the net loss has been evaluated at 4,000 billion VN Dong (US$300 million).

However, the floods are not necessarily always viewed as an "enemy" by local farmers. Benefits from flooding are identified as:

- **Fish** – the main source of protein for local farmers;
- **Sedimentation** – regarded as a natural fertilizer by farmers; and
- **Flushing toxicity from acid sulphate soils** – floodwater has been utilized by farmers to improve the quality of acid sulphate soils by removing toxicity released from the soils. An extremely large amount of water is needed to dilute the leachate in order to prevent negative impacts to the environment (Minh, 1998).

Dams can obstruct sedimentation movement and create a silting zone in the reservoir and change the sediment load regime (Axelsson, 1992). Dam construction would most likely affect the fertility of the MD.

2.3 Acid Sulphate Soils

Acid sulphate soils, which form when soils containing iron sulfide are exposed to oxygen, cover 1.6 million hectares (40 percent) of the MD (Minh et al., 1996). Soils with high iron sulfide content do not usually become a problem so long as the soil remains inundated (Brinkman, Ve et al., 1993).

Acid sulphate soils are sensitive to fluctuations in river discharge. In the rainy season, a large discharge from the rivers is necessary to leach and flush toxicity released from the soils before any crops can be cultivated. This activity is highly water-intensive (Minh et al., 1997a). During the dry season, in order to maintain a certain groundwater level to prevent oxidization of pyritic substances, a minimum river discharge is needed. Reduction of river discharge in the dry season can lower the groundwater table in the MD, eventually causing the soil and water to become more acidic.

In order to cultivate in acid sulphate soils, improving soil quality is essential. Heavy leaching requiring a large amount of fresh water is a common practice. The leachate will ultimately be discharged into the river, which may cause water pollution and is another reason for the reduced size of the fish population.

Originally, acid sulphate areas were covered by natural forests of *Melaleuca sp.* Recent studies (Minh and Chiem, 2000; Ni, 2001) show that this type of forest helps to reduce pollution caused by acidity. Forests grow on undisturbed soil, while cultivated crops need ploughed soils. Soil disturbance will increase the acidity discharge (Minh, 1998). Opening up this soil for rice cultivation in the Plain of Reeds has caused significant pollution (Tran Duc Kham, 1988).

2.4 Salinity Intrusion

Currently, 1.7 million hectares of the delta (42 percent) is affected by salinity intrusion (SIWRMP, 1995). Salinity intrusion is the principal limiting factor in agricultural production (most of the area is under mono-crop rice cultivation), where most of the poor provinces with a high ratio of poor farmers are located. Shortage of drinking water is another constraint for local people. In order to prevent further salinity intrusion, it is necessary to keep flows from dropping too low (WB-ADB, 1996).

Extension of areas affected by salinity intrusion, shown in Figure 5, are influenced two different factors: tidal movement and river discharge. In general, the higher the discharge, the narrower the area of salinity intrusion. Therefore, reduction of river discharge by storing water upstream or by diverting the mainstream water body to other catchments will affect the salinity intrusion zone in the MD.

More fresh water available in the dry season could destroy the shrimp culture and can cause damage to mangrove forests and wetlands. These ecosystems are very fragile (NEDECO, 1993).

Table 1: Conflicts in resource utilization in the salinity intrusion areas

Land-use	Resource	Policy
Rice and shrimp	Water ▪ Rice: fresh water ▪ shrimp: saline water	▪ Food safety ▪ Exporting ▪ Land use policy
Shrimp and mangrove	Land	▪ Exporting ▪ Environment ▪ Land rights policy

In this area, several conflicts exist in land use systems, namely between shrimp and rice cultivation. Shrimp cultivation requires saline water, while rice needs fresh water.

The expansion of shrimp farms into mangrove areas and the removal of forests for shrimp cultivation can be found in the region.

2.5 Environmental Problems

An expanding economy heavily based on agriculture, coupled with a dense population (228 inhabitants per square kilometer, higher than China's 132 inhabitants per sq. km (Le Quy An, 2000) forces the region to confront increasingly severe environmental problems, such as:

- Pollution of water resources by pesticides, herbicides, and fertilizers, especially in the past ten years (Le Quy An, 2000). Water in large parts of Mekong delta has been polluted by agricultural activities, including soil reclamation (Tran Duc Kham, 1988; Minh et al., 1997c). Local farmers depend entirely on surface water for drinking, irrigating their crops, fishing, and aquaculture.
- Deforestation, especially in the mangrove belt along the coastline and *Melaleuca sp.* forests found primarily in acid sulphate soils, is another problem in the region. *Melaleuca* forest area has been drastically reduced, from an estimated 700,000-800,000 hectares in 1940 to 140,000 hectares in 1992 (Miller et al., 1999). Several causes of the damage have been identified, of which population growth and poverty are emphasized (Ni, 1997). Mangroves in Vietnam prefer the silt-clay soils of the delta coast with moderate salinity. Too high or too low salt content strongly influences the well-being of mangroves (Phan Nguyen Hong and Hoang Thi San, 1993).
- Depletion of natural resources, including land, water, flora, and fauna. Wetlands in the Mekong Delta are fragile systems (NEDECO, 1993), and are under threat by rapid population growth in the region (Nguyen Hoang Tri, 1995).

3. Resource Management Policies

3.1 National Policy Framework

The following is a list of laws, governmental decrees, and directories related to environmental issues:

- Law in People's Health Care (1989)
- Governmental decree on Environmental Protection and Fishery Resources (1989)
- Forest Protection and Development Law (1991)
- Environmental Protection Law (1993)
- Water Resources Law (1998)
- Articles related with environmental protection in Civil Code (1995) and Criminal Code (2000)

In 1998, Vietnam issued the Environmental Norm, consisting of about 200 items and standards of allowable levels in water, soil, air, and noise.

3.2 Some Important Resources Management Policies in the Mekong Delta

3.1.1 Watershed management and reforestation program

The target of this program is to reforest an area of five million hectares by 2020, bringing the forest coverage area in Vietnam to 47 percent (currently 29 percent).

This program will improve the environment in general, and will contribute significantly to improving water resources and flood control in Vietnam, especially in Central Vietnam. However, more research is needed to ensure smooth implementation of the program. In the MD, conflict between mangrove reforestation and shrimp cultivation, for example, could be the focus of policy research. The new plan by the Ministry of Agriculture and Rural Development (MARD) to expand the total area of shrimp cultivation to 500,000 hectares by 2005 might have negative impacts on water quality and might cause further reduction of mangrove forest coverage.

3.2.2 Food security and rice export

This year, Vietnam will produce 33 million tons of rice. Together with the population growth, expansion of rice cultivation in the Mekong Delta (Figure 4) will be a heavy burden on the environment.

A policy of balancing agriculture development and environment protection is crucial for sustainable development in the region (Minh, 1996). More rice cultivation might claim wetlands, forest, etc. Cultivation of high-yielding rice varieties might cause water pollution by agro-chemicals and fertilizers (Ongley, 1996).

3.3.3 Management of problem soils

A large part of the MD is affected by problem soils. "Management" of these soils can have several implications:

- Improving soil quality for agricultural purposes – this is the most likely scenario.
- Keeping the area intact for conservation – this is the ideal but the least likely option.
- Reforesting part of the problem soil area – this scenario is likely under the new reforestation policy to cover about half of Vietnam's surface area.
- Allowing optimal development and human interference under legal regulations – this is the most realistic scenario. In this case, studies on what are optimal conditions and under what kind of regulations will be key.

A summary of the consequences and related policy research issues can be found in Table 2.

From a policy and regulatory standpoint, one can clearly observe that the political will exists to protect the environment in Vietnam. To carry these policies out, there are two institutions under the Ministry of Science, Technology and Environment (MOSTE): the Environment Office in MOSTE and a Provincial Department of Science, Technology and Environment in each province. At the district level, similar organizations have been established.

Table 2: Analyzing the three most environment-related priorities for development in the MD

Priority	Possible consequences	Policy research issue
Reforestation	- Conflict with other land uses: fruit tree planting, shrimp cultivation, etc. - Inequality—widening gap between rich (resource control) and poor (labor)	Policy to effectively and fairly implement the program
Food security and agricultural exports	- More water pollution by overuse of agro-chemicals - Reduction of wetlands, reducing biodiversity	Development plan balanced between agricultural production and environmental protection
Management of problem soils	- More water pollution by toxic elements from problem soils - Reduction of wetlands - More water needed to leach the soils and to dilute the effect	Clear definition and objectives in policy for the term "management"

4. Roles of Provincial Authority

The roles of provincial authorities in environmental protection have not been well documented. Many studies focus on basin-level actors, such as the World Bank (WB), the Asian Development Bank (ADB), and the Mekong River Commission (MRC), and on national-level governance, such as legal frameworks, laws, structure of ministries involved, etc. Much less attention is given to the provincial (or district) level. However, where and how policies are interpreted, implemented, and realized at the grassroots-level is an important link in the chain. The translation of policies into reality based on specific conditions in the province can be the most crucial step in the whole process.

Functioning under the same strong political will from the central level, as mentioned earlier, not all provinces in Vietnam as a whole, and the MD in particular, can successfully translate policies into reality. Several good examples of environmental protection, however, can be found in Ho Chi Minh City, with its monitoring system (Le Huy Ba, 2000), Dong Thap, with its National Crane Reserve (Choowaew, 1992), and Ca Mau, with its mangrove protection efforts.

At provincial level, decision-makers have to:

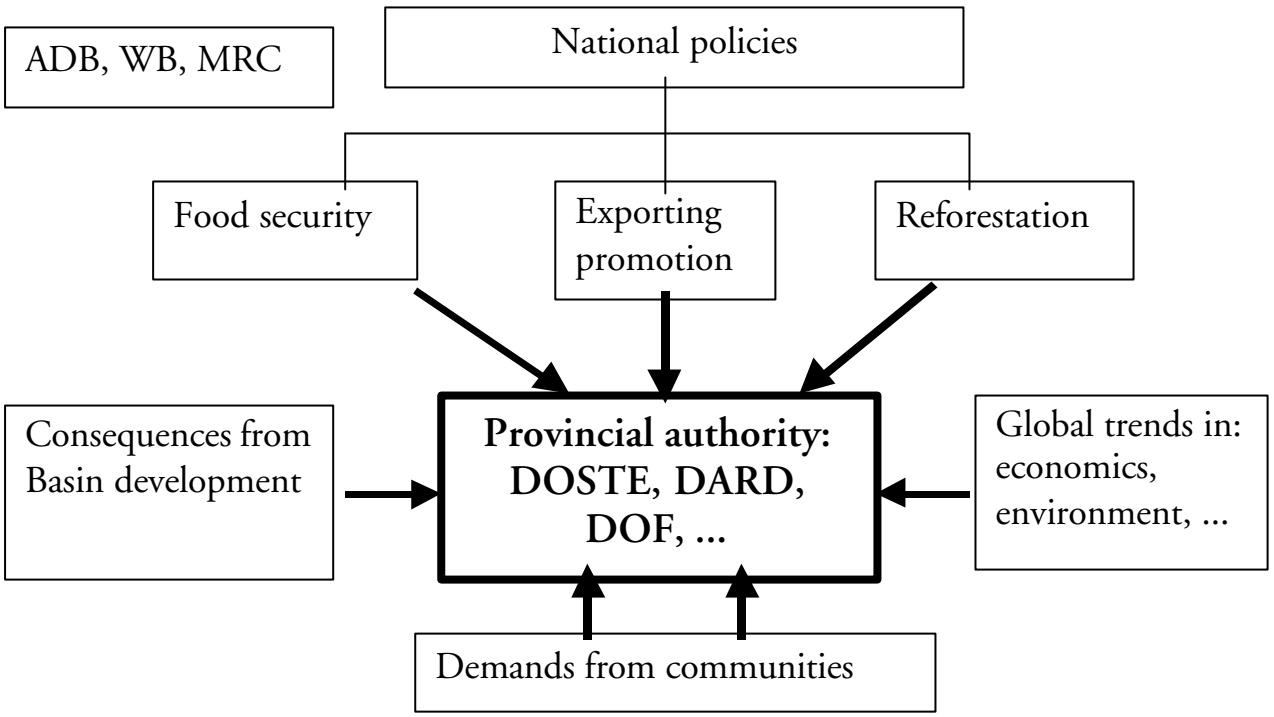
- Realize policies from central government;
- Implement guidelines and national programs;
- Use budgets properly, which is limited in the case of Vietnam; and
- Implement the immediate needs of the province.

At the same time, decision-makers have to meet many diverse demands from the grassroots level. If one simply sums them up, these demands stretch beyond the limitations of the national budget.

On top of the pressures provincial authorities receive, they still have to closely observe "development trends"' in the Mekong Basin, which might have impacts downstream. They must watch price fluctuations of agricultural commodities in international markets, global trends of environment, global warming, air pollution, etc.

Their list of immediate issues is quite long, as economic growth of the province, poverty reduction, social services such as schools, rural clinics or community health care centers, drinking water for villagers, etc., and environmental protection are among top priorities.

Figure 1: Important roles of provincial authority in implementing and realizing national policies



The Department of Science, Technology and Environment (DOSTE) is the main actor for implementing policies and enforcing environmental protection law. In some provinces, this department cannot function properly because of understaffing, lack of a well-trained staff, budget shortages, and lack of equipment (Le Huy Ba, 2000).

Decision-making at this level is often based on four categories: (1) urgency of the issue, (2) knowledge of the decision-makers about the issue, (3) budget or resources needed, and (4) image impact of the province.

Although often prioritized with high urgency, in some provinces decision-makers do not always make environmental protection a top priority because of limited knowledge or the high budget required. Compared with other locally urgent issues such as economic growth, poverty reduction, and social services, environmental protection is at a lower position on the priority list.

Because national policies are issued for the whole country (with seven different environmental regions each having different natural conditions), one particular province or one region might face conflicts in these policies. Provincial leaders interpretative skills are an important contribution to the success of environmental protection.

5. Transboundary Cause-Effects of Upstream Changes to the Mekong Delta

Construction of large dams, reservoirs for hydropower, irrigation, and water diversion upstream will change the characteristics of water flows. Several possible impacts are identified in Table 3. Assessments of these impacts have not been carried out in holistic ways taking into account differences in:

- Views—engineering, socio-economical, environmental, etc.;
- Scales—nation, project, community, etc.;
- Approaches—top-down vs. bottom-up; and
- Locations—upstream vs. downstream.

Main questions:

- Is the sum of all of the gains from upstream development (electricity, irrigation, etc.) higher, equal or lower than all of the losses downstream (fish, environment, wetlands, etc.)?
- What will be permanent losses? How can this be assessed? What will be temporary losses? Can any mechanism be created to "compensate" for the losses?

Table 3: Summary of possible impacts to the Mekong delta caused by the changes in the basin

Activities	Downstream changes	Likeliness	Negative impact	Positive impact
Dam construction	Fish migration blockage	+	Fish population and number of species	
	Lower sediment load	+	Soil fertility Fish population	Reduction of river mouth siltation
	Higher flood buffering capacity, rainy season	?	Fish population	Flood damage reduction
	Higher river discharge, dry season	?	mangrove, shrimp cultivation	Reduction of acidification
River diversification	Reduction of river discharge, dry season	+	Rice area, mangrove forest, fish	Shrimp cultivation
Deforestation	Higher flood severity and frequency	+	Life, infrastructure agriculture losses	Acidity and agro-chemical removal
	Higher sediment load	+	Fish population, siltation	Soil fertility

+ likely ? doubtful

The possible reasons for the question marks in Table 3 are:

- Reliability of calculations/assumptions/hypotheses. Good systems of analysis do not always exist. They are different in scale and/or methodology and are sometimes the outcome of computer models or a kind of mathematical black box (i.e., only programmers really understand strengths and weakness).
- There are no clear operational schemes of these structures available. Rule curves to dictate the operational schedule of a dam after construction are sometimes different from the "designed"' curve. Scenario analyses to justify the construction do not necessarily coincide with what happens in reality.
- Collaboration between countries in the region is the most important factor that decides the directions of impacts—the more collaboration the less negative impacts downstream.
- Sources of data/information are scattered and mostly consist of mono-disciplinary or unbalanced approaches.

6. Proposed Research Issues

6.1 Mechanisms for Local Community Participation in Development Planning

Livelihoods of farmers and local communities in the Mekong delta depend heavily on the water flow from the river, whose characteristics are changing from human activities and other factors upstream. Local communities must understand these changes in order to adapt their lifestyles. The urgent need to incorporate local community views into development policies has been identified and strongly recommended in many international workshops and conferences—the question is how to incorporate these views. More study is needed concentrating on an effective process to bring their voices into the planning process, via:

- Direct participation and consultation in the planning process;

- Research teams in the above-mentioned network institutions;
- National representatives; or
- A combination of the three above-mentioned ways. In this case, the questions are "who is doing what?" and "what goes where?"

6.2 Identifying Causes/Effects of Changes in Water Regimes

A comprehensive research program with a network of multi-disciplinary researchers located in different upstream and downstream regions, like the Resources Policy Support Initiative (REPSI), can help identify cause-effect irregularities in river flow regimes. The results of this study can be used to predict fluctuation tendencies of water regimes; that, in turn, helps policymakers to develop a long-term vision to cope with "irregularities."

The main questions are:

- To what extent does deforestation affect the water regime?
- How does global warming influence rainfall?
- To what extent does dam construction and/or water diversion change flow characteristics? And, as a consequence, how do these activities affect soil acidification and environment in the MD?

6.3 Systematic Study on Legislation and Function of Institutions Involved in Implementing Water and Natural Resources Protection Policies

Inconsistencies and overlap between different laws that regulate water and related resources, such as water laws, forest laws, environmental protection laws, land laws, etc., can hinder achievements of the overall goals of these laws.

Incompetence of the agencies implementing the laws and policies is sometimes the cause of confusion and overlap in responsibility.

6.4 Research on the Linkage between Poverty and Natural Resource Depletion

Poverty alleviation is a top priority in the MD. However, almost all government poverty alleviation projects have been designed separately from natural resource protection efforts. In addition, environmental protection programs are isolated from poverty alleviation programs. More research is needed to show policymakers the strong linkages between these two issues. Incorporating them into one comprehensive program will help reduce costs, minimize risks, and increase the efficiency of investment.

6.5 How can Policies and Policymakers Balance the Immediate Needs of Feeding an Exploding Population with Long-term Environmental Protection?

More research is needed to provide answers to this question. Studies can be design to show that environment protection is the only way to secure sustainable development. Over-exploiting a resource will give short-term gain but long-term loss. When economists can provide better tools to assess the total gains and losses in terms of facts and figures, policy can easily change or adjust accordingly. Tentative linkages between mangrove removal and the outbreaks of shrimp diseases have been identified by research at Cantho University. Cutting more mangrove might cause more damage to the shrimp population and hinder profits from shrimp cultivation.

7. Conclusions

1. The complexity of the interrelation between water, soils, and human activities in the Mekong Delta is sometimes not well documented. Downstream impacts of upstream development have been simplified. More studies are needed to provide policymakers with a clear picture of cause-effect relationships in the region. Guidelines and tradeoffs between rice production, shrimp culture, and environment are still needed.

2. One upstream activity might have different downstream impacts, negative to one actor while positive to another, depending on where the impacts are and who is affected. One cannot take for granted that the "construction of dams will reduce flood discharge and increase dry season flow (if it is realistic), *therefore improving agricultural production and livelihoods of farmers.*"

3. In Vietnam, the central government's political will to protect the environment can clearly be observed from laws, decrees, directories, etc. that have been issued. Government structure is also organized in such a way that these can be implemented.

4. Without proper regional coordination, well-intended policies can cause conflict, such as shrimp cultivation versus mangrove protection; increasing rice-exports versus preserving wetlands; land reclamation versus preserving wetlands and biodiversity, etc. Balancing these interests and policies is not always feasible. Corresponding guidelines have not been developed and research results are not available.

5. Provincial authorities play a crucial role in implementing environmental protection policies. Their role has been underestimated in past studies, which have concentrated on regional actors, such as the WB, the ADB, the MRC, and national-level actors (government, ministries, etc.), and then jump all the way to grassroots/community-level actors, bypassing provincial authorities. Evidence shows that different provinces implement similar policies in different ways, based on different well-intentioned interpretations.

8. Figures and Maps

Figure 2: Common rice cropping calendar in the Mekong delta (shows the dependence of rice crops on water regimes)

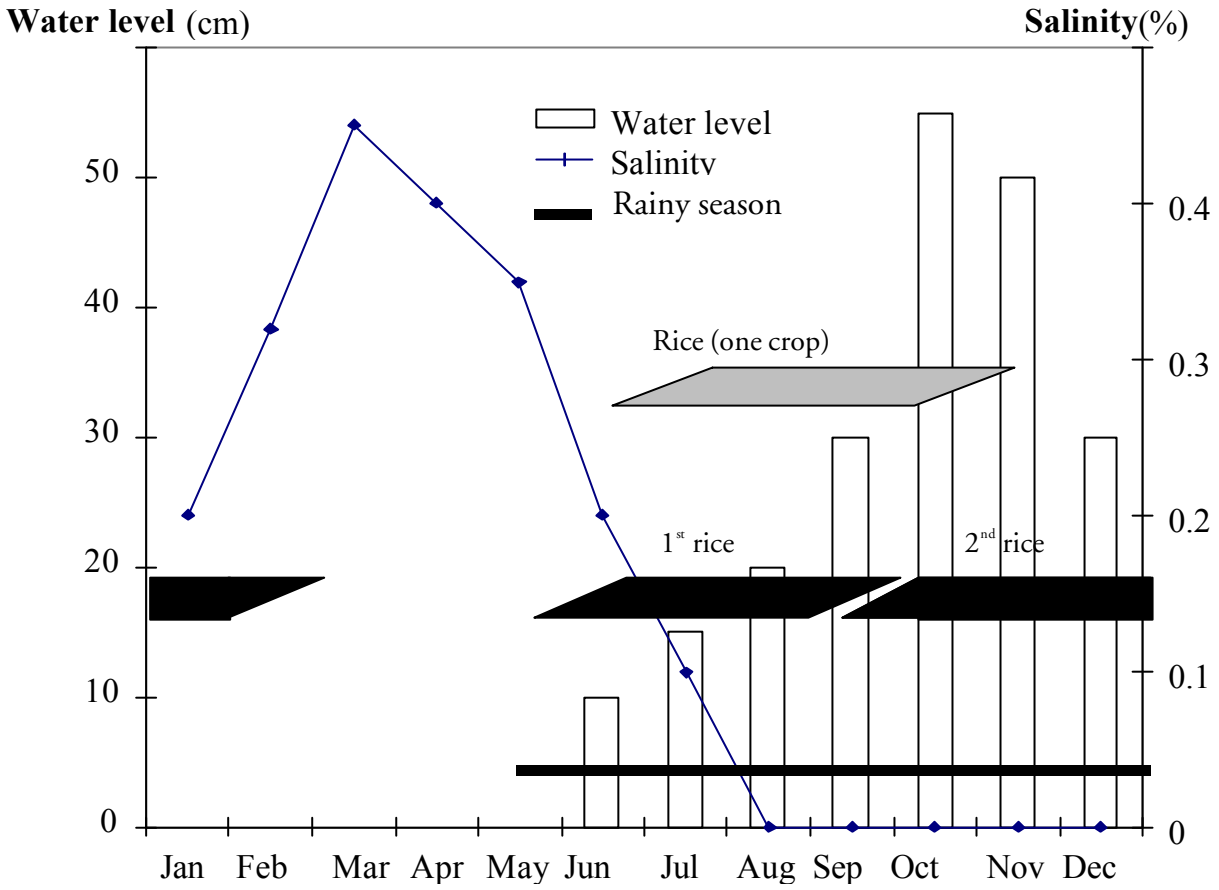
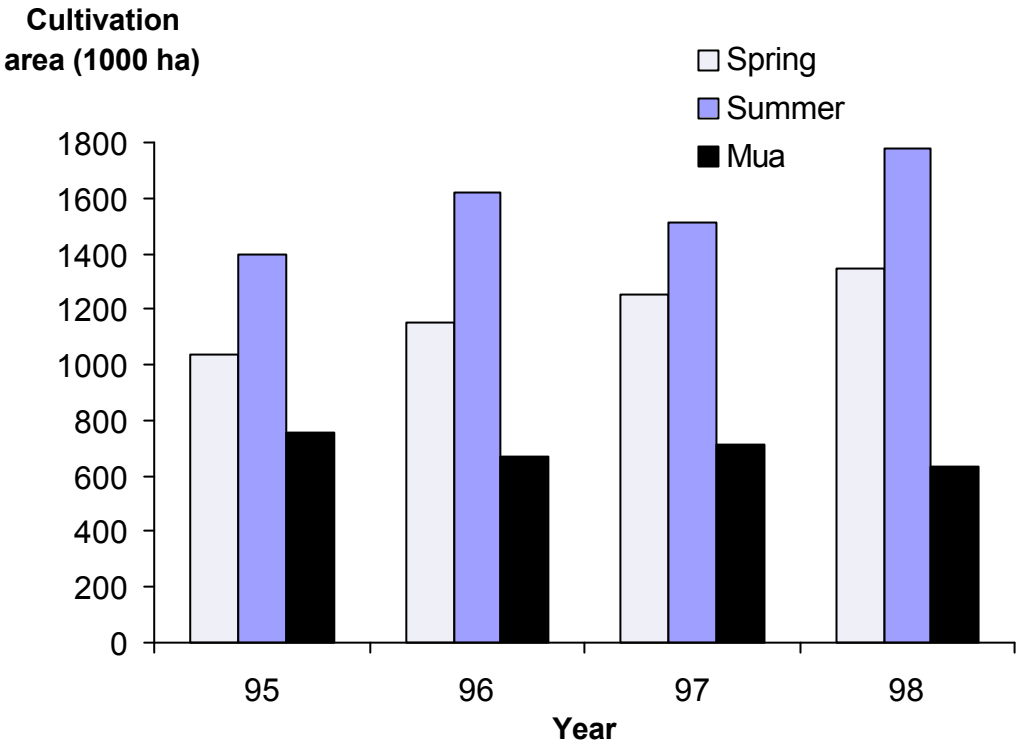
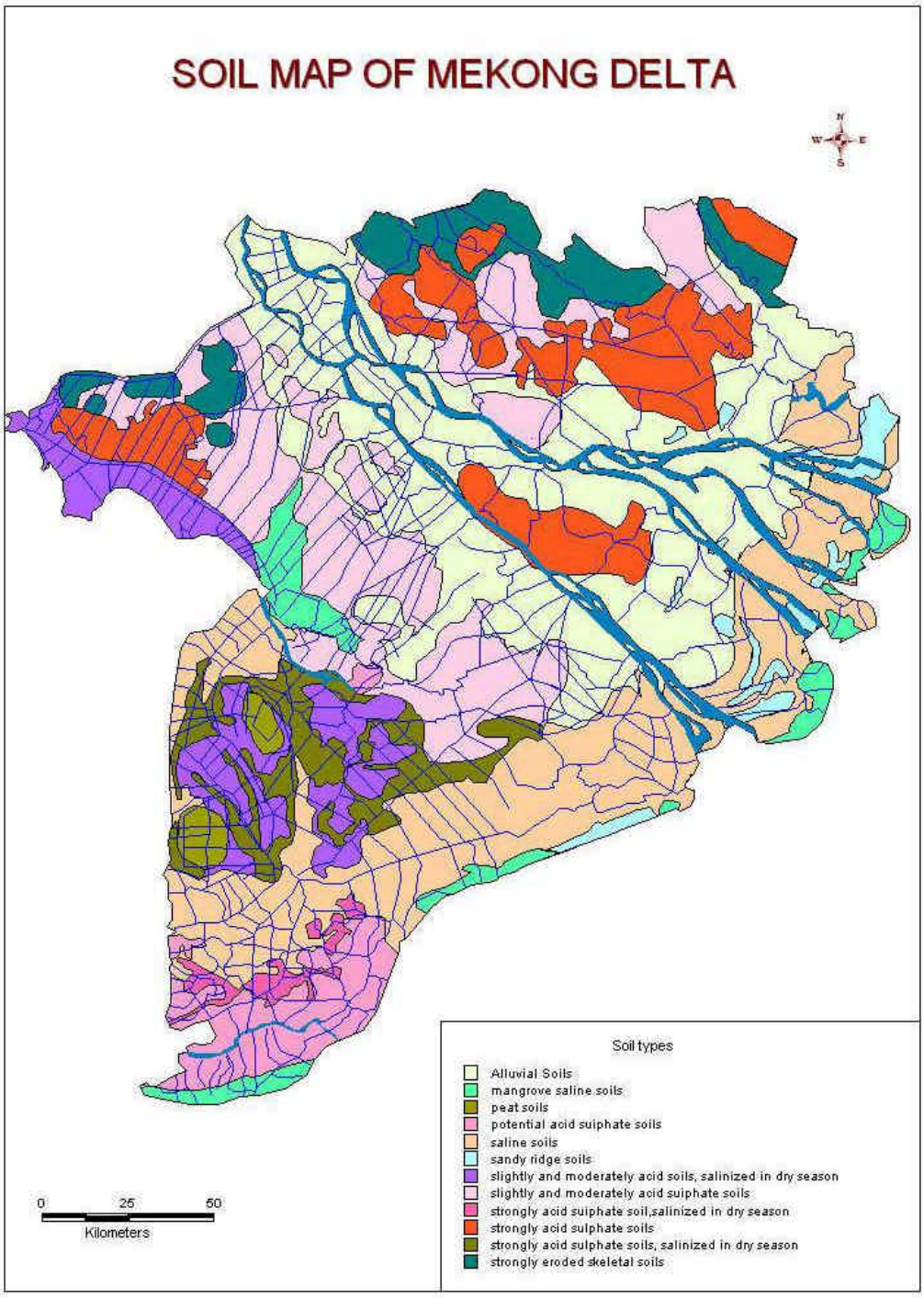


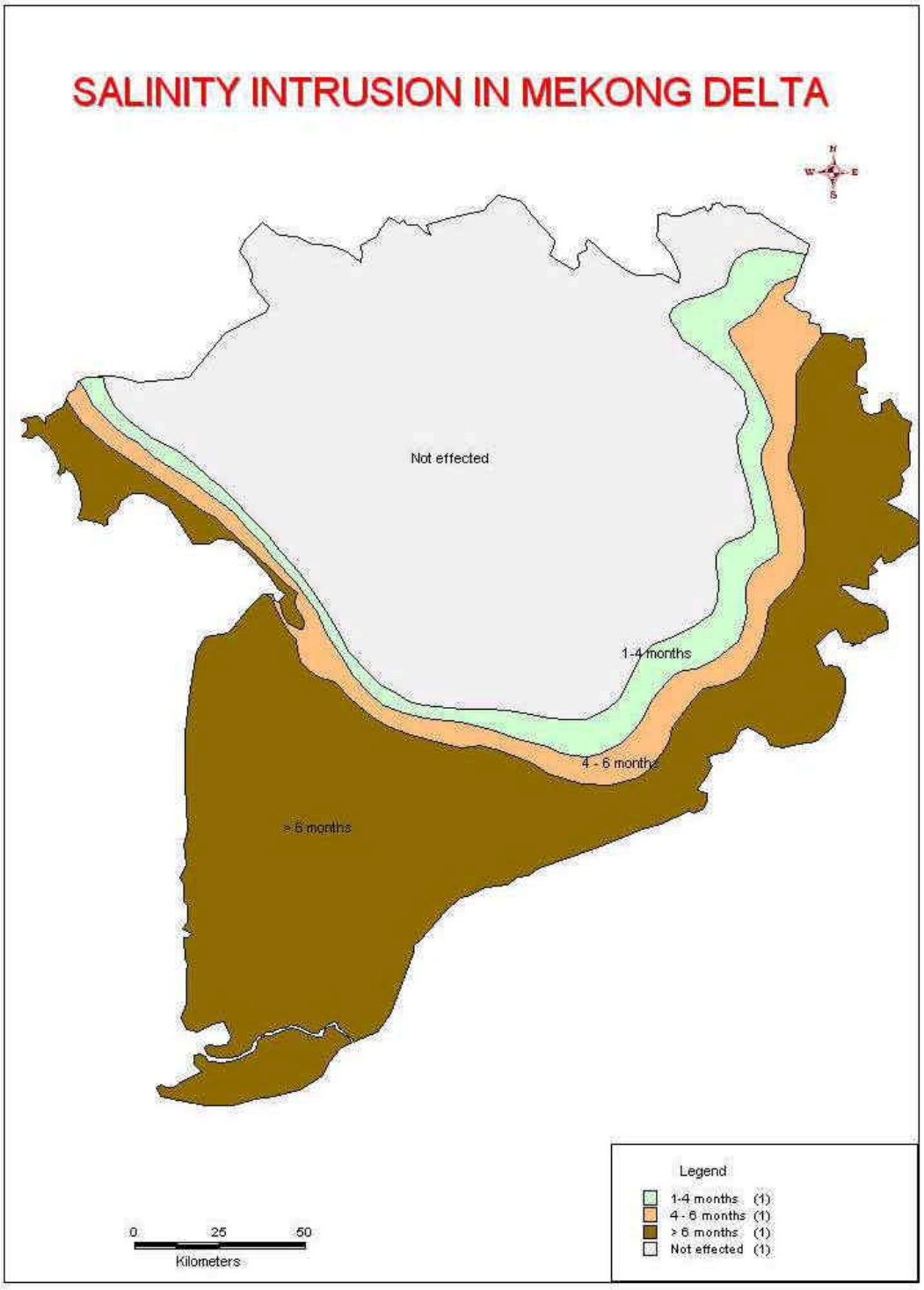
Figure 3: Increasing areas of double-rice crop (spring and summer crops) in the Mekong Delta.



Map 1: Soil Map of the Mekong Delta



Map 2: Salinity Intrusion in the Mekong Delta



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