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FESS Issue Brief

July 2007

Key Points

The Mekong Delta of Vietnam is confronting an emerging security challenge because it faces environmental threats, is a major population and exporting region, and lies on an international border with historic political and social tensions. The rate and complexity of the transformations taking place in the Mekong Delta are daunting.

- One of the largest challenges facing Vietnam in the twenty-first century is the provision and protection of water resources.
- Much of Vietnam's export growth since the early 1990s has been in natural resource-based industries such as rice, coffee, and fisheries; stresses on land and water resources will likely have national economic security consequences unless appropriate measures are instituted to minimize environmental degradation.
- The growth of urban and peri-urban residential and business development in the Mekong Delta places high human population densities in areas prone to water-borne disease, water pollution, and flooding.
- For Vietnam as a whole, urbanization is associated with improved water quality and quantity; for the Mekong Delta provinces, urbanization is associated with significantly worse water quality and quantity.
- The rapid transformation of farms into mass production-oriented operations and fast urban growth are sharply increasing the demand for water and increasing water pollution. These trends are far outpacing district and provincial state regulatory and planning capacity.

Water and Environmental Security in Globalizing Vietnam: Emerging Risks in the Mekong Delta

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Introduction

The purpose of this *Issue Brief* is to identify the critical national concerns in Vietnam that have an environmental security component and that are likely to evolve into national security issues unless concerted policy steps are taken in the near to medium term. Environmental challenges in Vietnam fall into three categories: green (e.g., deforestation, conservation), brown (e.g., sanitation, industrial pollution), and blue (e.g., coral reef protection, overfishing).

Environmental security concerns, which overlap with these categories, are generally those that affect population and economic centers, as well as those that impact the natural resources central to the national economy and defense. The Mekong Delta of Vietnam is clearly a region facing an emerging security concern because it faces at least two environmental threats, is a major exporting region, is a major population center, and lies on an international border with historic political and social tensions. The Mekong Delta security threat exists because the region is simultaneously a fast-developing population center, the most productive food industry processing region, and has a natural resource base that has, to date, been one of the country's main export platforms. These domestic characteristics all take place in a region that is historically claimed by Cambodia, significantly affected by upstream use of the Mekong River by China, Thailand, Laos and Cambodia, and was the site of cross-border armed conflict from 1954 through 1989.

The rate and complexity of the transformations taking place in the Mekong Delta pose daunting challenges. One of the largest challenges facing Vietnam in the twenty-first century is the provision and protection of water resources. Although decision makers potentially have available a great range of management strategies, public policy options, and planning tools they can use to address them, concerns nevertheless remain. Particular areas of concern are:

- The security of the Mekong Delta's water supply now and in the future is in question. For the Mekong Delta provinces, urbanization and development are associated with significantly worse water quality and quantity; in the rest of the country, urbanization is associated with better water quality and quantity.
- The rapid transformation of the physical, social, and economic environment is accompanied by the inability of public services to keep up with this rate of change. The brisk pace of change in the face of a limited institutional capacity to respond is a more serious problem for the region than population growth, which is

modest. It also is a more serious problem than poverty, which although widespread in Vietnam, is declining rapidly as a result of economic growth.

- Intergovernmental coordination is one of the more immediate development challenges in an environment in which distinct agencies, enterprises, and residents of wetlands areas are hampered by a very complex process of gaining legal recognition for their activities, leading to an overly permissive and unplanned environment.

Underlying these water-related challenges lies the fast pace of increases in living standards, burgeoning global trade integration, and rapid urbanization. These trends are currently creating new demands on water for agriculture, aquaculture, flood control, and domestic use. At the same time, unplanned rapid development has begun to undermine the natural resource base required to provide adequate quantities and quality of water. To date, there is generalized concern about water resources, but many more questions than answers about how to successfully balance economic and socioeconomic development of the region while sustaining the natural resources necessary for a livable environment. If left unmanaged, this conflict may evolve into a significant environmental security threat for Vietnam and the region.

Post-1990 Development in Vietnam: Poverty, Inequality, and Urban Services

There have been two significant changes in Vietnam since 1990 that are central to understanding the current environmental challenges facing the country. First, Vietnam began to implement its version of post-Soviet reform, *Doi Moi*, in 1986 and has steadily increased its market integration over the past two decades. Second, Vietnam has made substantive gains against poverty by passing significant market reforms allowing for increased household control over agricultural land (1993) and greater freedom in enterprise development (initiated in 2000 and extended in 2006). Vietnam also has signed trade agreements with other countries (e.g., with the U.S. in 2000) and international organizations (the WTO in 2007).

Despite achieving such major gains in policy reform and steady annual economic growth, which averaged 6.5 percent between 1999 and 2006 (CIA 2007), Vietnam remains a very poor country, a characteristic often forgotten in the excitement of such an economically dynamic context (Stiglitz 2004). According to World Bank indicators, Vietnam's average per capita income was US$480 in 2003, which was on par with Mongolia, Uzbekistan, Sudan, and Pakistan, and US$10 below the average for sub-Saharan Africa (World Bank 2003).[1]

Yet, for many years, Vietnam has shown consistent and rapid rates of growth, a process that according to experts is likely to continue into the future and yield major development gains (Folkmanis 2006). Despite continuing poverty, Vietnam's important positive trends are noteworthy and have led to increases in the quality of life for its citizens. From 1993 to 1998, general poverty was reduced from 58 percent to 37 percent, and extreme poverty fell from 25 percent to 15 percent (Arkadie and Mallon 2003).

Along with these improvements come serious concerns that the well-being of the poor is threatened by decreasing access to public services of all kinds (Arkadie and Mallon 2003). This threat is especially relevant because Vietnam's gains over the 1990s came not only through improved incomes but also through broader-based improvements in the quality of life. For example, despite its low GDP figures, Vietnam scored an impressive 109 out of 177 nations in the Human Development Index (UNDP 2006), a broad-based measure of welfare that includes a wide range of public services such as health, education, and clean water. One of the most pressing questions in Vietnam's next phase of *Doi Moi* is how well public services, and in particular environmental services, will be maintained in the face of such a dynamic, transitional market economy.

The Mekong Delta has been a key element in Vietnam's high national growth rates, providing the country's most important source of rice for export since 1993 and the major source of inland fisheries production, processing, and export. The region poses a critical development paradox, however. The Mekong Delta is an urbanizing region that leads the nation in agricultural production for export, yet falls short on a number of the public services that have been essential to Vietnam's progress with respect to the HDI.

Much of Vietnam's export growth since the early 1990s has been in natural resource-based industries such as rice, coffee, and fisheries rather than in manufactures. The predominance of resource-based industries may be the result of subsidies rather than comparative advantage, however (Dapice 2002). Resource-based industries highly dependent on land and water comprise a significant portion of Vietnam's current economy and account for the bulk of Vietnam's employment. Therefore, current and future threats to land and water resources will likely have national economic security consequences unless appropriate measures are instituted to manage resources appropriately and minimize environmental degradation.

Preliminary signs of concern for these resource-based export industries already can be seen in the Mekong Delta. It is a socially, economically, and environmentally important region, home to 21 percent of Vietnam's total population, and encompassing 12 percent of its area (United Nations

2002). Conflicts in the Mekong Delta over the diminishing natural resource base have already begun to pose a serious economic and social risk for the nation.

Current Urbanization and Development Conflicts in the Mekong Delta

Ho Chi Minh City is now a rapidly growing urban region, and its development includes an inter-urban corridor to Can Tho in the heart of the ecologically sensitive Mekong Delta. Demand for water and land is increasing through the effects of globalization, urbanization, residential housing development, the intensification of agriculture, expansion of aquaculture, and newly developed commercial and industrial enterprises. Anecdotal reports suggest that serious tensions have already developed between different users over the quality and quantity of water available for both domestic and industrial use.

Such environmental conflicts are taking place in the context of rapid societal changes that entail some degree of social and economic dislocation. Local environmental conflicts are indicators of a much larger set of related human ecology phenomena that pose a threat to environmental security. The rapid and generally unplanned economic development and the intensification of human activities in the Mekong Delta are related to at least three little-understood characteristics of the process:

- The transformation of farms into mass production-oriented operations that draw out large volumes of water and dispose of large amounts of fertilizer, pesticides, and organic waste, thereby threatening the availability of drinking water.

- The growth of urban and peri-urban residential and business development that places high human population densities in areas prone to water-borne disease, water pollution, and flooding.

- A lag in the capacity of district and provincial state regulatory and planning agencies to respond to the two trends discussed above.

Some of these conflicts are inherent to the development process. However, policymakers need to better understand the range of current efforts and future planning needs in order to manage emergent local environmental conflicts before they lead to ecological collapse and subsequent national and regional security concerns.[2]

"Conflicts in the Mekong Delta over the diminishing natural resource base have already begun to pose a serious economic and social risk for the nation."

Threat scenarios might include formal and informal encroachment into relatively plentiful land in Cambodia, the destruction of Vietnam's export base, and other possibilities. In particular, policymakers and planners need a better understanding of the alternatives in four areas of research and decision making:

- The impact of global economic and social integration on urban planning and management in the context of Vietnam's transition to a market economy. This requires information about the kinds of infrastructure and services that will be needed to manage human and economic growth in the region.

- The importance of increasing local autonomy and administrative capacity. In particular, attention must be given to the capacity to finance needed infrastructure, which has been shown to be one of the major challenges of urbanizing other parts of Southeast Asia (Laquian 2005).

- Alternative approaches to integrated river basin management of the Mekong. This includes analysis of how these alternatives may affect human and economic centers in the Mekong Delta areas of Vietnam.

- The characteristics of circular migratory movements to and from the Mekong Delta. Such information is critical to understanding household-level motivations and developing alternative ways to manage the increasing pressure placed on the region's ecology.

Environmental Conflicts in Vietnam: Recent Events

Trade Liberalization, Poverty, and the Environment: The Impact of Unstable Food Industry Exports

On June 28, 2002, the Catfish Farmers' Association of the United States sued the Vietnamese Association of Seafood Exporters and Processors for "dumping" cheap catfish on the American market. This conflict between locally based American fish farmers and Vietnamese producers is emblematic of a larger process of globalization that can pit small-scale producers against one another and prompt grassroots political activism to protect products not usually discussed in free trade debates, which tend to focus on garments, computers, and call centers. This process has put the U.S. and Vietnamese governments in awkward positions regarding trade liberalization and opened up many questions about the definitions of products, patents, and subsidized production.

On August 7, 2003, the U.S. Department of Commerce announced anti-dumping duties on catfish fillets exported from Vietnam to the United States under the labels *tra* and *basa*. In response, the Vietnam Association of Seafood Exporters and Processors planned to submit legal proceedings against the Department of Commerce for its "unreasonable decision" at the United States Court for International Trade. In addition, the U.S. Department of Agriculture awarded US$34 million to U.S. catfish farmers for losses due to bad weather and natural calamities in 2001 and 2002, apparently contradicting arguments that losses were due to dumping by Vietnamese catfish farmers in the U.S. market, and perpetuating the idea among Vietnamese farmers that the United States employs unfair trade protectionism against Vietnam.

However, contrary to the economic disaster this protectionism might have portended for the Vietnamese producers, the Vietnam News Agency reported that *tra* and *basa* catfish farmers have found new markets in Japan and Europe, compensating somewhat for their losses in the United States. Nevertheless, many fish-farming households in the Mekong Delta now find that they have over-invested in aquaculture.

This story has larger relevance as trade liberalization becomes the standard for how the Vietnamese state, producers, and consumers relate to their counterparts in other countries. As an increasing number of commodities become part of the global market, products such as catfish—a vaguely and culturally defined category that describes a wide range of bottom-feeding fish with whiskers—as well as other products that benefit from a type of locally oriented "branding," have become particularly susceptible to protectionism.

Accusations of protectionism again bubbled to the surface in 2003, prompting *The New York Times*, in an editorial, to "urge the International Trade Commission to….[decide this case [of the *basa* catfish] on its merits" (2003). If not, the editorial warned, "Vietnam will become yet another case study in the way the United States, Europe and Japan are rigging global trade rules so that they remain the only winners."

Behind this conflict lie Vietnam's rapid social and economic reforms. In 2000, the Vietnamese government passed the Law on Private Enterprise, allowing private sector businesses of all sizes to operate free from state-mandated input and output regulations. In the same year, Vietnam negotiated a bilateral trade agreement with the United States that provided most-favored nation status. The former created an environment in which large numbers of privately acting firms could locate, hire, purchase, and supply goods and services independent of state quotas and subsidies; the latter opened up an enormous market for exported Vietnamese goods. Parallel to these two changes, provincial governments rushed to create industrial zones to nurture regional development.

Within two years, Vietnamese catfish exports from the Mekong Delta to the U.S. had more than doubled to US$21.5 million, and the number of enterprises engaged in this production had grown to 200,000 farmers and 53 processors and exporters (Thanh 2003) served by a wide range of business associations, brokers, buyers, and university extension programs (Long 2005; Dinh 2005). Simultaneously, from 2000 to 2004, the two main producing provinces, An Giang and Dong Thap, showed a doubling of output (in tons) from river-based aquaculture (fish farmed under rafts floating in the Mekong River) and a roughly 30 percent increase in the surface area of land devoted to aquaculture (Can Tho City Statistical Office 2005). These rapid increases in the volume of fish and the amount of land converted to ponds has led to significant new sources of organic wastewater pollution, especially since most of this growth has been driven by small household farmers whose operations are difficult to regulate according to environmental standards.

On the other hand, planning and policy has played an important enabling role behind the scenes. The growth of the indigenous industrial production of catfish required domestic capital invested by farmers and domestic credit for state-owned enterprises as well as university-based technical expertise and a strong pre-existing artisanal industry of small catfish farmers. Many of these capital and intellectual resources were drawn to the zones developed in the region's largest city, Can Tho, and surrounding towns. Thus, the rapid rate of urbanization and industrialization of the Mekong Delta, one of the largest wetland ecologies in the world, is in large part the result of trade integration.

The trade war over *basa* catfish is an excellent example of some of the growing pains associated with market reform and globalization. To date, no detailed scholarly research has been conducted on the origins of the conflict, its implications for how trade liberalization should progress in Vietnam and the Mekong Delta, and in particular how these responses of small-scale producers to market reforms affect their economic prospects, the risk of overinvestment, or pollution.

Nevertheless, field interviews conducted in 2005 and 2006 strongly suggest that Vietnam's current minimally planned and minimally managed system for production in the food sector leaves producers quite vulnerable, socially and ecologically. Because Vietnam has recently become a member of the WTO, the country's production for export—especially in the food industries—will increase (potentially at a much higher rate than at present), and such trade conflicts will increase unless there are fundamental changes in Vietnam's planning and policy environment. This scenario is strongly supported by a flurry of

accusations of unfair production processes subsequent to the *basa* catfish case, and some local Vietnamese observers recognize this lack of capacity as the next main challenge Vietnam faces in its market reforms.

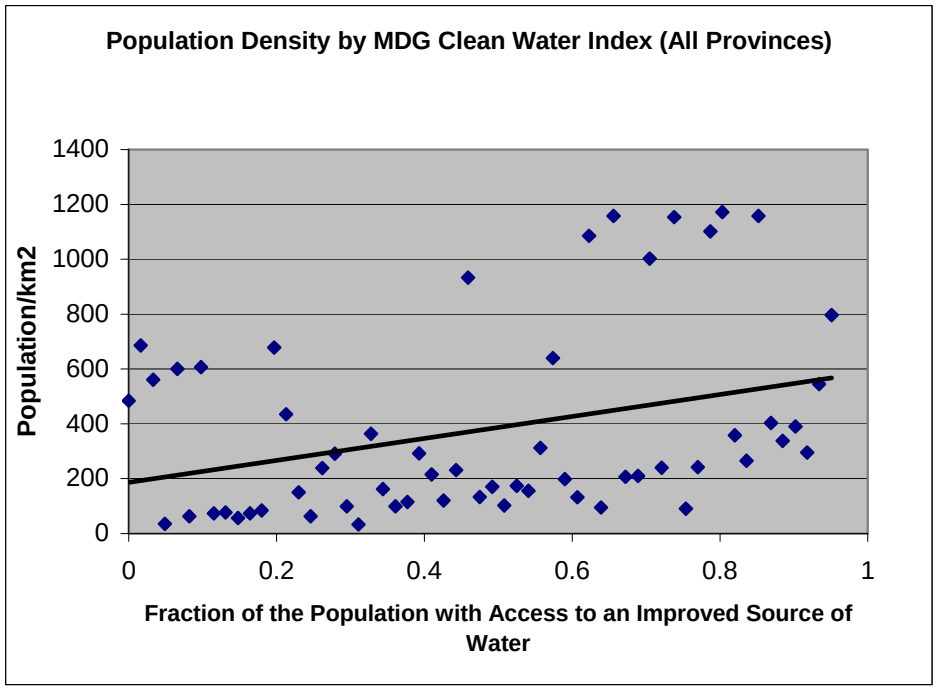
Increased exports of other products to the U.S. and Japan have prompted similar accusations, for example, regarding the Vietnamese coffee, shrimp, and shoe export industries (Bui 2005; Van 2005), all of which rely on natural resources. Although WTO entry has offered Vietnam some degree of protection from the most frivolous charges, it also exposes Vietnam's relatively uncoordinated production systems in the food export industries—especially those with health concerns—to closer scrutiny. Such scrutiny stands to significantly temper the anticipated benefits of Vietnam's global trade integration, and, like many other poor countries, Vietnam seems ill-prepared for such scrutiny (Bui 2005; Nguyen 2005; Van 2005).

Urbanization, Environmental Quality, and Human Security: Development Effects on Scarcity of Clean Water Supplies

Demand for water is increasing for intensive agriculture, recently expanding aquaculture, residential development, and for newly developed commercial and industrial enterprises. Anecdotal reports suggest that serious tensions have already developed between different users over water quality in the Mekong Delta. For example, run-off of pesticides from intensive rice agriculture has affected the farming of fish in the Mekong River, fertilizers and pesticides used in intensive rice agriculture potentially threaten contamination of the natural aquifer used by the bottled water industry, and agricultural land conversion to fish and shrimp aquaculture has led to the loss of productive land.

Provincial-level data from Vietnam provides a window into the problems that may be generated by these

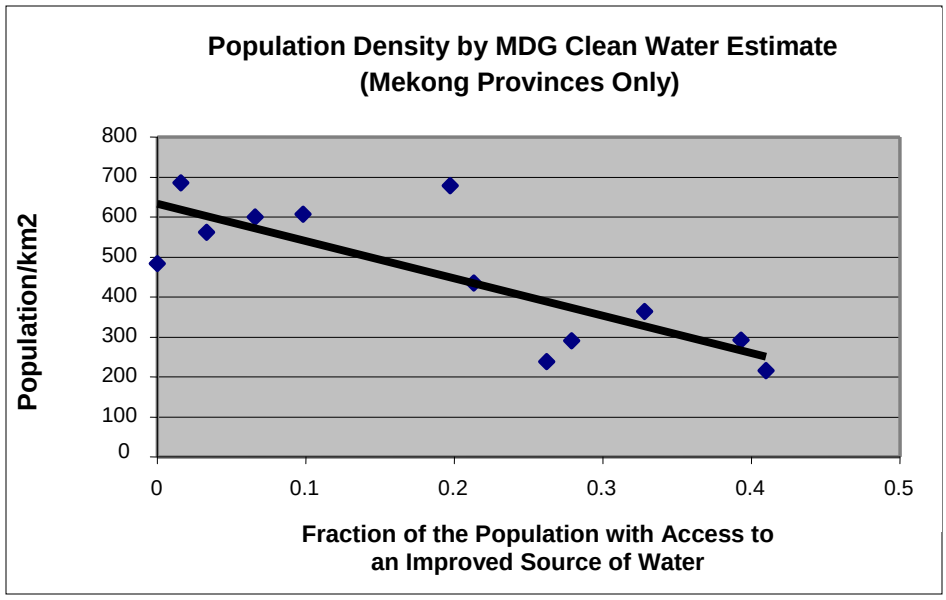
Figure 1



Source: United Nations 2002.

Note: The clean water index shown is a composite measure of household water quality and quantity, as defined by the UN in collaboration with the Vietnamese government.

Figure 2



Source: United Nations 2002.

Note: The clean water index shown is a composite measure of household water quality and quantity, as defined by the UN in collaboration with the Vietnamese government.

Table 1

Mekong Delta provinces: Population and economic trends in the *Doi Moi* export growth period

	2000	2001	2002	2003	2004
Total population	16,364,046	16,543,507	16,754,929	16,919,818	17,108,850
Male	8,024,063	8,108,133	8,216,148	8,298,455	8,378,559
Urban	2,899,586	2,941,581	3,036,478	3,363,999	3,463,427
Value of GDP	US$5,052	US$5,436	US$6,025	US$6,654	US$7,412
Annual percent change in GDP	--	8.1	10.8	10.4	11.4
Value of GDP per capita	US$308	US$329	US$360	US$393	US$433
Annual percent change in GDP per capita	--	6.8	9.4	9.2	10.2

Source: Can Tho City Statistical Office 2005.

Note: GDP figures are calculated in million US$ and based on 1994 prices.

intensive production activities in such an ecologically sensitive wetlands region as the Mekong Delta. To date, global concerns over clean water have been driven by Millennium Development Goal (MDG) No. 7, "Ensuring Environmental Sustainability." Conventional financing mechanisms for provision of this necessity promote market principles in the allocation of water, albeit with moderate governmental regulation. This shift in the role of the state from provider to regulator is accompanied by a fundamental distinction in human use of water resources as a necessary consumer good and as basic input for industrial production.

As transitional states like Vietnam shift from primary provider to regulator, agencies are less able to coordinate the management of water resources for these multiple objectives, depending to a larger degree on private sector and civil society institutions. Such social and market coordination is becoming the norm regarding clean water provision throughout Vietnam, leading to greater competition, negotiation, and conflict both within households and within the industrial sector. In an environment such as the Mekong Delta, however, where water is both a household need and the primary basis for rapid industrialization and economic development, there is the additional complexity of competition over water between households and industry.

Part of the MDG effort in Vietnam includes collecting indices of access to sufficient supplies of clean water. Figure 1 displays the relationship at the national level between an aggregate measure of water access and water quality defined by the Millennium Development Goals and the degree of urbanization. Figure 2 displays the same relationship exclusively within Vietnam's Mekong Delta provinces. The clear implication from this juxtaposition is that, for Vietnam taken as a whole, urbanization is associated with improved water quality and quantity. For the Mekong Delta provinces taken alone, urbanization is associated with significantly worse water quality and quantity.

Such development pressures are manifest in environmental health concerns now coming to the fore. A recent study illustrates some of the complexities of residents' choices regarding water systems and fears of environmental pollution (Spencer 2006a, 2006b). A survey of 200 households in a peri-urban area of the Mekong Delta conducted as part of this study found that residents feel threatened by both actual pollution and perceived pollution. Although residents clearly expressed increasing concerns with pollution of all sorts (organic and industrial), so far they have been able to manage pollution by making careful choices about their use of natural water sources. In doing this, they have been able to minimize the prevalence of water-borne diseases. However, it is the fear of chemical and industrial pollution that drives residents' willingness to invest in new clean water technologies such as piped household water. In this light, the role of policymakers and planners in managing residents' fears and perceptions of environmental health through accurate data and analysis will become increasingly important in the Mekong Delta, especially as the major environmental health concerns shift

from traditional water-borne diseases with short-term consequences to more chronic health problems associated with chemical pollution, such as cancer.

The conflicts discussed in detail above are examples of how market reform, global integration, and environmental change have created significant new challenges that Vietnamese residents, business interests, and policymakers are struggling to address. If the challenges were limited to these specific conflicts, policymakers could rely on ad hoc responses, as has been the case to date. However, current demographic, socioeconomic, environmental, and industrial trends suggest that these two cases are the leading edge of larger societal changes transforming the social ecology of the Mekong Delta.

Trends in the Mekong Delta: Population, Production, Land Use, and Pollution

It is difficult to predict the medium to long-term future. Nevertheless, recent trends help bound the range of impacts of unpredictable events such as natural disasters, sudden policy shifts, or cross-border conflicts. This section outlines the recent trends, from 2000 to 2004, regarding a number of indicators in the most recent period of *Doi Moi* export growth. More specifically, there are three areas that, if combined, may lead to elevated risk of environmental conflict: demographic and socioeconomic change; environmental and land use change; and changes in the economic activities that create pollution.

When examined together, the data for the Mekong Delta suggest that while overall population numbers have increased only slightly, the growth of urban residents has been quite rapid, with associated major increases in the socioeconomic status of its residents. Socioeconomic improvements are paralleled by the steeper growth of land development through construction relative to the slower increase in agricultural and aquacultural activities. This intensification of physical development is mirrored in sharp increases in industrial activities that produce both organic and inorganic forms of pollution. The regional picture described in these figures confirms that the major challenge facing the Mekong Delta is not one of population growth or poverty per se, but the rapid transformation of the physical, social, and economic environment. While the pace of change entails vast challenges, the transformation itself offers a great range of management and policy alternatives amenable to public policy and planning.

Population Change

The four years following Vietnam's entry into a bilateral trade agreement with the United States have shown steep increases in economic production. The GDP of 8 provinces comprising the Mekong region grew by 46.7 percent from 2000 to 2004, an impressive rate suggesting that the region's human and natural resources have been utilized extensively. At the regional scale, these gains have led to major socioeconomic improvements; during 2000 to 2004, per capita GDP in the Mekong Delta grew 40.31 percent, or almost as much as national GDP. Since the population of the region grew by only 4.55 percent, gains in GDP are in large part attributable, in conventional economic terms, to "land" and "capital" rather than labor, assuming that the educational gains possible in only four years are small or negligible. In other words, the economic growth of the Mekong Delta is due largely to greater exploitation of natural resources, investments in production, and technological improvements.

In addition to the remarkable growth in production, the region has experienced a very rapid urbanization process. In

Table 2

Mekong Delta provinces: Growth of construction and change in land use in the *Doi Moi* export growth period

	2000	2001	2002	2003	2004
Gross output in construction	7,476,611	9,853,955	11,138,456	13,596,842	16,189,329
Agricultural, forestry, and aquacultural land	3,272,655	3,591,828	3,327,159	3,325,882	3,209,522
Special use land	216,335	219,524	234,921	241,001	245,247
Homestead land	105,807	105,308	101,175	99,996	101,156
Wasteland	327,607	353,181	281,546	303,016	300,527

Source: Can Tho City Statistical Office 2005.

Note: Figures are in million Vietnam Dong, unstandardized.

Table 3

Mekong Delta provinces: Aquaculture growth in the *Doi Moi* export growth period

	2000	2001	2002	2003	2004
Gross output of fisheries[a]	US$1,053	US$1,302	US$1,478	US$1,735	US$2,061
Area of surface for breeding aquatic products[b]	401,945	499,945	557,532	600,484	633,103
Area of breeding shrimp	203,744	321,098	349,821	381,938	412,885
Gross output of cage farming[c]	377,380	450,380	528,211	639,117	790,383

Source: Can Tho City Statistical Office 2005.

[a] Output measured in million US$.

[b] Area measured in hectares.

[c] Output measured in tons.

just 4 years, the urban population increased by about 20 percent. This high rate is even more remarkable given that there was very little absolute population growth in the region. When birth rates and the rate of population growth in an area are high, natural increase may account for much of the growth in the urban population. In the case of the Mekong Delta, however, the population of the region overall has grown only slightly and therefore the growth of the urban population can only be explained by such factors as in-migration into the cities and the expansion of city boundaries to incorporate an increasing number of residents.[3]

Environmental and Land Use Change

The rapid rate of growth in production based on natural resources and the rapid urbanization of the region are reflected in an analysis of changes in land over the same period. The gains related to natural resource exploitation described above can be achieved through extension of lands devoted to productive activities or through the intensification of those activities on land already under cultivation. Table 2 strongly suggests that the latter explanation is driving the rapid growth of GDP in the Mekong Delta provinces.

Agriculture, forestry, and aquaculture are by far the most prevalent forms of land use in the region. Moreover, less than 10 percent of all land in the region was undeveloped (i.e., wasteland) at both the beginning and the end of the period. Thus, this period of rapid production growth is marked not by bringing previously unused land into production, but rather through the intensification of land use on land already under cultivation. This has been accomplished through increased use of high-yield inputs to agriculture and the conversion of low-value crops, such as rice, to higher-value crops, as well as conversion to higher-value forestry and aquaculture use. The following section explores important changes in land conversion to aquaculture that are likely a major part of this production growth.

In Vietnam, the designation of "urban" land is a specific category accompanied by policy and planning shifts allowing for higher densities of housing, infrastructure, and other urban services. Table 2 provides a general picture of how important this rapid urbanization has been for land use. From 2000 to 2004, the construction industry's output increased by 116 percent. This growth is due both to increasing numbers of people living in cities and to increased demands for urban amenities such as water infrastructure, concrete housing, and other services. Thus, even as there seems to be an intensification of exploitation of natural resources, there is very rapid increase in urban land development. The intensification of activity in both agricultural and urban areas set in motion forces likely to create excessive pollution if left unregulated. In the Mekong Delta, two of the most important intensification processes creating pollution are the rapid growth of the aquaculture sector and, more generally, industrialization.

Forces Creating Pollution

The forces driving pollution of the Mekong Delta can be classified as organic pollution (due to conversion of land to aquaculture) and chemical pollution (usually associated with the industrialization of productive sectors), which includes aquaculture.

a. Organic Pollution

The example of trade conflicts in the production of catfish in An Giang and Dong Thap provinces discussed above reflects a larger Delta-wide process that has developed since 2000. Table 3 shows the extent to which aquaculture has shown extremely high growth rates for the Mekong Delta as a whole. In terms of gross output, the fisheries sector has grown by about 95 percent in 4 years, while the surface area used for breeding all kinds of aquatic products has increased by about 57 percent. The area devoted to shrimp breeding, for example, has doubled in only four years. Similarly, the portion of gross output of fisheries devoted to those products bred directly in river waters under floating cages has more than doubled (109 percent increase), putting ever more organic waste directly into the Mekong River.

b. Chemical Pollution

The exponential intensification of the fisheries sector is matched by similar growth rates in the rise of the region's industrial production. The overall gross output of industry grew by 98 percent, and the labor force associated with these sectors grew by 26.51 percent. These growth rates are clearly influenced by *Doi Moi* reforms. Although the baseline level of output of state industry was somewhat higher than for non-state industry in 2000, between 2000 and 2004 non-state industry grew by about 137 percent compared to only about 68 percent for the state sector, so that by 2004 non-state industrial output exceeded that of the state sector.

This stark difference in growth rates is important for understanding the challenges of current development because private sector industries have weaker connections to state institutions and are therefore more difficult to regulate.

In contrast to the pattern of growth in output, the growth of the workforce in the state sector (35 percent) actually exceeded that in the non-state industrial sector (24 percent). However, the size of the workforce in the state sector was only about 20 percent of that in the non-state sector. This difference also suggests the difficulty of regulating activities—including environmental pollution—within the non-state sector, as compared with the state sector, because the latter has considerably fewer workers. Additionally the state sector is also generally more responsive to state directives—even though it does not always conform to official regulations.

Finally, while the foreign direct investment (FDI) sector has grown remarkably in response to *Doi Moi* (150 percent), the baseline levels of employment in this sector are quite low, suggesting strongly that most industrial economic activity is happening in the non-state, domestic sector. Such enterprises are the most difficult to regulate regarding pollution, and this situation reflects the major challenges facing policymakers in the Doi Moi export growth period that are discussed in the following section.

The Policy Context: Administrative Ambiguity, Enforcement, and the Growth of the Private Sector

Discussions with national, provincial, and local officials, NGO representatives, and scholars during 2005 and 2006 revealed some of the major policy and planning challenges Vietnam currently faces. Informants strongly suggested that, left unaddressed, the following challenges might result in greater environmental conflicts, and therefore a higher risk of environmental insecurity.

The central government of Vietnam has recently passed important environmental decrees and regulations summarized in the 2006 law on the environment. However, the directors of the Ministry of the Environment and numerous NGO representatives have expressed concerns that the current law is confusing to local officials as well as to the people and enterprises being regulated.

For example, to date there has been no specific law or policy regulating wetlands development. Thus, these sensitive ecological environments have been under the administrative jurisdictions of the Ministry of Agricultural Resources and Development, the Ministry of Fisheries, and the Ministry of Natural Resources and the Environment, each of which has its own regulations, enforcement agencies, and provincial representatives. Any development activities have been subject to these distinct agencies, and enterprises and residents living in wetlands areas have been hampered by an extremely complex process of gaining legal recognition for their activities. Because of this complexity, many have simply sidestepped the bureaucratic process or expanded based on whatever permits they have been able to obtain from these state agencies.

In 2006, the Vietnamese National Assembly passed Decree No. 109, which attempted to clarify these administrative ambiguities, but this legal change is only the first of many steps required to achieve successful implementation of improved wetlands management. The lag time from legislation to implementation is likely to be quite long without specific interventions to improve the management of environmental risk.

Interviewees identified four main issues that tend to hamper the implementation of good national legislation. First, many of the local representatives of national line ministries compete at the provincial level for resources, leading

to higher levels of intra-agency conflict. Second, during a period of government decentralization, the overall control of the central government is diminishing. For example, most national parks are under the control of provincial governments, and in the absence of greater financial and other resources from the central government there are few tools that central lawmakers can use to force or encourage the compliance of local governments. Third, since the legal system of Vietnam is underdeveloped and there are many decrees that contradict each other, people generally do not know how to respond to regulation. In the case of wetlands, for example, there is much confusion, even among officials, as to what is allowable at the local level. In this policy environment, officials are conservative in what they allow, and residents and enterprises ften choose to circumvent the legal process altogether, leading to no regulation. This process is compounded by the fourth major issue: lack of enforcement facilities and personnel. Strong environmental legislation in Vietnam is hamstrung by the inability of local officials to enforce improved planning guidelines and environmental controls, even where there is no confusion over what environmental laws allow.

These four challenges have long been present in Vietnam and predate the *Doi Moi* period. Nevertheless, they have become accentuated since 2000, as the need for environmental regulation has grown exponentially due to huge increases in the intensification of natural resource-based production, and as the privatization process has dramatically increased the role of private sector actors, most of whom are small entrepreneurs. These twinned processes of economic growth and privatization are most intense in the Mekong Delta provinces and, left unaddressed, are likely to lead to significant environmental security concerns for the residents, officials, and enterprises of the region over the next several decades.

Summary of Preliminary Recommendations

- Develop an overall strategy for better managing the decentralization process as it relates to natural resources management. In particular, improve local officials' awareness and commitment to national environmental objectives. Develop mechanisms for financing enforcement and regulation at the local level.
- Improve governance coordination to reduce agency competition at the local level.
- Develop improved tools for assisting local officials and citizens to better understand legal requirements. This improved knowledge should be used to develop local alternatives for matching individual and private development objectives within the regulatory framework.
- Develop financial tools for funding improved enforcement capacity in the environmental sector.■

Endnotes

1. UNDP uses a different system for estimating GDP in calculating its Human Development Index. The UNDP GDP per capita figure was $2,070 for 2001, a much higher figure than $480. In either case, though, the measure is comparable to low-income Central Asia and sub-Saharan Africa (GDP per capita of US$1,831 for the latter). I use the World Bank method for calculating the measure of average income relative to other countries, however, because it uses the Atlas method to adjust for short-term fluctuations in exchange rates that can distort annual measures of GDP figures.
2. By their nature, such environmental security threats are difficult to identify at a stage during which preventive technical and social measures are likely to be most effective. Nevertheless, Diamond's (2005) comprehensive historical analysis of societal and ecological collapse argues that identifying these environmental security threats early determines societal success.
3. It should be noted that migration to cities is not necessarily from other regions of the Delta. However, any in-migration from other regions is offset by out-migration from the Delta.

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This report is made possible by the generous support of the American people through the United States Agency for International Development (USAID). The contents are the responsibility of the Foundation for Environmental Security and Sustainability and do not necessarily reflect the views of USAID or the United States Government.