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## Sustainable Development in Vietnam: The Interconnectedness of Climate Change, Socio-Economic Development, Land Use, and Food Security

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In response to climate change, many nations are facing a crisis in regards to managing land use, mitigating environmental degradation, and otherwise pursuing sustainable development. Vietnam faces many unique circumstances, both historical and present, that make it an interesting case study in such topics. As the discernable impacts of climate change increase, it is necessary for Vietnam to pursue policies that are holistic and effective, especially considering the extreme vulnerability of the nation's inhabitants. The most important factors to consider are climate change, socio-economic development, land use, and food security—especially how these concepts intertwine to create the reality of Vietnam's political, ecological, and social landscape.

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## Introduction

In Vietnam, climate change, socio-economic development, land use, and food security are all closely interconnected. These topics must be examined in conjunction in order to address contemporary issues with development, as well as potential for sustainable development moving forward.

Changes in patterns of land use can have impacts that complicate the future of Vietnam's economy, while improvements in socio-economic status conversely affect the landscape quite dramatically (Rutten et al. 2014: 29). Climate change has the potential to exacerbate these effects on the landscape, and land use change has major implications for food production and security. The most overarching of these topics, climate change, will be discussed first.

## Climate Change

Government reports and scientists around the world confirm that anthropogenic climate change is a reality that is already having discernable impacts across the globe (IPCC). Climate change is particularly salient in the context of development because its disastrous effects have the potential to not only undo, but to inhibit progress toward just and sustainable economies and societies. In the case of Vietnam, the country simply cannot avoid the impacts of climate change, even though it has done comparatively little to contribute to climate change (Waibel 2008). Incorporating climate change into all levels of development planning is important as the nation progresses with the assistance of international expertise and financial support (Waibel 2008).

The Government of Vietnam views climate change as a development priority due to the nation's extreme vulnerability (USAID 2015). Among the eighty-four developing countries found in coastal areas, Vietnam is one of the most heavily affected by the risk of sea level rise. It ranks number one in terms of impact on population, gross domestic product (GDP), urban extent, and wetland areas. Furthermore, it ranks second in terms of impact on land area and agriculture. With forty-three-million people living in what are termed "low elevation coastal zones" (LECZs), fifty-five percent of the country's population is vulnerable to sea level rise—the highest percentage in the world (Waibel 2008). Being situated in a coastal position increases the risk of typhoons and other extreme weather events, and a higher frequency has already been observed (Waibel 2008). Figure 1 illustrates that, in coming years, the number of people living in coastal zones and at risk by floods will increase substantially, with the assets and wealth in Vietnam at risk by floods exhibiting a similar pattern. Repeated incidents of flooding causing more and more damage result in increasing population pressure in urban areas such as Ho Chi Minh City, and since these are hubs for economic development that pressure presents a considerable challenge for further development (Waibel 2008).

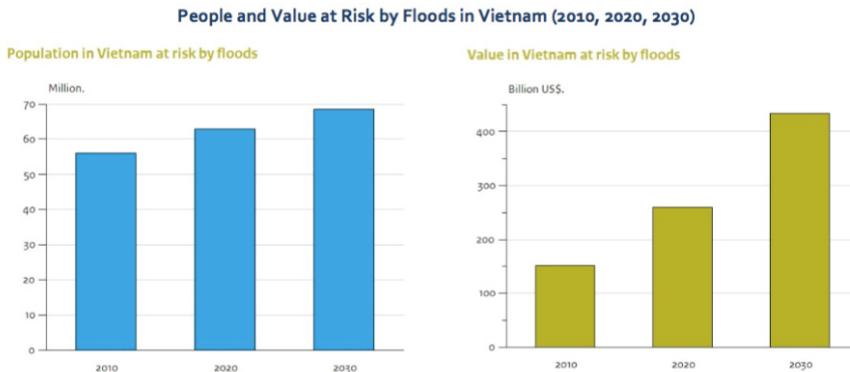


Fig. 1: Map of the Delta Complex at Akrotiri (Palyvou 1986: 190, Fig. 9). Source: Climate & Development Knowledge Network. 2012. "Land Use, Food Security, and Climate Change in Vietnam." Pg. 9.

In addition, USAID (2015) has identified the country as a priority for programming focused on climate change. The agency is committed to uplifting long-term, climate resilient economic growth accompanied by a reduction in greenhouse gas emissions produced through processes of development (USAID 2015). Two key programs that USAID has implemented are the Vietnam Forests and Deltas Program and Vietnam Clean Energy Program, which are described below.

A component of development is urbanization, and Vietnam is a transitional country with one of the most rapidly urbanizing populations on the planet, with great exposure to hazards in its low elevation location characterized by a delta structure (Garschagen 2015: 600). Garschagen (2015: 602) explains Vietnam's long, disastrous history with such hazardous exposure: it is among the countries with the highest amount of losses from catastrophic events such as flooding and typhoons, with 9,865 deaths attributed to natural disasters from 1989-2009. 101,000 were injured in that period, and an additional 8.2 million individuals in Vietnam were affected indirectly through the food supply, requirements to evacuate, etc.

While socio-economic development in modern times has actually reduced losses of human life and improved hydraulic infrastructure, economic intensification increases the potential for natural disasters to cause significant material damage. In Vietnam, industry is heavily concentrated along the coastline and in the deltas. As a result, human settlement is also abundant in these vulnerable areas (Garschagen 2015: 603). Vietnam's current strategy for risk management is centered on command-and-control approaches to hazards and crises, on protective measures such as dykes, on evacuation, and on government support of households in times of need (Garschagen 2015: 604). However, the action of the government lacks a holistic systems perspective and fails to go much deeper into the issues than providing relief; officials fail to pay proper attention to the root causes and instead focus on observable symptoms after the fact.

## Socio-economic development

In today's global society, industrialization is a key indicator of development. As the socio-economic status of Vietnam increases, industry continues to grow. Socio-economic growth is accompanied by problems that heighten the risks associated with environmental degradation, most notably in regards to water and air pollution. Most of the wastewater discharged from sites of industrial production undergoes improper treatment, which leaks harmful chemicals into the Ku Cing and Hong Rivers (Asia Society 2015). Furthermore, the World Bank reported in 1995 that the dust from cement factories in Hai Phong exceeded government standards by up to eight times (Asia Society 2015). Industry also causes soil erosion through land degradation, which

makes the coastal zones even more vulnerable to devastating floods. These negative effects to industrialization reveal an unbalanced trade-off between industrial job creation and destruction of the environment.

As income levels rise, carbon dioxide emissions follow suit in a positive relationship (Tang & Tan 2015: 447). With an average GDP growth of 6-8% over the last decade, GHGs have increased exponentially. The figure from 2010 is 151 million tons of CO<sub>2</sub> equivalent, over half of which was directly associated with agricultural production and land use change, mostly related to rice farming (Rutten et al. 2014: 29).

There is also a direct causality between foreign direct investment (FDI) and CO<sub>2</sub> emissions (Tang & Tan 2015: 447). Income and FDI, as well as energy consumption, are the top three determinants of Vietnam's greenhouse gas emissions (Tang & Tan 2015: 447). FDI is negatively related to GHGs by providing developing nations with green technologies potentially not otherwise available to them (Tang & Tan 2015: 453). These advancements are more efficient, which has dual benefits: less environmental intensity, as well as cost reduction and increase in productivity, which contributes to socio-economic development in the country.

A modeling study analyzing potential scenarios predicts the futures of Vietnam experiencing high climate impact (HCI), high economic growth (HEG), and a baseline "business as usual" (BAU) (Rutten et al. 2014). The HCI scenario addresses the possible impacts of climate change on economic progress and land use, discovering a negative impact on growth because of shocks to crop yields (Rutten et al. 2014: 33). This discovery is supported by the fact that agriculture is an important component of Vietnam's economy and that climate change has devastating effects on crop success. It is possible that market prices of food will rise while agricultural incomes fall in response to climate change, leading to a challenge for food security.

The HEG scenario implements growth and yield targets established by the Vietnamese government to reach economic and agricultural goals. Such a future for the country would be characterized by rapid economic growth accompanied by growth in the yields of crops, probably due to innovations stemming from the magnification of technological advancements (Rutten et al. 2014: 33). A high rate of urbanization would also lead to the disappearance of protected land areas, a tragedy to Vietnamese biodiversity. However, if the country followed current trends in a BAU trajectory instead, growth would be somewhat stagnant, reflecting a global macro-economic slowing (Rutten et al. 2014: 33). Like in the HEG scenario, high rates of urbanization would be extremely likely. (Rutten et al. 2014: 33). Also under BAU, agricultural employment would fall which would have a positive impact on wages in industrial and other jobs; however, the reality of climate change and its effects diminishes the benefit (Rutten et al. 2014: 33). The food security situation will improve by 3.4% if business as usual continues on its current path, but mostly due to imports that do not benefit poor, rural rice farmers financially. This is compared to conditions of high economic growth, in which Vietnam would be less subject to price swings on the international food market, depending more heavily on the domestic agriculture sector as a means of securing a steadily expanding GDP (Rutten et al. 2014: 33).

While these potential futures are incredibly important in understanding the interconnectedness of climate change, development, land use, and food security, socio-economic improvements are currently having major implications for the Vietnam landscape and patterns of land use as well.

## Land Use

With an increasing need for built-up environments in response to socio-economic development, industrialization, and urbanization, agricultural land is sacrificed (Rutten et al. 2014: 29). Industrial development is densely concentrated in the Red River Delta region, and less substantially in the Mekong Delta, where paddy rice fields are frequently bulldozed and paved (Rutten et al. 2014: 42). These trends largely play into the issue of food security in Vietnam, especially the strain on domestic provision of sustenance. In addition, this development comes at the expense of non-production forest, shrub land, and grassland, an example being other agricultural lands in the Northern part of the Red River region that are affected as Ho Chi Minh City grows (Rutten et al. 2014: 38). These changes will be the most severe under conditions of high economic growth in the nation, with a predicted 47% of protected land traded in for economic gain (Rutten et al. 2014: 38).

Such a loss would greatly threaten biodiversity. According to the American Museum of Natural History, “Vietnam encompasses three major biogeographic zones, four Endemic Bird Areas (EBAs), and a wide variety of unique habitats” (American Museum of Natural History 2015). Changes in land use places the rare and endemic species inhabiting Vietnam’s diverse landscapes at great risk. Population pressures, industry, and climate change-related weather events also threaten biodiversity. Biodiversity must be protected, especially considering 80 percent of the needs of the poor are derived from biological resources, and biodiversity provides ecosystem resiliency, medical discoveries, and other opportunities (Shah 2014).

Land use change also increases the volume of greenhouse gases being released into the atmosphere, especially when proper mitigation and carbon sequestration strategies are not in place. Land use change alters the Earth’s surface albedo, or the amount of radiation reflected back into the atmosphere, and this can greatly encourage warming temperatures (USGS 2015). Deforestation also changes evapotranspiration rates, a direct climate influence (World Meteorological Organization 2015). Thus land use change is an interconnected factor in climate change, and both affect agriculture.

There are also interesting contemporary issues regarding the liberalization of land ownership since the Land Law of 1993 (Garschagen 2015: 608). The Land Law and subsequent policies must be understood in the context of Doi Moi, meaning “Renovation,” the program of economic reform initiated in the late 1980s in pursuit of a market-based economy. In the early phases of Doi Moi, collective land was granted to individual farm owners and prices were liberalized, which led to a rapid disappearance of centrally planned farm cooperatives (FAO 2007). Individuals were hence able to reconnect with the land and operate in the marketplace, which prompted agriculture to succeed much more quickly than heavily invested-in industry (FAO 2007). The Food and Agriculture Organization of the United Nations (2007) reports that, “As a result of the reforms, the household is now the main stakeholder in agriculture with almost 14 million households deriving 79 percent of their income from farming.” Though the reforms appear to have been successful in securing economic freedoms and land security for individuals, they also encouraged real estate speculation and inflated land prices (Garschagen 2015: 608). Speculation and inflation are problematic because those who are less socio-economically privileged face the risk of not being able to afford land, being pushed out of agricultural settings, and also not having the ability to purchase housing in urban areas. The results is the presence of slums, more respectfully called “urban villages,” on marginal lands vulnerable to risks such as floods (Garschagen 2015: 608).

The flood risks mentioned previously apply more pressure on both urban and rural populations, as well as the financial assets located in these areas, which are currently around \$150 billion in U.S. dollars (USD) but have a predicted worth of over \$400 billion USD by 2030 as incomes increase (Rutten et al. 2014: 39). For now, much of these incomes come from farming, and land in general has played an enormous role in the development of Vietnam. Nearly 70% of the country’s inhabitants are in rural areas, and agricultural production comprises one-fifth of the nation’s GDP

(Rutten et al. 2014: 29). With this in mind, it is clear that strategies in the agriculture sector are a prime opportunity for reducing poverty and securing food security, discussed next (FAO 2012).

## Food Security

Vietnam's success in agriculture has made it an attractive location for foreign direct investment, spawning economic growth as the country transitioned from an inward-looking planned economy to a market-based system participating in the globalized world (Tang & Tan 2015: 448). The crux of agricultural production in Vietnam is rice, a staple food grown by poor paddy rice farmers. The nation is the world's second largest exporter of rice, but domestic production does not suffice; households are net purchasers of foodstuffs (Rutten et al. 2014: 29). Additionally, increasing prices following the 2008 global food crisis results in pressure on the Vietnamese population to secure sufficient, nutritious, affordable food. Vietnam has been identified as a hunger hot spot in Asia and the Pacific (CDKN 2012, Rutten et al. 2014: 29). It remains a hunger hot spot despite the fact that for decades FDI has been a tool in increasing the general standard of living and ameliorating a certain amount of poverty for much of the population (Tang & Tan 2015: 448). In general, food security is defined as a condition "...when all people, at all times, have physical, social, and economic access to sufficient, safe, and nutritious food to meet their dietary needs and food preferences for an active and healthy life" (FAO 2015).

Socio-economic status plays a role in food security. As low incomes in paddy rice production place farmers in increasingly difficult circumstances, they switch their crops to more profitable ones to make more money. Unfortunately, these crops are typically used to satisfy industrial demand rather than feed the nation's people. Some even use land that was previously used for cultivating rice to instead build ponds for seafood production, which also yields higher incomes for the farmers (Hung 2009). An example from class is that in the Indonesian highlands as well, "Since cacao was the most productive crop available to them, they planted more of it" (Li 2014: 120).

While some sources say that Vietnam achieved food security by the year 1989, this statement does not reflect the fact that the measurable improvements in the level of food security have not happened equitably throughout the population. In rural areas, 11 percent of people lack access to sufficient, safe, and nutritious food, while the number is only 2 percent for urban locations in the country (FAO 2007). Poverty, which exhibits the same spatial distinction, is a factor. Though overall socio-economic status has improved, there remain problems with distribution and a huge urban-rural gap (FAO 2007). Income inequality plays a role in motivating farmers to switch crops, which as mentioned previously also impacts food security. Table 1 indicates this disparity in rural and urban poverty and food insecurity, with numbers slightly different from what the FAO reports. Regardless, the gap is striking.

Table 2. Poverty and food poverty rates, 1993–2003

	National		Urban		Rural	
	Poverty	Food poverty	Poverty	Food poverty	Poverty	Food poverty
1993	58.1	24.9	25.2	8.0	66.4	29.0
1998	37.4	15.0	9.2	2.5	45.5	18.6
2003	28.9	10.9	6.6	3.9	35.6	11.9

Sources: GSO and World Bank.

Tab. 1

Also as stated, climate change and the increased risk of flooding is particularly hazardous for the Red River Delta and Mekong Delta, and this threatens food security as well. In response to urbanizing forces decision makers in Vietnam have replaced much of the paddy land in these locations with industrial parks. Additionally, if five percent of fertile agricultural land is lost through sea level rise—as is predicted—rice yields will be reduced by five million tons each year (Hung

2009). In this case, it would be necessary to pursue advancements in agricultural technologies and efficiency. The FDI that has bolstered the national economy so greatly could also serve as viable investments in mitigation strategies.

Climate change also exacerbates vulnerability in regards to poverty and access to successful, reliable crops. Warming temperatures alter weather patterns such as precipitation, and changing rainfall has a huge effect on agriculture. Pests and diseases are also required to find new geographic ranges as the climates of their native habitats change, further threatening crops (Campbell 2013).

Overall, even though processes of land use change indicate a declining importance of paddy rice farming, Vietnam continues to dominate exports of this important commodity (Rutten et al. 2014: 38). However, rising incomes in urban areas leads to changing diets—a trend seen in developing areas worldwide (Hung 2009). Higher socio-economic status tends to encourage replacement of rice for more processed foods (Climate & Development Knowledge Network 2012: 9).

## Policy Recommendations and Conclusions

Managing environmental degradation and land use in the face of climate change and changing socio-economic dynamics has been unsuccessful for the country of Vietnam (Asia Society 2015). There is a lack of public awareness about how individual actions contribute to the destruction of the natural world, and this is at the root of this issue. Despite a widespread misunderstanding of the factors of development, climate change, land use, and food security, many policies options are available to resolve many of the issues and threats reviewed previously.

With the continuing growth of developing countries across the globe, climate change and emissions are being increasingly prioritized in agreements concerning foreign direct investment and environmental standards (Tang & Tan 2015: 447). As mentioned, income, FDI, and energy consumption are the main determinants of carbon dioxide emissions in the country. Of these determinants, a policy priority should be using FDI as a tool to adopt clean technologies in order to reduce the growth of GHGs while benefiting economic growth (Tang & Tan 2015: 447). Ideally the concept of a green economy will continue to garner interest in Vietnam and other developing countries, and with the importance of FDI to economic growth, these investments should be used to positively influence adherence to climate agreements and environmental standards. Green FDI policy can achieve green growth, and screening of foreign capital investors is an important step (Tang & Tan 2015: 453).

Policies are also critical in protecting the Vietnam landscape and biodiversity. Considering the predicted high rate of urbanization could lead to a catastrophic disappearance of protected land areas in the nation, policies in line with the objectives of the World Wildlife Federation may become necessary. To mirror the WWF would require: clear and achievable targets for conservation, provision of financial assistance and technological support, a program for evaluation and monitoring progress, and national advocacy initiatives (WWF 2015).

Food security policies are a necessity, as well, such as mandatory allocation of land for paddy rice farming, rather than conversion to built-up land or a production forest (Rutten et al. 2014: 29). A holistic agenda with ambitious targets for crop productivity and technological advancements will position Vietnam on a trajectory with possibilities of enriching both the agriculture sector and the overall economy (Rutten et al. 2014: 40).

Some steps are already being taken, including two programs that USAID has implemented: the Vietnam Forests and Deltas Program and Vietnam Clean Energy Program. The Forest and Deltas Program focuses more on resilience than is typical of current policies, which can prevent disasters from being as devastating as they could be. Improved forest management, training programs on climate smart livelihoods, green growth strategies, and innovated land use planning are all components (USAID 2013). Ideally, this program will empower local people to assess hazards and

work toward long-term resilience while building capacity at multiple levels to confront climate change effectively (USAID 2013). The Clean Energy Program also has a capacity-building goal in sight and focuses on increasing efficiency in the building sector (USAID 2014). With the transition of land to built-up areas, this is a particularly important step.

It is necessary to evaluate these programs moving forward, to consider what options are available, to pursue aggressive policy solutions, and to delve more deeply into the interrelated nature of socio-economic development, climate change, land use change, and food security.

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