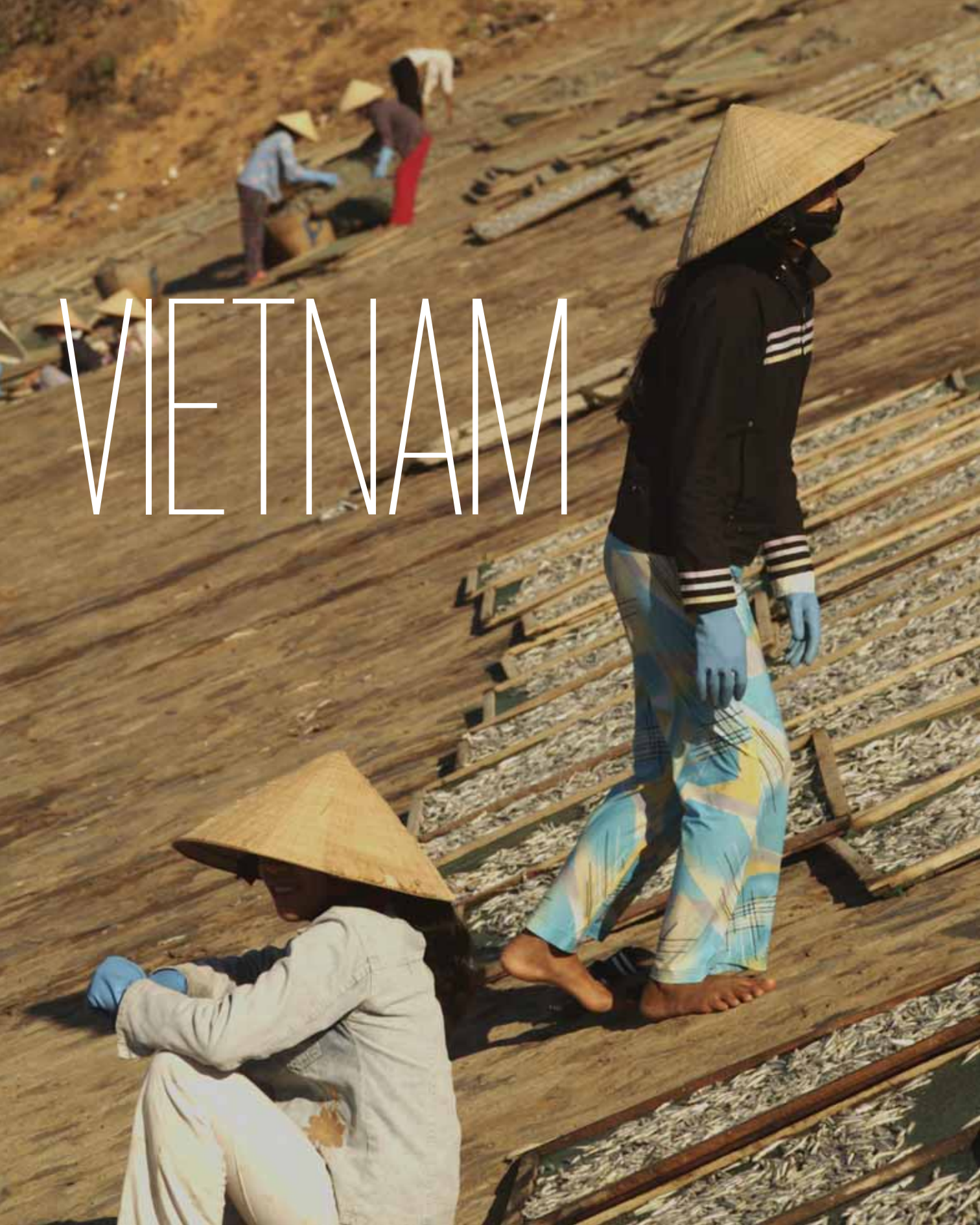


VIETNAM



COUNTRY STUDIES

GENERAL PURPOSE

1

FEEDBACK FOR THE DEVELOPMENT OF THE MONITOR'S METHODOLOGY

2

EXPLAIN HOW THE ANALYSIS OF THE MONITOR CAN BE USED IN A NATIONAL SITUATION

3

SERVE AS A KNOWLEDGE-SHARING MECHANISM FOR BEST PRACTICE AND CHANGE MANAGEMENT FOR THE BENEFIT OF OTHER VULNERABLE COUNTRIES

4

PROVIDE AN OUTSIDE SUPPORTING ANALYSIS OF INTEREST TO NATIONAL POLICY-MAKERS AND DEVELOPMENT PARTNERS



KEY FIGURES

Population	87,840,000
2012 GDP PPP (Dollars)	
Total	\$320,874,000,000
Per Capita	\$3,549
Real Growth	5.6%

ECONOMY

GDP by Sector	
Primary/Extractive	22%
Secondary/Productive	40%
Tertiary/Services	37.7%
Key Sector(s)	Industry

SOCIO-ECONOMIC DEVELOPMENT

Human Development (Rank)	Medium (128th)
Life Expectancy	75.2 years
Annual Population Growth	1%
Illiteracy	3.1%
Urban Population	31%
Access to Electricity	97.6%
Gender Development	48 th
Undernourished Population (2006/08)	11%
Living below poverty line (\$1,25/day)	13.1%
Population without Improved Water Source	12.2%
Official Development Assistance (% of GDP)	4.4%
Public Health Expenditure	7.2%
Public Education Expenditure	5.3%

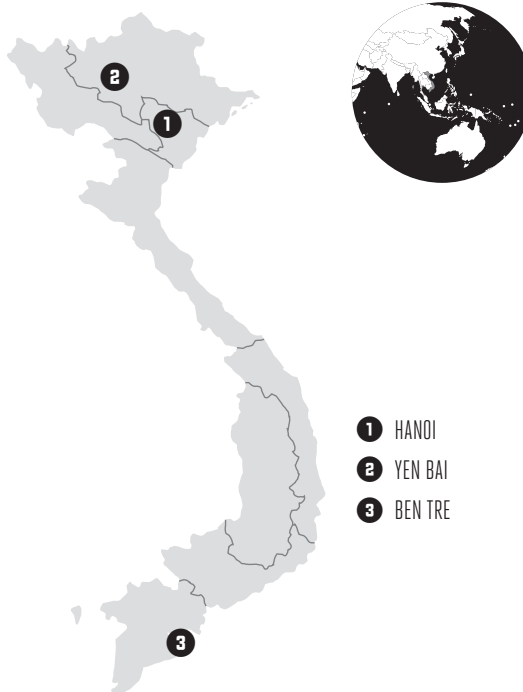
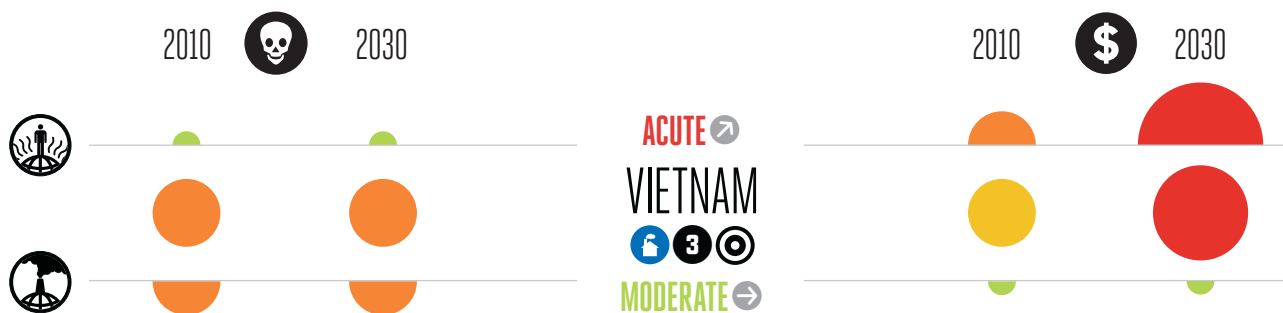
CLIMATE/GEOGRAPHY

Climate Zone	Monsoon tropical
Projected Rainfall Change	Likely to increase by 1.0-5.2% and 1.8-10.1%
Tropical Cyclones	Yes (decreasing trend)
Desertification	None
Low-Elevation Coastal Zone (10m and below)	20%
Forest Cover Change (1990-2008)	44.3%

MIGRATION/DISPLACEMENT

Emigration Rate	2.4%
Immigrants as Share of Total Population	0.1%
Internally Displaced People	None

Impact Areas	Indicator	Confidence	Bias	Vulnerability	
				2010	2030
CLIMATE	DROUGHT	✓		Red	Red
	FLOODS & LANDSLIDES	✓	♀	Red	Red
	STORMS	✓		Green	Green
	WILDFIRES	✓		Green	Green
	BIODIVERSITY	✓		Green	Green
	DESERTIFICATION	✓		Green	Green
	HEATING & COOLING	✓		Yellow	Orange
	LABOUR PRODUCTIVITY	✓	♂♀	Red	Red
	PERMAFROST	✓		Green	Green
	SEA-LEVEL RISE	✓		Yellow	Yellow
	WATER	✓		Green	Green
	DIARRHEAL INFECTIONS	✓		Green	Green
	HEAT & COOL ILLNESSES	✓		Yellow	Yellow
	HUNGER	✓		Green	Green
	MALARIA & VECTOR BORNE	✓		Green	Green
	MENINGITIS	✓		Green	Green
	AGRICULTURE	✓		Yellow	Orange
	FISHERIES	✓		Orange	Red
	FORESTRY	✓		Green	Green
	HYDRO ENERGY	✓		Green	Green
	TOURISM	✓		Green	Green
TRANSPORT	✓		Green	Green	
CARBON	OIL SANDS	✓		Green	Green
	OIL SPILLS	✓		Green	Green
	BIODIVERSITY	✓		Green	Green
	CORROSION	✓		Yellow	Yellow
	WATER	✓		Yellow	Yellow
	AIR POLLUTION	✓		Yellow	Orange
	INDOOR SMOKE	✓	♀	Orange	Yellow
	OCCUPATIONAL HAZARDS	✓	♂	Orange	Yellow
	SKIN CANCER	✓		Yellow	Yellow
	AGRICULTURE	✓		Green	Green
FISHERIES	✓		Red	Red	
FORESTRY	✓		Green	Green	



The Monitor research team held a nationally-focused policy workshop in the Vietnamese capital of Hanoi and undertook field research in two provinces: Bến Tre, in the extreme south of Vietnam, at one of the outlet points of the Mekong Delta, and Yên Bái, in the highlands to the north-west of Hanoi in northern Vietnam.

In recent years, Vietnam has consistently been one of the world's fastest growing economies and is an important contributor to global growth (IMF WEO, 2012). Getting climate policy right will enable Vietnam to grow even faster and to accelerate its already impressive strides in reducing poverty and safeguarding the health of its people, as evidenced by the significant progress it has achieved with respect to the Millennium Development Goals (ODI, 2010). Among the countries most vulnerable to the effects of climate change, especially in economic terms, Vietnam also suffers serious health impacts from carbon-intensive urban industrial and transport-related air pollution and, especially in rural and highland areas, hazardous household cooking and heating practices from the indoor burning of wood, coal, and other materials. The full range of climate-related effects is harming last mile efforts to reduce poverty. The government has clearly recognized the benefits of a strong response to climate change and embraced efforts to begin low-carbon transition as a means of increasing competitiveness. It has unequivocally prioritized these steps in its policy directives and foreign relations. As a result, it is taking concrete steps to safeguard and enhance the economic, social, and environmental dividends of its growth. This in itself is a compelling message to the world, given that Vietnam is anticipated to be among the largest economies of the 21st century (O'Neill et al., 2005).

The country's policy stance on climate change is path-breaking for one with low-emissions and limited responsibility for climate change experienced to date. However, new research aggregated for the Monitor's assessment in this report suggests that there is still further scope for enhancing these policies. Nevertheless, the approach adopted serves as an important example of success that other vulnerable countries around the world would be well advised to examine in detail.



MULTI-DIMENSIONAL CLIMATE VULNERABILITY: **ACUTE** ↗



MULTI-DIMENSIONAL CARBON VULNERABILITY: **MODERATE** →

CAPACITY: **INTERMEDIARY**

POPULATION 2010/2030: **88/102 MILLION**

GDP 2010/2030 (PPP): **280 BILLION/1.5 TRILLION USD**

GDP PER CAPITA 2010/2030 (PPP): **3,000/14,000 USD**



BACKGROUND AND CONTEXT

BACKGROUND AND CONTEXT

With a population of over 90 million today, Vietnam is a populous and fast-growing lower-middle-income South East Asian country, bordering China to the north and Laos and Cambodia to the west (CIA, 2012). Vietnam is similar in size to Germany or Japan. Its climate is tropical monsoon and varies from warm in the south to cool in parts of the sub-tropical north; its climate also changes depending on elevation in the many mountainous parts of the country.

Although economic growth has been consistently fast in the last decade, GDP per capita is still very low at 3,000 US dollar (PPP), or 1,200 dollars per capita in nominal terms, but could increase ten times by 2030, as anchored in IPCC marker scenarios (IPCC, 2000). The affluent and international urban centres of Hanoi and Ho Chi Minh City contrast with the less developed rural areas with their still excessive poverty levels. A strong education system and human capital, as well as relatively robust institutional governance and infrastructure indicate that Vietnam's capacity is not among the lowest. For similar reasons and due to its population size, the United Nations has never considered Vietnam a Least Developed Country. The country carries relatively high macroeconomic climate risk compared with more advanced economies, since the agricultural sector represents 20% of GDP and employs over half of its workforce. Reducing risks will involve diversification of the labour force into the industrial and service sectors, as well as modernizing farming through irrigation systems.

As the Vietnamese economy experiences sustained high growth, it will be a priority to limit the negative effects of the industrialization process associated with its structural progression to higher income levels. While Vietnam's GHG emissions are low at 3.5 tons per capita and are expected to remain below 4 tons per capita into the 2020s. Vietnam's industrial,

THE MONITOR'S ASSESSMENT OVERVIEW

urbanizing, power generation, and socio-economic profiles mean have led to high concentrations of fine particles, which are extremely toxic. Moreover, heavy reliance on firewood for domestic cooking and heating poses serious health risks (Climate Analytics, 2012). Despite its strengths, the environmental vulnerability of Vietnam to climate change is extreme. Its mountainous geography and coastal frontage combine with exposure to tropical cyclones (typhoons) and storms which form in the western Pacific Ocean, leaving the country prone to extreme floods, landslides, heavy rainfall, and high winds. The low-lying Mekong delta is one of the largest flood-prone zones of the world. Most of the southern tip of the country, including much of nearby Ho Chi Minh City, are at less than one metre above sea level. Vietnam's tropical climate will continue to heat up, bringing more drought spells and fishery losses as thermal conditions increasingly exceed already elevated historical levels. Social and economic vulnerabilities are also high, especially in remote highland communities. Insurance exists for health care, but is rarely available for farmers, fishing operations or even infrastructure. Electricity grid access is very high for the country as a whole, but in some of the poorest communities, it reaches just over half of all households, where plumbed water sources are also absent and malnutrition rates and the associated stunting of children can be commonplace.

THE MONITOR'S ASSESSMENT OVERVIEW

On the basis of the Monitor's assessment, the impact of climate change is estimated to have already held back to a significant degree the economic prosperity of Vietnam's fast-growing economy, effects which are estimated here to grow steeply in severity in the next 20 years. Certainly, the top 10% of days and nights previously considered "hot,"

CLIMATE CHANGE

a key indicator of climate change, has increased in number by 30 and 50 respectively for a given year, as compared with Vietnam's 1960s climate. Both are set to increase even more substantially through to mid-century and potentially beyond (McSweeney et al., 2012). The multi-dimensional vulnerability of Vietnam to climate change is considered in the highest category of Acute and rising. Vulnerability to the carbon economy is estimated as Moderate and stable. Economic impacts are the main sources of Vietnam's vulnerability, with human or health effects being less extreme in comparison with other countries. Total economic losses are estimated to cost Vietnam 5% of its GDP in net terms in 2010, growing to 11% of GDP by 2030, as the country's vulnerability shifts from Severe to Acute over this period. The economic cost of the carbon economy is estimated at a much lower 0.8% and is set to remain stable relatively through to 2030. However, the human cost of the carbon economy is considered Severe and estimated already to cause over 50,000 deaths per year, increasing to over 60,000 deaths per year by 2030.

CLIMATE CHANGE

The following most serious climate change impact areas are assessed (for 2010/2030) in order of the scale of GDP losses from higher to lower:

- LABOUR PRODUCTIVITY, **ACUTE/ACUTE** 4.4%/8.6% of GDP
- SEA-LEVEL RISE, **HIGH/HIGH** 1.5%/2.7% of GDP
- FISHERIES, **SEVERE/ACUTE** 0.5%/1.6% of GDP
- AGRICULTURE, **HIGH/SEVERE** 0.2%/0.4%
- HEATING AND COOLING, **HIGH/SEVERE** 0.1%/0.3% of GDP
- FLOODS AND LANDSLIDES, **ACUTE/ACUTE** 0.1%/0.1% of GDP
- BIODIVERSITY, **MODERATE/MODERATE** 0.1%/0.1% of GDP
- DROUGHT, **ACUTE/ACUTE** 0.1%/0.1% of GDP

The most serious health impacts

CARBON ECONOMY

related to climate change are estimated to be Heat and Cold Illnesses and Hunger. Heat and Cold Illnesses, or mortality among chronic disease sufferers during heat waves, present particularly severe challenges to the elderly, whereas Hunger predominantly concerns young children. While mortality is low in each case, an average of over 800,000 people is estimated to be affected each year by the aggravating effect of climate change on hunger. The assessment used for Labour Productivity and Sea-level Rise are considered relatively reliable, whereas other main impacts are more indicative or less certain due to the limitations of models relied upon for these indicators. In terms of positive impacts due to climate change assessed here, Vietnam is understood to benefit very slightly from additional water supply as a result of additional rainfall, overcompensating for heightened evaporation as the heat increases. For similar reasons, Vietnam is also estimated to experience a slight decline in aridity in the driest zones which could become more humid. However, these findings are based on global models (or IPCC model ensembles) and their results contrast with Vietnam's own reference scenarios, which project higher rates of evaporation than rainfall, and large declines in rain and river flows during dry spells, which are not always offset by increases in flood flows (Nohara et al., 2006; Hansen et al., 2007; Vietnam MONRE, 2010).

CARBON ECONOMY

Regarding carbon economy cost in human terms, Indoor Smoke is the most serious concern, accounting for just over 40,000 deaths per year in 2010 and similar mortality levels by 2030, as a result of disease from exposure to smoke from indoor fires for cooking and heating. Deaths due to indoor smoke are stable, because despite a fast expanding population, economic growth is expected to see many households adopt cleaner burning fuels and stoves. Air Pollution

NATIONAL RESPONSE STATUS

is estimated to claim 10,000 casualties a year in 2010, rising to over 20,000 deaths per year in 2030 as pollution levels rise. The northern Red River basin around Hanoi has significant, excessive levels of fine air particulates from traffic and industrial emissions which are highly hazardous to human health. The country's current growth pathway would see that worsen as economic growth and industrialization expand (World Bank, 2012; Donkelaar et al., 2010). In economic terms, the most significant economic losses due to the carbon economy concern Biodiversity (2010/2030: 0.3%/0.6% GDP), Human Health (2010/2030: 0.3%/0.3%) and Fisheries (2010/2030: 0.2%/0.2% GDP). The carbon economy effects for Agriculture constitute a 0.2% loss to GDP in 2010, but are converted into a 0.1% gain to GDP by 2030, due to the expected realization of carbon fertilization benefits for crop productivity. However, this gain to GDP is more than offset by the expected 0.4% of GDP losses due to climate change. The human health impacts are considered relatively reliable, whereas impacts for Biodiversity, for instance, are considered more indicative. Fisheries impacts are labelled here as speculative, due to the limited scientific research currently available, especially as regards the effects of various pollutants, such as acid rain on key species of fresh or brackish water fish and aquatic life. The acidification of the oceans as it absorbs CO₂ is however a well established area of concern (Sabine and Feely in Reay et al. (eds.), 2007; IPCC, 2007).

NATIONAL RESPONSE STATUS

Policy development on climate change in Vietnam has been a serious and active field of activity for many years. The 2007/8 "National Target Programme to Respond to Climate Change" (NTP-RCC) carved out the



CLIMATE FINANCE

first major national policy framework and committed over 50 million USD of domestic resources to tackling climate change, in particular to respond to the impacts of climate change (Vietnam MONRE, 2008). In 2012, Vietnam launched its “National Climate Change Strategy” (NCCS), which covers a range of vulnerability and low-carbon issues (Vietnam NCCS, 2011). The NCCS is also fundamentally different from the earlier National Target Programme, in that it conveys firm directives of the Executive to all relevant government offices to bear responsibility for implementation. The Strategy outlines the following ten priority task areas for implementation, which provide a useful insight into the foundations of Vietnam’s national response to climate change:

1. Disaster preparedness and climate monitoring
2. Food and water security
3. Sea-level rise
4. Protection and sustainable development of forests (carbon sinks and biodiversity)
5. GHG reductions
6. Increase of the role of government
7. Community capacity development
8. Scientific and technological development
9. International cooperation and integration
10. Diversification of financial resources and investment effectiveness

Furthermore, concerted efforts to implement climate change policy at the regional level are also underway, with one of the initial target provinces, B n Tre, visited as part of the field research for the Monitor.

CLIMATE FINANCE

In 2010, Vietnam attracted the sixth largest volume of international climate change finance among developing countries, totalling over 500 million USD. Only Brazil, Egypt, Kenya, India, and Indonesia received more funds. However, with 200 million USD targeting adaptation, Vietnam was the single largest recipient of Adaptation funds, and has a very balanced allocation of international

resources between adaptation and low-carbon investments. These funds represent monies announced by donor governments or multilateral institutions to the main database of the Organization for Economic Co-operation and Development as principally targeting climate change (OECD CRS, 2012). They do not necessarily represent funds supporting the government of Vietnam’s climate change policies and programmes, although a share of these funds may, indeed, be applied in this manner. In the case of Vietnam, climate finance is almost exclusively bi-lateral with Japan as the largest climate donor, followed by Germany and France. The split of bilateral funds between loans and grants is almost 90:10, so most of the finance is in the form of concessional loans.

All other factors remaining equal, the high levels of vulnerability in Vietnam and its relatively significant capacity make the country a sensible early priority destination for climate finance. Vietnam is developing a robust climate change policy and implementation model that will be of interest and use to other countries in similar income and vulnerability strata, but which, unlike Vietnam, have farther to go in making progress on building their multi-dimensional capacity for implementation. Despite being the largest contribution worldwide, the 200 million USD of external support for adaptation is well below 0.1% of Vietnam’s GDP and therefore pales in comparison to the scale of economic losses estimated at over 5% of GDP in 2010. In ideal circumstances, greatly enhanced international support should be forthcoming to assist Vietnam in dealing with such large-scale impacts. However, given the possible scale of the shortfall and the low-end prospects for large-scale increases in foreign assistance, Vietnam will likely come under increasing pressure to invest available domestic resources in order to preserve the resilience and ensure the ongoing competitiveness of its economy.

ASSETS

ASSETS

Several strong points are notable hallmarks of Vietnam’s response to climate change:

- *Strong Executive Leadership:* The clear support of the Prime Minister behind the climate policy project of Vietnam will be essential for meaningful vertical (central, provincial, district/municipal) and horizontal (across multiple ministries/departments) collaboration, necessary to strengthen the country’s resilience to climate change and seize key opportunities for low-carbon development.
- *Governance Mechanism:* A clear and comprehensive policy framework and coordination mechanism has been established with executive authority and provides the substantive and operational mechanism with phasing, responsibilities, and financial parameters outlined for implementing Vietnam’s climate policy response. The National Workshop held in the context of the country research undertaken highlighted how moving from governance to effective implementation and monitoring is now becoming the overriding challenge for Vietnam.
- *National Reference Scenarios:* Vietnam has regularly updated and communicated national climate change scenarios with a high resolution of sub-national information across a range of key concerns such as rainfall and evaporation, sea-level rise, and others. Clarity on an agreed set of reference scenarios is essential to calibrating policy responses, allocating/prioritizing resources and anchoring expert debate; regular updating is essential, given the fast pace of knowledge development in the field of climate change. In light of this assessment for instance, Vietnam might consider adding sea and pond temperature and acidity reference measures of concern to the fisheries industry, and Wet Bulb Globe Temperature (WBGT) of interest to businesses, occupational safety specialists, and economists.
- *Vibrant National-level Civil Society:*

GAPS

Engaged and concerned groups of academics, non-governmental organizations, international actors, and other civil society actors especially active in the nation’s capital are a valuable resource for the Government to draw upon, as it refines and advances its climate change policy project in the years ahead. The group should be fostered and relied upon to support the fine tuning of policy development, implementation, and monitoring.

- *Buoyant International Support:* The Government has clearly indicated to development partners the importance of climate change as a national development priority. International development partner donor governments, such as Japan and France, and international financial institutions including the World Bank have responded by forming a “Support Programme to Respond to Climate Change” (SPRCC) coordination group to assist Vietnam in its development and implementation of climate change policy; an evaluation mechanism fiscal/loan support, including financial resource commitments form a growing share of Vietnam’s Official Development Assistance (ODA), all of which promote harmonization, cooperation, action, and results.
- *Public Financial Commitments:* Vietnam has committed substantial government mobilized funds to the project, initially amounting to approximately 50 million USD over a 5–6 year period.
- *Key Sector Effects Addressed:* The existing climate change strategy and policies of Vietnam already address the majority of the key issues, including sea-level rise, agriculture/food and water security, heating and cooling (through urban energy efficiency), as well as disasters, such as flooding and landslides.

GAPS

Some gaps can be identified on the basis of this Monitor’s innovative assessment methodology. In 2010, the first Monitor would have identified



OTHER CHALLENGES AND OPPORTUNITIES

very few gaps, testifying to the quickly evolving nature of our understanding of climate change. Gap areas which merit further exploration by stakeholders include:

- **Labour Productivity:** The most significant impact for Vietnam as assessed by the Monitor. It is to be expected that it is not addressed by current policies, since the effect has not been included in any IPCC reports to date (IPCC, 1990, 1995, 2001, and 2007). However, in noting in its 2008 NTP that mines would require more energy for cooling, Vietnam did recognize the important relationship between worker productivity and rising heat (Vietnam MONRE, 2008). Experts also noted ongoing inquiry by the Vietnamese Ministry of Labour – Invalids and Social Affairs (MOLISA) into climate change effects. With nearly half of its workforce currently vulnerable to extreme forms of occupational heat stress, incorporating a response to this large-scale economic impact would be advisable for future climate policy iterations (Kjellstrom et al., 2009a).
- **Fisheries:** The impact of climate change on fisheries was recognized in the 2008 NTP, but has yet to find its way into an operational strategy or response. On the basis of the Monitor's assessment, Vietnam has the largest total losses in the fisheries sector due to climate change of any country in the world. Losses from climate change and the carbon economy are over 0.7% of GDP in 2010, growing to nearly 2% of GDP by 2030. This is in part due to the sheer scale of the country's fishing sector, and the vulnerabilities of its tropical waters and unsustainably managed fish stocks (UoC and Vietnam MPI, 2010). Therefore, building resilience or limiting impacts in the fisheries sector through improved fisheries management would help to reinforce any future climate policies.
- **Low-carbon Objectives:** The current national policy includes increasing energy efficiency across different sectors, carbon sinks through forests

and the share of renewable energy in the power generation sector to 5% by 2020 and a modest 11% by 2050. It also involves reducing emissions from agriculture and waste disposal in a comprehensive low-carbon strategy. With carbon economy losses representing 0.8% of GDP and quite significant human impacts particularly due to indoor smoke, providing incentives for the use of clean burning household fuels/stoves and emission reductions that also yield clean air benefits could help Vietnam to maximize the social and economic benefits of low-carbon development. The Clean Development Mechanism (CDM) should continue to be drawn upon in order to maximize low-carbon technology saturation that will increase energy and economic resilience and competitiveness, in addition to their potential health, social and environmental benefits. A "Green Growth" strategy is set to be adopted in 2012, which may provide additional impetus to the work of Vietnam in this area.

- **Regional/Transnational Dimensions:** Vietnam's interests are directly affected by the policies of neighbouring countries. In particular, increased water withdrawals and sediment withholding infrastructure in the upstream Mekong, such as in neighbouring Laos and China, have direct impacts on biodiversity, fisheries, coastal erosion, and saline intrusion in the downstream delta region in Vietnam. Vietnam's national policies could, therefore, consider raising these concerns in the context of the intergovernmental Mekong River Commission, and seeking to stimulate domestic policy responses in other countries that are favourable to its interests.

OTHER CHALLENGES AND OPPORTUNITIES

- **Awareness:** Country research stressed the level of public awareness on the issue of climate change as both a challenge and an opportunity at various levels, national, provincial, and municipal. So much can be achieved through awareness alone, from flood

safety to forest protection or farming knowledge, that it was seen as a key priority and features prominently also in the National Strategy. However, explaining complex concepts and responses in terms accessible and meaningful to different communities was seen as a challenge. Wide-ranging media: TV, radio, and the Internet, could provide a range of possibilities for reaching target audiences. Efforts to raise awareness should focus on options for practical action that people can relate to and become involved in implementing.

- **Forestry and Payment for Ecosystem Services/REDD+:** Forest covers almost half of the surface of Vietnam, but land-use conversions, such as wetlands to productive zones for fisheries or agriculture, as well as deforestation and forest degradation, are all clearly at significant levels, as evident from the country's national carbon inventory, where land usage and change (LULUCF) make up 15% of all emissions (Climate Analytics, 2012). Deforestation exacerbates fresh water scarcity, flash flooding and landslides, depletes natural carbon sinks, pollutes the air, and contributes to the erosion of biodiversity, all impacts that drain GDP and inhibit economic growth. The National Strategy aims to stabilize or increase forest cover, but given the macroeconomic risks involved, it may make sense for the Government to give incentives to land holders or local custodians to ensure sustainable forest management through a payment for ecosystem services scheme. Efforts to maximize the potential of the UN deforestation programme (REDD+) should also be prioritized as a central component in future climate strategies.
- **Monitoring and Evaluation:** Policymakers and the climate change community in Hanoi expressed an interest in enhancing monitoring and evaluation efforts in order to promote learning and improve the mobilization and prioritization of resources towards higher impact outcomes. Better criteria for evaluation were seen as

vital to ensuring quality control of implementation projects.

- **Safety Nets:** In some of the poorest parts of Vietnam, health services are made available free of charge to the lowest income groups including ethnic minorities, with progressive cost schemes depending on income level for health services or insurance. Emergency teams as state or volunteer services are mobilized for on-the-spot responses to extreme events.
- **State Education System Reach:** Vietnam's public school system is present in every municipality and is a major asset for responding to climate change in vulnerable communities around the country. The potential for expanding awareness and education programmes is high, while schools can also support health monitoring and food security among children, who are a high-risk demographic group.
- **Sustainable Fishing:** Fishing is a large industry, but facing growing concerns about overfishing and fish stock depletion due to unsustainable practices (UoC and Vietnam MPI, 2010). Losses due to climate change could be attenuated in part by improving the sustainability of fishing practices, and in this way the resilience of fish stocks. Enforcing simple regulations on fish net size (large gauge) and promoting sustainable produce certification for fishing operations are just two examples of compelling and simple options for addressing unsustainable fishing.
- **Pollution Controls:** In all regions visited, industrial, domestic and agricultural pollution was highlighted as a major concern. From mining refuse to coal plant slurry, pesticides, domestic sewage and the use of poison to catch fish, water resources were being polluted, with negative effects for fishing, biodiversity, and water availability. The finding implied that increasing resilience to climate-induced water stress could be addressed in part through improved waste management across different sectors.



BẾN TRE – MEKONG DELTA

The Mekong delta of Vietnam is almost identical in area and population size to The Netherlands in Europe including the Rhine and Meuse, Schelde Delta, each spanning some 40,000 km² with around 18 million inhabitants. Bến Tre itself is one of a number of low-lying coastal provinces in the area and is heavily dependent on the fishing industry, including intensive aquaculture such as shrimp farming. Hallmark concerns for the area relate to sea-level rise, such as salt intrusion into water and soils, fisheries impacts due to warming waters and to a lesser extent, air pollution. Drought as well as heavy and unpredictable rains were further concerns raised by the community and these are highlighted in the Monitor's assessment. Sea-level rise causes a range of effects, including erosion of sea frontage and isolated flooding especially during record tides when the estuaries of the delta begin to inundate the surrounding land. The most serious current effect, however, relates to the increasing salinity of the waters as the sea pushes further upstream the Mekong. Bến Tre's many downstream waterways are undergoing a transformation as salty water progressively replaces previously fresh water, ultimately restricting the availability of water for domestic and agricultural purposes, and effectively drying up this coastal community.

RESPONDING TO SEA-LEVEL RISE

Needless to say, the very serious impacts and imminent risks linked to sea-level rise are of great concern. Local adaptation plans aim to gradually transform the Mekong delta into a South-East Asian version of The Netherlands, with a long list of intended actions costing over 100 million dollars in near-term investments for the province of Bến Tre alone, only one of 58 provinces in Vietnam. Although 50–60% of the plan is aimed at crucial infrastructure investments, such as dykes, polders, water supply works and dams, including 65kms of concrete sea walls and coastal defences reminiscent

of the Maginot Line, it nevertheless represents a bargain, if compared to the unthinkable costs such enormous infrastructure investments might incur in a developed country. A long-term Mekong Delta “Master Plan” is also under development with the involvement of a Dutch consortium (NWP, 2012). Local officials were open about the fact that investment needs far exceed what the community could conceivably afford to invest, and hoped that 90% of funds would be forthcoming from the international community and the central government. The ability of the community to take on loans to pay for all the intended construction was also severely limited. However, certain projects were reported to be potentially justifiable as loans, in light of the anticipated increases in agricultural production that would result from implementation. This suggests some scope for communities and businesses to pay for construction costs of water infrastructure later on the basis of expanded incomes. With almost the entire province lying below only one metre above sea-level, the whole area would be underwater by the end of the century according to the mid-point of the IPCC's estimates (IPCC, 2007). Since the last IPCC report, much higher estimates have been consistently put forward, suggesting that the IPCC is at the low-end of possible outcomes (RSNZ, 2010; Füssel in Edenhofer et al. (eds.), 2012). At the moment, however, sea-level rise is a more manageable 2–3mm per year, or 1 cm every 3–5 years (Vietnam MONRE, 2010; NASA Climate, 2012). Given that it is not likely that international resources will ever be made available to fund infrastructure for an expanse of over 60kms of coastline over the next five years, a diversification of the response strategy is likely called for.

In a broader context, it is evident that climate-driven sea-level rise is not the only factor aggravating Bến Tre's water-related concerns. Two important issues are equally worrisome. If adequately addressed, they might well

help to alleviate or offset some of the climate-related stress being felt and at a lower cost than solid infrastructure responses.

First, an intensification of agriculture in the area has used water pumped from underground or from canals to meet growing irrigation needs. The water volume removed from local supplies is therefore increasing in a context of growing water scarcity. Increasing heat and drought due to climate change remain a likely exacerbating factor. However, withdrawal of ground water contributes to land subsidence, or sinking land, which heightens inundation vulnerabilities and can result in perceived sea-level rise (Larson et al., 2001).

Rainfall, especially in heavy concentrations, is predicted to increase for much of Vietnam due to climate change, as the Earth's hydrological system is accelerating (Vietnam MONRE, 2010). An alternative to expensive large-scale water generation facilities are low-cost, locally produced water catchment and storage units that harvest rainfall for subsequent use for domestic purposes; however, the available area for artificial catchment would likely fall short of meeting the needs of the agricultural industry. The second key factor is also linked to the booming agricultural industry of the broader region. From the ocean frontage of Bến Tre back through the Mekong across Vietnam and reaching to the hinterlands of Cambodia, the agricultural boom has been sustained by large-scale irrigation systems that are fed by the Mekong itself. Upstream, not only in Vietnam but also in Cambodia, this is often accomplished through the construction of dams or dikes that help ensure a predictable water supply at specific points. On the whole, however, the Mekong's flow rate may be affected by a large-scale diversion of its water for irrigation (Fredén, 2011). Furthermore, dams built for irrigation purposes also trap riverine sediment upstream, depriving the downstream river delta of crucial alluvial deposits vital to its



CLIMATE ★

	2010	2030
Contraction of biological zones (km ²) - yearly average	-150	-300
Additional land degraded due to climate change (km ²) - yearly average	-3,500	-7,250
Additional/reduced energy load due to climate change (GWh) - yearly average	1,500	6,000
Additional CO ₂ generated/reduced for heating and cooling due to climate change (kt CO ₂) - yearly average	550	2,500
Share of workforce particularly affected by climate change (%) - yearly average	48%	37%
Additional land lost due to climate change (km ²) - yearly average	150	300
Additional water losses/gains due to climate change (km ³) - yearly average	-1	-1

environmental integrity (Baran, 2010; Yang et al., 2005). A slowing river flow might therefore also be responsible for increasing contamination of downstream zones in water with a high salt content as the Mekong's ability to force back oceanic tidal movements is compromised. It is unclear whether or not an expected increase in river flow due to climate change would offset a growing intensification of water withdrawals (Vietnam MONRE, 2010). The retention of sediment also has a further negative impact on marine and freshwater biodiversity and fisheries by reducing the nutrient content of the lower Mekong, as experts confirmed. Nor is does the question concern the suffering of downstream Bến Tre alone. The ecosystem of all parts of the delta system being tightly interlinked, local experts stressed the interdependence of fish movements. With the local biological richness of Bến Tre declining, its ability to serve as a corridor for fish migrations upstream is compromised and is leading to a decline in fish stocks in non-coastal delta provinces. Therefore, there is a strong incentive for inter-provincial cooperation to ensure that common resources are managed effectively and for the benefit of all. However, according to experts, this type of cooperation was still at the exploratory phase. The upstream provincial university at Can Tho for instance had recently formed "MekongNet," to foster greater understanding and cooperation around shared Mekong river interests. At a national level, the long-term development objectives of neighbouring Cambodia have direct implications for the prosperity and risks facing the downstream delta communities of Vietnam, such as Bến Tre, Can Tho, and others. Therefore, transnational cooperation on issues affecting the Mekong river are a serious economic, environmental, and livelihood concern for Vietnam—even more so considering the growing array of considerations linked to climate change. Working more actively with the Mekong River Commission, prioritizing the issue

in formal bilateral relations with Cambodia and clearly spelling out the concern in future national policies, would constitute steps forward in addressing these challenges.

SUSTAINABLY MANAGING AQUACULTURE AND FISHERIES

Catch fisheries and aquaculture, particularly shrimping, are the dominant industries and sources of livelihood in Bến Tre. Serious exposure of the fisheries industry to climate and carbon risks did not, however, appear to be a major local consideration. And at the same time that the industry is a major income earner, it is also capital intensive and highly risky. If disease breaks out in a shrimp pond, the entire harvest is compromised, and possibly also in the neighbouring ponds. So, while the industry is an important income earner, it is also the sector that incurs frequent losses. No insurance was reported to be available for such high-risk activities as commercial pond shrimping.

Furthermore, experts confirmed that water temperature and acidity (pH) were fundamental concerns for controlled fish or shellfish ponds and directly linked to disease outcomes. Increasing heat and pollution-related water acidity would only heighten the risk of disease. Government intervention appeared to be limited to issuing guidelines during periods of extreme heat, to try and limit the loss of fish or shellfish from farms.

One systemic vulnerability identified for the aquaculture/shrimp industry was the quality of hatcheries. High quality disease-resistant seedlings are bought at extra cost that is hard to justify when a neighbouring pond might purchase the low-cost version and contract and pass on disease anyway. Improving seed supply for shrimp is an important response to this concern: Stricter regulation ensuring highest quality control for all hatcheries could ensure that all farmers use disease resistant seedlings to begin with, reducing

CARBON ★

	2010	2030
Volume of water to treat (millions m ³) - yearly average	2,000	3,000



system wide risks and losses. The increased resilience should help offset to some extent the mounting concerns over water temperature and acidity. In terms of catch fishing, there did not appear to be any serious regulation targeting overfishing and experts referenced the use of poison for fishing and the harmful effect of sewerage and aquaculture pond refuse on free-roaming fish stocks. Higher prices were reported for fish or shellfish produced under certified sustainable conditions. They provide an economic advantage, which, in most cases, outweighs the extra capital required to ensure compliance with certification schemes, such as MSC. However, many fishermen could not afford the additional financial outlay. With sustainable fishing programmes only beginning to appear, the full possibilities for such programmes were understood to be high. Building the capacity of producers by offering detailed training programmes was seen as an important step for promoting wider adoption of sustainable fishing activities. Financial stimuli or incentives are also likely to be necessary to help operators make the transition to certified operations.

Establishing and enforcing strict regulations on net size (gauge) was another important measure that helped to avoid depletion of young fish stocks and support the sustainable replenishment of fish. Finally, the preservation of coastal mangrove forests was viewed as an important priority for enhancing biodiversity that could improve the quality and quantity of local fish stocks. Mangrove swamps serve several functions: naturally accreting sediment that stems coastal erosion and warding off sea-level rise and the contamination of coastal water lenses due to salt intrusion. Mangroves also reduce sea-to-land wind speeds during severe storms, and help to limit the damage caused by extreme weather. According to local experts, some preservation zones had been established, but in areas where mangroves were not protected, the forests were in decline, due to a combination of local plundering and coastal stress. There seemed to be few if any arguments for not protecting and seeking to expand the entirety of the remaining mangrove forests. The main driver for degradation of the forests is pressure to enlist more space for agriculture or aquaculture.



YEN BÁI – NORTH-WEST HIGHLANDS

Therefore, regulations and monitoring would be required to ensure protection. Yen Bái is a large and relatively populous province in the north-west highland region of Vietnam. It is a heavily forested area with an agriculture-based economy active in the valley zones, with several hydro-energy installations in place. Farmers produce staple crops, such as rice and cassava, and, depending on the zones, cultivate plants ranging from tea to fruit trees, and in certain areas, also raise livestock. The dominant form of energy for cooking and heating is wood and biomass for indoor fires/stoves, with all the health risks that this practice implies.

The area of Yen Bái visited by the project researchers has a very low per capita income and high proportions of minority ethnic groups, living at the socio-economic margin. No specific climate change adaptation plans were in place or under development for that area. However, a number of government-led initiatives address key climate-related vulnerabilities and local officials had participated in workshops on climate change policies as a part of recent provincial and central government initiatives.

SOCIAL VULNERABILITIES

The main climate change risks for the region are extreme weather and shifting climate patterns, with flooding, drought, and agricultural concerns emphasized. Levels of socio-economic vulnerability were very high, with child malnutrition rates and stunting at 10–20% or higher in certain villages. Although mortality was reportedly very low, children and the elderly are the high-risk groups. Some 40% of households were without electricity, and similar levels of households, especially in poorer villages, were without an improved or plumbed water source. Other climate-related health concerns included a recent cholera outbreak in a remote community. However, programmes promoting personal hygiene and other education

initiatives had apparently made strides in reducing a variety of health concerns in recent years. In the poorest communities, refrigeration was unusual, and air conditioning was to be found only in upscale restaurants or hotels.

EXTREME WEATHER AND IMPACTS

Experts reported a clear shift in the last 5–7 years in weather patterns. The abruptness and timing of season changes was a hallmark alteration. One school visited by the research team had 60 children absent for reasons of illness, attributed to the sudden arrival of warm weather. Large amounts of stone debris brought downstream in recent flooding were visible in most main waterways. Tractors were in some locations clearing the debris and locals attested to the expense of flood cleanup operations. Prolonged hot and dry spells were widely reported to be more common and had led to livestock and crop losses and reductions in stream-flow during these periods. Higher temperatures were a concern for agriculture and forestry due to water stress and insect and plant disease outbreaks. A hotter climate was forcing farmers to abandon some traditional crops—one form of cabbage was cited as no longer able to grow effectively. Although winters were now shorter and the hot periods of the year longer, the area had also experienced several extreme cold snaps that had caused health concerns and livestock losses, testifying to the volatility of weather in this area. No insurance schemes were available for crop or livestock losses due to such extremes of weather or drought. But public irrigation works were ensuring wider access to reliable water sources and it was hoped these would be further expanded. A number of government-linked rural extension programmes were operational in the region, assisting farmers to grow new varieties of crops, such as those promising to be more suitable to warmer conditions, and to

bring higher yields and higher market prices. However, improved varieties of rice required more attention and technical care from farmers, indicating the importance of access to training and knowledge, as farmers made the shift in their crops and cultivation. The timing of planting and harvesting was cited as particularly important. Weather forecasting information was made readily accessible and was regularly consulted by local farmers, with rural extension officers also promoting the practice.

SCHOOLS AND EDUCATION

Disaster education programmes were being successfully piloted in a number of schools, although the focus was mainly on personal safety, such as avoiding riverbanks during heavy rains. However, environmental and climate issues were set to be introduced in two schools visited, following training sessions for teachers on these issues. Schools were already active in teaching children to help preserve forests, to cultivate climate-resistant vegetables outside their homes as a food supplement, and to follow basic sanitary guidelines. Children from the poorest remote communities were also lodged and fed at the school during term time for minimal fees. Evidence of behavioural change as a result of these initiatives was cited and teachers confirmed that children also passed on what they learned to their parents and relatives. The importance of education was underscored by the number of houses in some of the lowest-income villages that lacked any improved water source, but did possess colour televisions with satellite dishes. There were also limits to knowledge: hardship was cited as one of the main causes of local forest degradation, since people with no other alternatives would rely as a last resort on the forests by chopping down trees in order to sustain their livelihoods. Teachers suggested that the impact of educational programmes might nevertheless be improved by offering

prizes in extra-curricula student competitions on environmental/climate issues; even very low-cost items such as sun caps could make the programmes more attractive, well attended, and broaden results. Schools also worked in close cooperation with health stations monitoring children and their families and alerting and referring sick children who needed early intervention. In several schools, children whose families could not feed them would also receive free meals.

HYDRO-ENERGY

On the basis of the Monitor's assessment, Vietnam is expected to experience modest benefits for its Hydro-Energy sector as a result of higher levels of rainfall. Local experts explained that more dry spells during the hotter seasons would not affect production for energy installations with reservoirs, if annual rainfall (or runoff) were to increase. However, installations without reservoirs which relied instead on a constant stream-flow would be negatively affected. Increasing the immediate water catchment potential and quality of surrounding land could potentially offset any losses. In particular, the high-altitude forests absorb more water (by "cloud catching") and also release it more slowly and regularly, which helps to diminish the severity of droughts (Postel and Thompson, 2005). On the whole, the bulk of hydro energy in Vietnam is being produced from reservoir type installations. Local hydro-energy producers had also successfully accredited projects with the Clean Development Mechanism (CDM) and were able to confirm that the additional income stream provided by the sale of carbon credits as Certified Emission Reductions (CER) was the determining factor in making the installations commercially viable. Therefore, local entrepreneurs planned to undergo the 1–2 year registration process as a part of all future business



expansion efforts for new energy installations.

TOWARDS COMMUNITY RESILIENCE

A boost to the resilience of Yen Bái as it comes to grips with a warmer and more volatile climate could expand on and reinforce various initiatives already under way as described above. Schools and health stations are active institutions at the centre of the poorest communities doing crucial work but severely lacking in resources. Reinforcing the ability of schools and health centres to deliver social support would likely yield immediate results for the most vulnerable communities. Supporting farmers as they make the transition to higher-yielding, higher-value crops is an ongoing priority, as is the expansion of irrigation works. Preserving, growing and sustainably managing the forests of Yen Bái is also a public good that will reinforce the environmental resilience of the region with positive benefits for farmers and their families, and advantages for hydro-energy installations. The CDM is already being used to support large-scale energy projects in the region. However, CDM projects could also be developed as bundled programmes of activity, in particular to promote the dissemination of clean-burning or low-emission cooking/heating stoves (UNDP, 2011). This would help to address both the indoor smoke health risks and the forest degradation concerns of the region. Local manufacturing of appropriate and low-cost stoves may yield an additional economic dividend. Policymakers may also be interested to consider offering lifeline payments to forest holders or custodians, especially ethnic minority groups for forest stewardship, giving them incentives to preserve and sustainably manage the region's forests.

Finally, the very limited access to either crop/farm and infrastructure insurance or finance for small-scale farmers also

merits attention. The government has an interest to increase the transfer of risks to the insurance industry and to expand access to finance in order to support enhanced economic growth. Microfinance and micro-insurance schemes have met with success in other countries in communities of similar income levels, and these could provide inspiration for applying such tools in Yen Bái and other parts of rural Vietnam (Jansson, 2010).

Micro-insurance is of interest for a number of reasons. First and foremost, because communities with the highest levels of vulnerability, such as the subsistence farmers of Yen Bái, risk much more of their livelihoods to extreme weather events than any other segment of the population. Since micro-insurance is by definition affordable and should be offered on a sustainable and equitable business model for all concerned, it offers the prospect of breaking part of the cycle that links poverty so closely to vulnerability (Churchill and Matul, 2012). The fact that health care insurance is widespread, even among the poorest communities in Vietnam demonstrates the viability of the concept for other concerns, particularly in the agricultural context, such as for crops and livestock. If farmers have income protection from year to year, their productivity can be regularized and enhanced. When farmers are insured, they are also more likely to be able to access finance to enhance their yields and income further (Zeller and Sharma, 2000). Ultimately, all this will boost economic growth and public finances, which can, in turn, be reinvested in more sustainable growth and should more than justify any outlay to provide incentives in partnership with competent organizations.

CONCLUSION

Vietnam has made an impressive beginning in tackling climate change, in particular from a government policy perspective. The country serves as a case of interest for other developing countries now considering how to meet the national climate change policy challenge. It has consolidated helpful assistance from foreign partners and, with pilot activities in select provinces, has begun to tackle the larger task of implementing its policies on the ground. As climate change is estimated in the Monitor to cause significant negative externalities for Vietnam, tackling the problem effectively should provide an economic boost for the country. Raising community level awareness, while fostering local sources of knowledge and the people's capacity to engage with climate change and take actions at the community level will enhance their impact. Likewise, focusing on monitoring and evaluating project performance will lead to higher-quality projects and better results.

Vietnam would do well to focus energies on core macroeconomic risks, such as improving resource management in the fisheries sector and responses to labour productivity exposure, as well as promoting ongoing diversification of the economy onto a lower-risk service and industrial sector-orientated footing. Opportunity should also be taken to help those remaining vulnerable communities to become more resilient through programmes such as education campaigns or encouraging the use of agro-insurance. Developing the interlinkages with low-carbon concerns on forestry, wetland or mangrove preservation and indoor household fuel use, and taking advantage of technology transfer and financing through the Clean Development Mechanism will all help to maximize economic, social and environmental benefits. With the anticipated intensification of climate change stresses in the immediate years and decades ahead, early action and investment will surely guarantee the highest dividends.