VULNERABILITY AND RISK ASSESSMENT (VRA)

Communities For Resilience (CORE)

TRAINING MANUAL

Vulnerability and Risk Assessment Training Manual

About the CORE Series

The Communities for Resilience (CORE) is a flagship capacity-building program of the Climate Change Commission (CCC). CORE aims to help poor and highly vulnerable communities adapt to climate change and reduce their risk to extreme weather events and natural hazard impacts.

CCC developed a compilation of user-friendly manuals intended to increase competencies of national and local government institutions, civil society, private sector, and local communities on disaster risk management; climate change adaptation and mitigation; and mainstreaming of climate change and disaster risk reduction in local development planning and decision-making.

Dubbed as the CORE series, these tool kits were demonstrated in several pilot cities and municipalities to converge efforts on local climate action, and to integrate lessons learned from its implementation. These will also continue to undergo a series of enhancements based on current updates and innovations relevant to building resilient communities, and will not necessarily be limited to a step-by-step guide of modules and manuals.

Similarly, other tools will be developed in the future as part of the series in the form of videos, best practice case studies, etc.

This initial set of seven manuals was reviewed and vetted by the Commission's National Panel of Technical Experts (NPTE) in November 2017.

The CORE Series are available at www.climate.gov.ph.

Acknowledgement

This publication is part of the CORE Series initiated by the Climate Change Commission (CCC). This series of toolkits is based on scientific research, available literature and relevant works.

This module is a result of the collaboration between the C**limate Change Commission (CCC)** and the **Foundation for Rural Enterprise and Ecology Development of Mindanao (FREEDOM), Inc.**

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Preface

Efforts to defeat poverty and promote social justice will be difficult to sustain unless measures are undertaken to help poor and highly vulnerable communities adapt to climate change. Changes in temperature and precipitation patterns, sea level rise, and extreme weather events can easily undermine development gains that the country has attained in recent years.

The Philippines posting the highest average increase in sea level since 1901 immediately puts at risk 13.6 million Filipinos living in coastal areas across the archipelago. Studies from the Philippine Atmospheric, Geophysical and Astronomical Services Administration and the University of the Philippines have also shown that current and future shifts in temperature and rainfall regimes will have significant impacts, mostly adverse, on our agriculture, forestry, water and coastal resources, health, and urban areas – bearing serious implications on our food and water security, energy sufficiency, human security, and ecological and environmental stability.

Meanwhile, destructive weather events will continue to pose a direct threat on our people and overall socio-economic development. From our country's experience with typhoons Yolanda (2013), Pablo (2012), Sendong (2011), Ondoy (2009), and Frank (2008), we already know that reconstruction costs take a substantial chunk off of our national budget. This challenge even becomes more daunting as we center rebuilding efforts on making communities more resilient to both sudden and slow onset of the impacts of climate change.

The country has already made progress in confronting climate change since the enactment of the Philippine Climate Change Act in 2009 and the Philippine Disaster Risk Reduction and Management Act in 2010. For its part, the Climate Change Commission (CCC) has been very active in promoting climate change action on both domestic and international fronts. But much remains to be done.

As early as 2009, the United Nations Office for Disaster Risk Reduction identified three non-climatic factors responsible for the continuing escalation of disaster risks worldwide, most notably in developing countries. These are poor urban governance, vulnerable rural livelihoods, and declining ecosystems. Because of inherent "multidimensional inequalities," the poor and highly vulnerable communities end up experiencing more the adverse impacts of climate change.

It is in this context that CCC's Communities for Resilience (CORE): Convergence Program is conceptualized and implemented. The Commission understands that building resilience requires a whole-of-society approach and that the starting point for this is the integration of disaster risk reduction (DRR) and climate change adaptation and mitigation (CCAM) into the development policies, plans and programs of the national government and local government units (LGUs), especially in areas that are highly susceptible to the impacts of climate change.

The CORE initiative specifically aims to strengthen the planning capacity and overall resilience of LGUs along the country's 18 major river basins– areas which are sensitive to temperature changes, rain-induced floods, drought, sea level rise, extreme weather events, and other water- and weather-related hazards. All in all, the CCC is bringing its flagship capacity-building program on climate change to 48 provinces, 56 cities, and 777 municipalities that are vulnerable to climate change, with the goal of covering all the 80 provinces and 1745 LGUs and cities as it rolls-out the CORE initiative.

The CORE program neither aims to reinvent the wheel nor duplicate past and ongoing efforts by other government and non-government actors in the disaster and climate change communities. Rather, it seeks to build on existing partnerships, adopt tested tools and methodologies, and harmonize different approaches from various sectors, including non-government organizations, private sector and the academe.

State Universities and Colleges, in particular, will be tapped for their resources and expertise on research, tools development, and capacity building. Under the CORE program, regional academic institutions will undergo training in science- and risk-based action planning for climate change to strengthen their capacities in guiding local decision makers and LGU planners on Vulnerability and Risk Assessment, Environment and Natural Resource Accounting, Natural Resource Assessment, Greenhouse Gas Inventory, Climate Change Expenditure Tagging, Geographical Information System, and in accessing financing windows that support climate change initiatives.

This publication is one of those training modules. The menu of methodologies and tools being offered under the CORE program is intended to raise national awareness and competence on climate change actions among national and local government institutions, civil society, private sector, and communities, including students from Grades K to 12. To LGUs, it is hoped that this would serve as a useful and practical guide as they prepare or enhance their Local Climate Change Action Plans (LCCAP).

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Abbreviations & Acronyms

BAU	Business-As-Usual
CBA	Cost-Benefit Analysis
CC	Climate Change
CCA	Climate Change Act
CCC	Climate Change Commission
CCO	Climate Change Office
CDP	Comprehensive Development Plan
CEA	Cost Effectiveness Analysis
CLUP	Comprehensive Land Use Plan
COP	Conference of Parties
CoRE	Communities for Resilience
CSOs	Civil Society Organizations
CVRA	Climate Vulnerability and Risk Assessment
DP	Disaster Preparedness
DRFI	Disaster Risk Financing and Insurance
DRR	Disaster Risk Reduction
DRRM	Disaster Risk Reduction and Management
ENRA	Environment and Natural Resource Accounting
EWS	Early Warning System
GAA	General Appropriations Act
GG	Green Growth
GhG	Greenhouse Gas
GoP	Government of the Philippines
INDC	Intended National Determined Contributions
LCCAP	Local Climate Change Action Plan
LDRRMP	Local Disaster Risk Reduction Management Plan
LDRRMC	Local Disaster Risk Reduction Management Council
LDRRMF	Local Disaster Risk Reduction Management Fund
LGU	Local Government Unit
MCA	Multi-Criteria Analysis
NCCAP	National Climate Change Action Plan
NDRRMC	National Disaster Risk Reduction Management Council
NDRRMP	National Disaster Risk Reduction and Management Plan
NFSCC	National Framework Strategy for Climate Change
NGOs	Non-Government Organizations
NRA	Natural Resource Assessment
OCD	Office of Civil Defense
PDP	Philippine Development Plan
PPFDP	Provincial Physical Framework and Development Plan
PSF	People's Survival Fund
RA	Republic Act
RTM	Risk Transfer Mechanism
VRA	Vulnerability and Risk Assessment

Definition of Terms

Adaptation - Adjustments in ecological, social, or economic systems in response to actual or expected climatic stimuli and their effects or impacts" (Smit et al 1999). Also refers to the modification in processes, practices, and structures to cushion or reduce potential damages or optimize benefit from opportunities associated with climate change. But one may point out that with climate changes, humans naturally adapt and react to changes. Even without an assessment, populations adjust to new climate conditions as history would tell us. Human civilization is a product of human adaptation through time. We have evolved a variety of strategies that allowed us to adapt autonomously. However, the damages due to climate variabilities and extremes have already cost severe human and economic losses. This has indicated that the current adaptation practices are no longer sufficient to contend with the climate change impacts. Without any plan for action to address potential stresses, the system will run the risk of severe damage due to current and future threats.

Adaptive Capacity - The capacity of the system, both natural and social, to cope or absorb or rebound, to impacts of climate change. It is defined as the ability of the system to "adjust to climate change (including climate variability and extremes) to moderate potential damages, to take advantage of opportunities, or to cope with the consequences" (IPCC 2007). Many of the determinants of sensitivity are similar to those that influence or constrain a system's adaptive capacity. Based on this theory, the stronger the adaptive capacity of the local communities, its vulnerability is consequently reduced. Hence the need for vulnerability assessment is primordial in formulating measures for climate change adaptation planning and implementation.

Autonomous Adaption - Action that does not constitute a conscious response to climatic stimuli while a planned adaptation is a result of a deliberate policy decision, based on the awareness that conditions have changes or will change in the near future, and the action is needed to reduce the risks and achieve desired state (IPCC AR4). With vulnerability assessment, adaptation planning can be better informed about present and future risks and adaptations can be better planned and implemented.

Exposure - Based on the IPCC SREX Report, Exposure "refer to the presence (location) of people, livelihoods, environmental services and resources, infrastructure, or economic, social, or cultural assets in places that could be adversely affected by physical events and which, thereby, are subject to potential future harm, loss, or damage."

Introduction

Climate change is now considered one of the greatest challenges to human survival. We are experiencing it and there is already science to confirm that it is happening. It is challenging the capacity of the inhabitants of Planet Earth to thrive amidst a changing global climate. It is and will be a test of human adaptability, co-existence with other species and ecosystems on Earth, and of global partnership, as we find ways to both adapt and reduce Greenhouse Gas (GhG) Emission.

While the United Nations has placed climate change as a major issue in attaining sustainable development, the Philippines has placed it in the forefront of development as the government approved the creation of the Philippine Climate Change Commission through Republic Act 9729. It is recognition of the vulnerability of the country to climate change impacts, being an archipelagic country, and at the same time a developing country, where livelihood and economy remain to be based on primary industry. Indeed, being one of the most vulnerable countries in the world, the Philippines has to be aggressive in promoting measures towards climate resiliency, a new found pillar of sustainability for our country.

One of the critical measures for adapting to climate change is by carefully planning development and mainstreaming climate change adaptation and mitigation actions in development planning at the local , provincial, regional and national levels. It is within this context that Vulnerability and Risk Assessment or simply referred to as "VRA" becomes a relevant tool for climate change adaptation and disaster risk reduction.

I. Module Overview

1.1 Brief Description

Vulnerability and risk assessment (VRA) can assist in determining the extent to which a locality or a place and its people are exposed to both natural and climate-induced hazards, alongside its ability to withstand and/or cope with the impacts of these stresses. This process can pave the way for mainstreaming disaster risk reduction and climate change adaptation in development planning and investments.

The primary value of vulnerability assessment is for identifying and prioritizing climate change adaptation strategies in development planning. Adaptation refers to (Smit et al 1999): "adjustments in ecological, social, or economic systems in response to actual or expected climatic stimuli and their effects or impacts." It also refers to modification in processes, practices, and structures to cushion or reduce potential damages or optimize benefit from opportunities associated with climate change.

One may point out that humans naturally adapt and react to changes; and that even without an assessment, population adjusts to new climate conditions as history would tell us. Human civilization is a product of adaptation through time. We have evolved a variety of strategies that allowed us to adapt autonomously. However, the damages due to climate variabilities and extremes have already led to severe human and economic losses. This has indicated that the current adaptation practices are no longer enough to contend with the climate change impacts. Without any plan for action to address potential stresses, human society will run the risk of severe damages due to current and future threats.

1.2 Summary of Topics

Session 1: Concepts, Principles and Framework for Vulnerability and Risk Assessment

- 1.1 Definition of Terms and Concepts
- 1.2 Climate, Weather and Climate Attributes and Hazards
- 1.3 Climate Change and Impacts in the Philippines
- 1.4 Frameworks in Vulnerability and Risk Assessment

Session 2: Introduction to Vulnerability and Risk Assessment: General Methodology

- 2.1 Introduction to Generalized Process of VRA
- 2.2 Introduction to a Modified NEDA MDGF List of Indicators and Corresponding Rubric for Estimating Vulnerability Indices
- 2.3 Use of GIS in mapping climate hazards and estimating exposures

Session 3:

Session 4: Use of Multi-Criteria Analysis in Prioritization of Climate Change Adaptation and Mitigation and DRR Activities:

4.1 Definition of concepts

4.2 Selecting criteria and indicators

4.3 Case Example: Upper Marikina River Protected Landscape

Session 5: Estimating Exposure, Sensitivity and Adaptive Capacity and Vulnerability Index Workshop:

5.1 Reviewing real data from respective localities and sectors

5.2 Developing the indicator system

5.3 Plotting the data on the VI template

5.4 Calculating indices

5.5 Mapping the hazards, estimating exposures and mapping the indices

II. Learning Objectives

At the end of VRA Module, the participants will be able to:

1. Understand the nature of vulnerability and risk assessment (VRA) and its importance;
2. Understand the methods and tools used in the conduct of VRA;
3. Analyze exposure and sensitivity to hazards;
4. Evaluate the system's adaptive capacity to exposure to hazards; and
5. Demonstrate knowledge and skills to estimate vulnerability of different systems to climate change impacts and risks.

III. Module Content

Session 1. Concepts, Principles and Framework

Climate change has been considered as one of the greatest threats to human security. Climate change impacts are profound and could potentially alter life and life forms on Earth including human well-being. To begin to understand climate change impacts and vulnerabilities of human and natural systems, there are some concepts that will be relevant such as, but not limited to, the ones listed below. First, it is necessary that we understand basic concepts in climatology.

Weather is the condition of the atmosphere at a particular place and time. It can change from hour to hour, and from one season to another. It also refers to the same attributes in the shorter term. For example, weather refers to the temperature at the moment (hours).

Weather/climate is measured and characterized by a number of elements but the three most important are temperature, humidity, and rainfall. Temperature refers to the degree of hotness and coldness of the atmosphere. Humidity is the moisture content of the atmosphere, while rainfall is the amount of precipitation in liquid form falling over a specific area. Rainfall distribution varies across regions in the country and depends on factors such as the direction of moisture-bearing winds, the presence of mountain systems, and others.

Climate refers to physical attributes such as rainfall, temperature, and wind speed in the long term. Climate is the average weather of a particular area that prevails over a particular period of time, for instance, over a month, one season, or a year. In the Philippines, we have 4 types of climate based on the modified Corona's Classification.

Natural hazards refer exclusively to earthquake, tropical cyclones, floods and drought, including tsunami and earthquake-induced landslides. Some of these are climate-related hazards such as rainfall-induced landslides, flooding, and extreme events like drought, storm surges and super typhoons. Other disciplines emphasize the role of economic development in adapting to changing exogenous risk and hence, differences in class structure, governance, and economic dependencies are significant variables in determining vulnerability.

Vulnerability According to Adger (2006), vulnerability is "the state of susceptibility to harm from exposure to stresses associated with environmental and social change and from the absence of capacity to adapt." The concept also emerged from the natural hazards discipline that emphasized that "hazards are essentially mediated by institutional structures, and that increased economic activity does not necessarily reduce vulnerability to impacts of hazards in general."

Vulnerability (to climate change) assessment, hence, is an approach to estimate the extent to which a sector is susceptible to the risks due to climate change and its impacts. Vulnerability is defined as "the degree to which a system is susceptible to, and unable to cope with, adverse effects of climate change, including climate variability and extremes (IPCC 2007, 2014). Vulnerability is a function of the character, magnitude, and rate of climate change and the variation to which a system is exposed, its sensitivity and its adaptive capacity".

Vulnerability to climate change is a function of three main variables: exposure, sensitivity and adaptive capacity. Hence, the following generic equation for assessing vulnerability:

Vulnerability = Exposure (E), Sensitivity (S), Adaptive Capacity (AC)

Exposure refers to the presence (location) of people, livelihoods, environmental services and resources, infrastructure, or economic, social, or cultural assets in places that could be adversely affected by physical events and which, thereby, are subject to potential future harm, loss, or damage (based on the IPCC SREX Report).

Sensitivity describes the susceptibility of the systems (or community) based on its characteristics (or baselines such as income, gender, livelihood, location of settlements, population, etc) to these mentioned climate hazards. Smit and Wandell (2006) noted that "exposure and sensitivity are almost inseparable properties of a system (or community) and are dependent on the interaction between the characteristics of the system and on the attributes of the climate stimulus." The exposure and sensitivity of a system (e.g. a community) to a climate change risk (e.g. drought, landslides, flooding) is a reflection of the likelihood of the system experiencing the particular conditions and the characteristics of the system (or a community) that influence its sensitivity to such exposure. Smit and Wandel (2006) emphasized that the occupance characteristics (e.g. settlement location and types, livelihoods, land uses, etc.) reflect broader social, economic, cultural, political and environmental conditions, and sometimes are referred to as "drivers" or "sources" or "determinants" of exposure and sensitivity. Hence, in some assessments, exposure and sensitivity are combined (Boer, Rahman, Faqih, Pulhin, and Islam, 2012).

Adaptive capacity is the capacity of the system, both natural and social, to cope or absorb or rebound, to impacts of climate change. It is defined as the ability of the system to "adjust to climate change (including climate variability and extremes) to moderate potential damages, to take advantage of opportunities, or to cope with the consequences" (IPCC 2007, 2014). Many of the determinants of sensitivity are similar to those that influence or constrain a system's adaptive capacity. Based on this theory, when the adaptive capacity of local communities is strengthened, their vulnerability is consequently reduced. Hence, the need for vulnerability assessment is primordial in formulating measures for climate change adaptation planning and implementation.

Adaptive capacity is similar to or closely related to concepts such as adaptability, coping ability, management capacity, stability, robustness, flexibility, and resilience (Smit and Wandell 2006). It had already been noted that at the local level, the ability to undertake adaptations can be influenced by factors such as managerial ability; access to financial, technological and information resources; infrastructure, the institutional environment within which adaptations occur, political influence; kinship networks, etc. It was also noted that some determinants of adaptive capacity are mainly local (e.g. the presence of a strong kinship network which will absorb stress), while others reflect more general socio-economic and political systems (e.g. the availability of state-subsidized crop insurance)(Smit and Wandel, 2006). Adaptive capacity is context- and scale-specific such as the capacity of a household to cope with climate risks which depends to some degree on the enabling environment of the community; and the adaptive capacity of the community is reflective of the resources and processes of the region (Smit and Pilifosova, 2003; Yohe and Tol, 2002). Some authors apply "coping ability" to shorter term capacity or the ability to just survive, and employ "adaptive capacity" for longer term or more sustainable adjustments (Vogel, 1998).

At present, the adaptive capacity of communities is being improved through the use of climate data and models in early warning systems. The availability of early warning systems are gaining importance because they strengthen the preparedness of the community when responding to extreme climate events. With rapid and appropriate response to the warnings, communities, are able to manage and reduce risks of climate change and mitigate significant losses in life and socioeconomic impacts.

Hazard

Potential occurrence of a natural or human-induced physical event or trend or physical impact that may cause loss of life, injury, or other health impacts, as well as damage and loss to property, infrastructure, livelihoods, service provision, ecosystems, and environmental resources (IPCC, 2014).

Risk

Potential for consequences where something of value is at stake and where the outcome is uncertain, recognizing the diversity of values, often represented as probability of occurrence of hazardous events or trends, multiplied by the impacts if these events or trends occur.

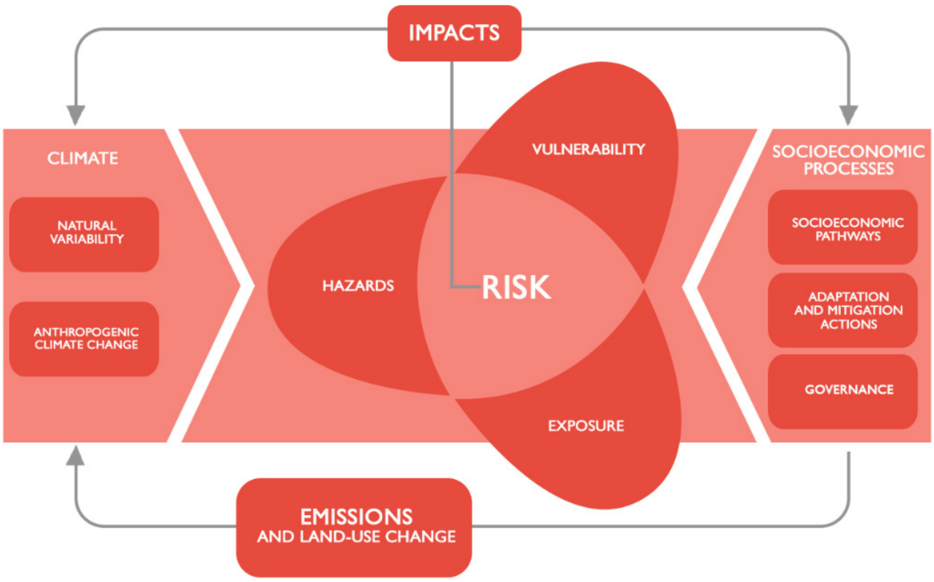

Figure 1. Risk as a result of the interactions between hazards, exposures and vulnerability of the system (or Capacities to Adapt) (AR5 WG2 SPM)

Risk is the interplay of vulnerability, exposure, and hazards. This framework refocuses discussion of climate change to risks, which according to the IPCC 5th Assessment Report is a new addition to the discourse on climate change. This framework encompasses the socioeconomic process such as the socioeconomic pathways, adaptation and mitigation actions and governance, and impacts on expanding or declining risk factor. This framework also encompasses both the natural variability of climate and anthropogenic climate change.

Risk assessment is input to planning for disaster risk reduction and management (DRRM) and climate change adaptation (CCA). Based on this framework, risk can be reduced by reducing or eliminating the hazard (if possible) or reducing the vulnerability by enhancing adaptive capacity. In this manual, vulnerability is measured in terms of three aspects: exposure to hazard, sensitivity, and adaptive capacity. Results of vulnerability and risk assessment can be the basis for the formulation of Local Climate Change Action Plan (LCCAP).

Autonomous Adaptation refers to "action that does not constitute a conscious response to climatic stimuli, while a planned adaptation is a result of a deliberate policy decision based on the awareness that conditions have changes or will change in the near future, and the action is needed to reduce the risks and achieve desired state (IPCC AR4). With vulnerability assessment, adaptation planning can be better informed about present and future risks; and adaptations can be better planned and implemented.

The VRA's primary goal is to assess the impacts of climate-related hazards to both the biophysical, as well as, the social dimensions of the human system. Specifically for assessing physical vulnerability, we are looking at infrastructures, buildings and settlements.

For example, the case of Upper Marikina River Basin Protected Landscape indicated that the physical infrastructures, such as roads and bridges, were generally vulnerable to climate change impacts and hazards (Figure 2); and these infrastructures are mostly located in crop zones and built up areas (Figure 3).

Meanwhile, impacts on socioeconomic aspects cover the people's welfare considering injuries, sickness and deaths, as well as livelihood, while giving importance to the marginal sectors of the society such as indigenous peoples (IPs), women and children and persons with disability (PWDs).

Session 2. Introduction to Vulnerability and Risk Assessment: General Methodology

Scoping

The most important process probably in vulnerability and risk assessment is identifying the scope of the study to provide analysts and other stakeholders the information on what are and are not covered in the assessment. Likewise, identifying what unit of analysis to use and setting the assessment objectives are critical at the beginning of the process. In addition, establishing which main climate hazards affect the area of interest from the existing climate information forms part of the scoping portion.

It helps to start from the long list of indicators made by MDGF in 2011 to examine which may be available in your target area. Note that major hazards usually have recommended indicators or critical levels. Similarly, the conduct of VRA should be specific for each and every hazard, ensuring compliance to international standards. Thus, the establishment of climate hazards at the very beginning would already provide an indication of the extent of the assessment.

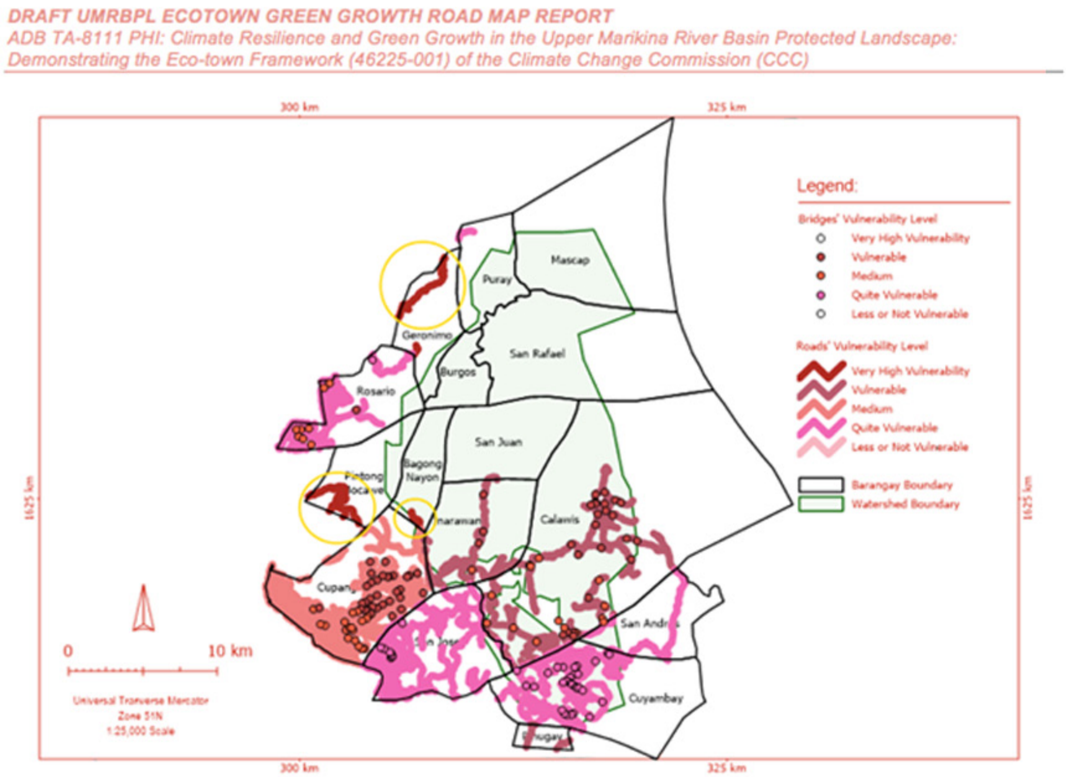

Figure 2. UMRBPL vulnerability assessment map for roads and bridges (ADB- TA PHI 8111, 2015)

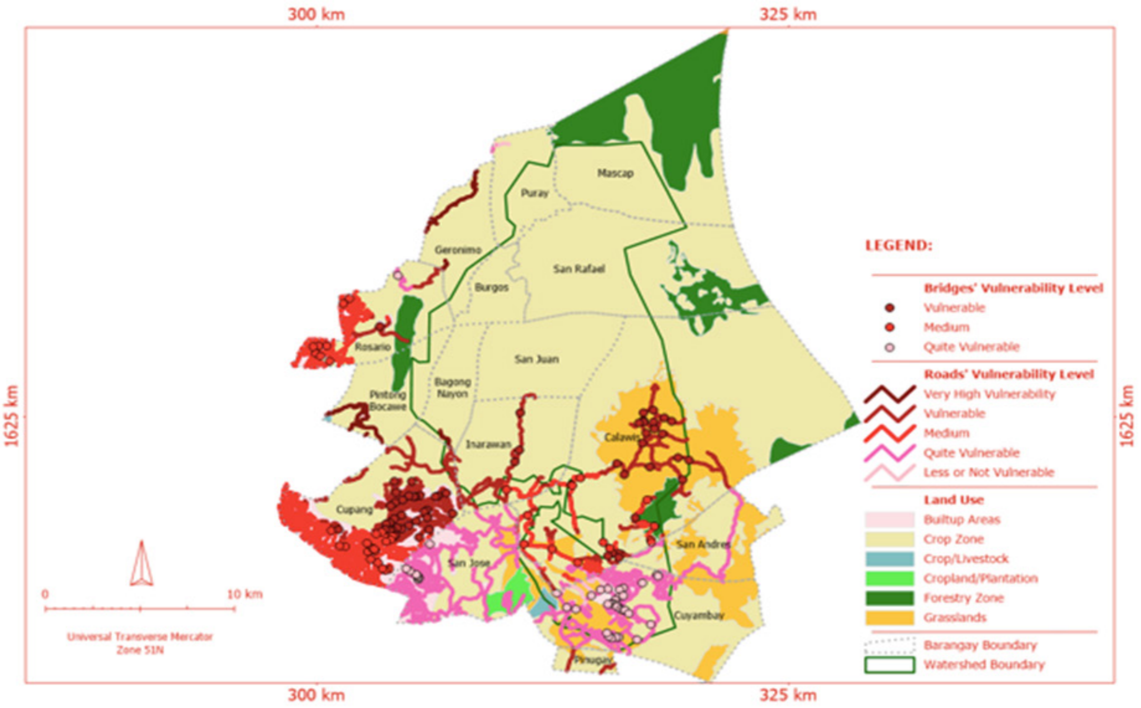

Figure 3. UMRBPL vulnerability assessment map for transport network over land use (ADB- TAPHI 8111, 2015)

Baseline conditions profiling

There is a need to establish the profile of the area by accounting the condition of its climate, demography, and society and economy, along with the status of its natural resources and existing policies and programs, to stand as reference points for future assessments and predictions.

Data collection, consolidation and analysis

Vulnerability assessment depends heavily on the collection of data, both primary and secondary, and thus requires considerable preparation of a list of data and data sources. Data preparation is needed to make sure that all necessary information for the conduct of the assessment is collected. During data gathering, it is important to document the standard unit, date of acquisition, and source of data and information.

When only secondary information is available, it is necessary to check the quality of said secondary data when used in the analysis of exposure, sensitivity and adaptive capacity. Quality check may be done by conducting a probe for the most recent or updated data or by validating the indicators with stakeholders and experts. For example, it would be best to adopt climate data as sensitivity indicators, and climate patterns and records as adaptive capacity measures, which are commonly done for most hazards. A sample list of data and information needed is shown in Table 1. From the review of literature and records, climate-related hazards may also be identified. Collection of secondary data as well as primary data would be based on the agreed framework and indicator system that will be developed.

Table 1: Secondary data needed for VA by sector

Sectors	Data Needed	Source
Agriculture	• Climate/ Geological hazards* • Maps of cultivated area to various crops in different municipalities • Thematic maps for: topographic and slope, land cover and land use, flooding potential, 1:20,000 or 1:10,000 scale if possible • Crops and livestock grown and raised • Production data • Irrigation facilities and water supply demand and supply • Soil erosion studies • Demographic profile of population depending of agriculture • Indigenous People • Pests and diseases of crops and livestock • Policies, rules and regulation, and current investments related to agricultural resiliency	• Provincial Dev. Plan, PDRRMO, • PAGASA • CLUPs, • MGB • Prov. Veterinarian Offices • Prov. Agriculture Office • DA RFU • NCIP • Local academics • LGU records • LIDAR maps • Project NOAH
Public Infrastructure	• Climate/Geological hazards* • Types and designs, specifications of bridges, roads, and public buildings (lengths, widths, heights) • Plans and programs • Policies, rules and regulation and investments related to infrastructure resiliency	• Prov. Dev. Plan, • PDRRMO, • PAGASA, • MGB • Engineering Office reports

**Minimum of 30-year period for climate data, maps, thematic maps by hazards, spatial and temporal dimensions of information*

Ratings Based on the Matrices

Once the climate-related hazards and impacts are identified, the exposure, sensitivity, and adaptive capacity are examined using both secondary and primary data. Table 2 shows the matrices to use for assessment.

Table 2. Sample matrix for VA

Sector	Climate Hazards/Risks	Level of Sensitivity, Exposure and Adaptive Capacity				
		Very High	High	Moderate	Low	Very Low
Coastal	Coastal Erosion	☐	☐	☐	☐	☐
	Siltation	☐	☐	☐	☐	☐
	Storm Surge	☐	☐	☐	☐	☐
	Storm Surge	☐	☐	☐	☐	☐
Health	Dengue	☐	☐	☐	☐	☐
	Diarrhea	☐	☐	☐	☐	☐
	Leptospirosis	☐	☐	☐	☐	☐
	Cardiovascular Diseases	☐	☐	☐	☐	☐
Agriculture	Pests And Diseases	☐	☐	☐	☐	☐
	Tropical Cyclones	☐	☐	☐	☐	☐
	Soil Erosion	☐	☐	☐	☐	☐
	Droughts	☐	☐	☐	☐	☐
	Floods	☐	☐	☐	☐	☐
Water	Flooding	☐	☐	☐	☐	☐
	Drought	☐	☐	☐	☐	☐
Forest	Flash floods	☐	☐	☐	☐	☐
	Landslide	☐	☐	☐	☐	☐
	Erosion	☐	☐	☐	☐	☐
	Drought	☐	☐	☐	☐	☐
	Wildfire and Forest Fires	☐	☐	☐	☐	☐
Public Infrastructure	Flooding	☐	☐	☐	☐	☐
	Landslide	☐	☐	☐	☐	☐
	Liquefaction	☐	☐	☐	☐	☐

Mapping of VA

To facilitate the consultation using Table 2, a scale will be developed to serve as a guide for estimating level of impacts per scale and per sector (e.g. very low, low, moderate, high and very high). Although seemingly arbitrary, the scales must be to be validated in several focused group discussions. The validation process is very crucial since vulnerability assessments are also used for priority setting. Once the assessment and validation process is completed, the results of the process are now transformed into Vulnerability Indices. Estimating exposure, sensitivity, and adaptive capacity uses a vulnerability index derived from a set of indicators (MDGF, 2012).

A balanced weighted approach is suggested for framing the initial template for estimation. Said approach must then be validated by relevant stakeholders, such as LGUs, people's organizations and other special sectors.

A separate section is devoted to a discussion on the procedure for measuring vulnerability indices per sector based on the NEDA/MDGF Vulnerability Assessment protocol (2012), ADB Ph TA 8111 (2015), and other related published references. A multi-sectoral consultation, guided by an agreed indicators system, may be used to estimate the three elements of vulnerability. Said consultation ensures that participatory process is in place, and ownership of the process by the stakeholders is improved.

A sample template for estimating exposure, sensitivity, and adaptive capacity for a sector is shown in Table 3.

Table 3. Sample template for vulnerability assessment for health sector: Dengue and Malaria

Biophysical & Socio-Economic Indicators	Weights	Description of The Indicators
A. Sensitivity Indicators ,Weight = .30		
Average monthly rainfall during wettest quarter	.25	
Relative humidity (%)	.25	
Historical records	.25	
B. Exposure Indicators, Weight = .30		
HH households' proximity to stagnant waters and unsanitary environment which favor growth of pathogens and vectors	20	Communities living close to bodies of stagnant waters and those with an unsanitary environment, lacking a waste management system, have high temperature, excessive rainfall, and relative humidity favoring growth of pathogens and vectors (MDGF 2012)
Population exposed to Malaria	20	
Household sanitation practices	20	Households with poor sanitary practices and facilities are highly vulnerable to Malaria.
Access to safe and clean water	20	Population with no access to clean water supply are vulnerable to Malaria
Household income	20	Population living below poverty threshold are highly vulnerable to Malaria
C. Adaptive Capacity Indicators ,Weight = .40		
Ecological waste management programs in place	.25	Communities with ecological solid waste management programs are less likely to be burdened by Malaria compared with communities with unsanitary environment.
Proximity to clinics and hospitals, drugstores and other important medical facilities	.25	Communities with access to medical services are better adaptive than those with low and no access to health services
Funding for health services for the public	.25	Sufficient funding for public health services promotes adaptive capacity.
Access to information and knowledge on CCA for health	.25	Information and knowledge dissemination programs availability

NOTE: Same template can be used for other diseases.

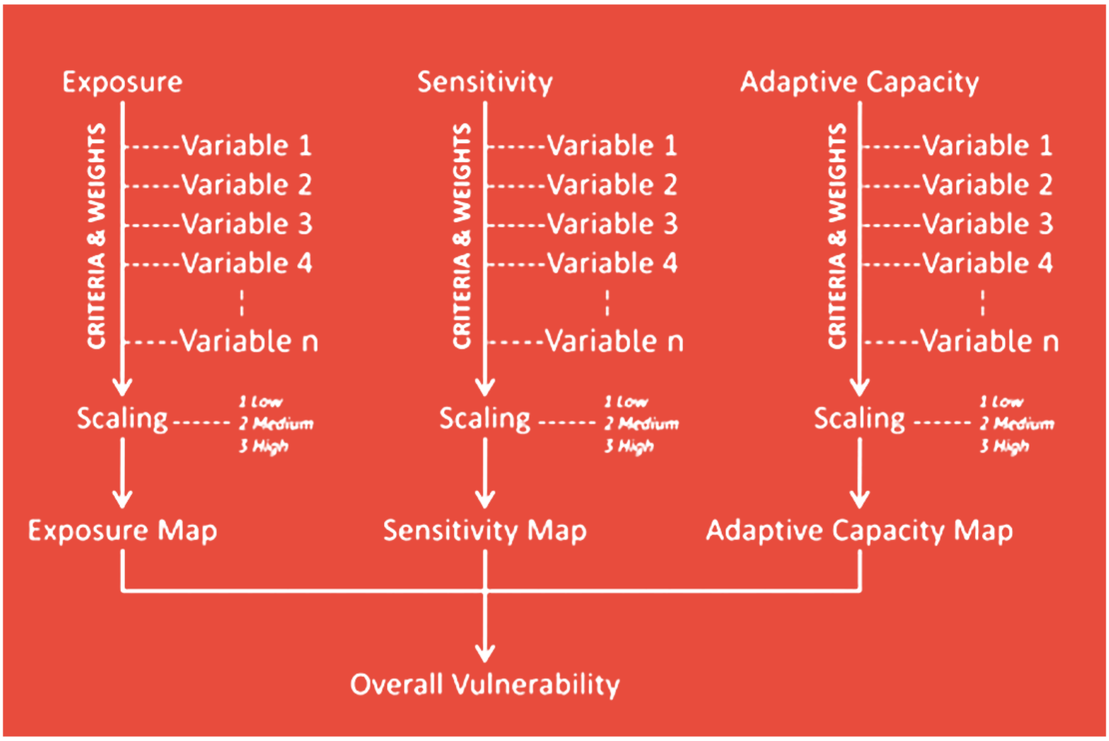

Figure 4. Procedure for mapping vulnerability (Tiburan 2016)

Mapping the results of the process entails the use of the GIS/RS tool. The participatory processes described above will be complemented with spatial analysis (to be conducted by GIS specialists/ professional) to ensure that results are properly validated. In doing the spatial analysis, data sets that can be studied through the GIS software must be available.

For example, three primary hazards in the coastal areas will be examined: coastal erosion, storm surge, and siltation. The areas exposed to these hazards will be mapped and overlaid to determine the level of impacts. Level of impacts can be measured in terms of area coverage, population to be affected, and agriculture production in coastal areas. The same process will be done for all other hazards.

Projection of climate scenarios from PAGASA is then considered. Population projections can also be done to determine the potential exposure and sensitivity of the population to various climate-related hazards, which is a major indicator of exposure in determining future vulnerabilities in twodifferent time frames (2020 and 2050). Considering climate projections ensure that future vulnerabilities are taken into account and also the required adjustments in future adaptive capacities (Figure 5).

Identification of adaptation and mitigation measures based on VA

After the vulnerabilities are identified and mapped, a participatory workshop consisting of multiple stakeholders should be conducted to determine adaptation and mitigation strategies.

Prioritization using MCVA

Cognizant of the need for efficient use of financial, human resources and other resources for adaptation planning and implementation, a prioritization workshop shouldbe conducted through some key steps.

Session 3. Use of Multi-criteria Analysis in prioritization of climate change adaptation and mitigation and DRR

Multi-criteria Analysis (MCA) or Multi-criteria Decision Analysis (MCDA) is a tool in decision making whereby options are examined based on a number of criteria. The basic steps in performing MCA are as follows:

1. **Establish the decision context.** Determine the goal/s of the analysis and identify the decision makers and other key players in the exercise.

2. **Identify the options.** Once the goal/s is/are defined, establish the possible adaptation and mitigation alternatives that may contribute to the attainment of the goal. These options include policies or programs that will help reach the goal/s.

3. **Identify the objectives and criteria that reflect the value associated with the consequences of each option.** Considering the different options identified, the next step is to decide on how to compare the alternatives in lieu of its contributions to meeting the goal. It is thus necessary to develop a set of criteria, wherein each criterion should be measurable and reflective of the consequences of each alternative.

   In choosing the set of criteria, the following are the considerations to make:

   - ✓ Completeness
   - ✓ Social Acceptance
   - ✓ Operationality
   - ✓ Sustainability
   - ✓ Replicability
   - ✓ Win-win options

A sample set of criteria to evaluate the identified strategies is shown in Table

Table 4.Multi-variable Criteria that can be used for prioritizing adaptation and mitigation strategies

Criteria	Description
Urgency and Approach	Will proposed project/approach address a severe CC impact and reduce its negative impacts significantly?
No Regrets Option	Will the project reduce CC impacts? Will the project reduce exposure and will it benefit the community even when there is no climate change?
Efficiency	Will the benefits that can be derived from the investment higher than the cost of the project? In many occasions, this is the single most important criterion used in decision making processes. It can also look at alternative measures that are less costly but with equivalent benefits that can be derived.
Equity and Cultural Acceptability	Will both women and men be provided equal access to benefits from the CC measure? Is there attention given to vulnerable groups, like the IPs? Will the project alleviate or reduce poverty in the community? Will this measure be consistent with cultural practices in the community?
Sustainability	Will the LGU or the community be able to sustain the CC adaptation measure after external support is ended? It will also look at whether the positive effects can be sustained beyond the intervention period and whether there are willing stakeholders to ensure sustained operation of the project.
Replicability and Scalability	Will the project be easy to be replicated in many households and departments within the LGU and other LGUs nearby (replicability); and whether it can be adopted at the provincial level or national level (scalability)
Environmental Impacts	Will this project have adverse impacts on other ecosystems or other sectors? Will the project have indirect impacts to other communities and ecosystems?

Criteria	Description
Timing	Will this project alleviate the adverse effects of CC immediately or will it take a long time?
Level of Implementation	This will identify the most effective implementation levels - households, community, district, town or region. The general approach can be tested and has a potential for a wider applicability is various locations
Bottom-up Vs. Top Down	Embarking on community development work is more sustainable using the bottom up or participatory and consultative process

Source: ADB 2015

4. **Describe the expected outcomes of each option against the criteria.** Determine what changes or results may be expected for each option vis-a-vis each criteria.
5. **Weighting** Assign "weights" for each of the criteria to reflect relative importance to the decision.
6. **Combine the weights and scores to derive the overall value**. Once the weights are assigned, overall score for each option will be computed by combining the weights and scores.
7. **Examine the results.** The next step is to review the results of the analysis.
8. **Conduct sensitivity analysis.** Perform sensitivity analysis to determine if there will be significant changes in the weights and scores.

MCA was utilized in the prioritization of projects for the case of the Upper Marikina River Basin Protected Landscape (UMRBPL). This can be found in the Case Study section of this manual.

Session 4. Estimating Exposure, Sensitivity and Adaptive Capacity and Vulnerability Index

For the workshop, VRA in the CORE planning, in general, consists of mainly four (4)parts. The first part is the formulation of a VA tool for each sector (sample for Agriculture sector can be found in Table 5).Each sector is considered vis-a-visthe impacts of various climate change-related hazards. The sub-indices of sensitivity, exposure,and adaptive capacity are subsequently defined and assigned weights according to their relative importance. The first iteration involves placing equal weights on the different components and indices, and later on validated by the stakeholders. This may be referred back to Figure 3.

The second part is the mapping of the natural hazards and areas of vulnerability. For each sector, the sub-indicators for Sensitivity, Exposures, and Adaptive Capacity will be mapped using GIS. For each sub-indicator of sensitivity,maps can be overlaid to derive the composite map showing various levels of sensitivity of an area to a given natural hazards. This procedure is repeated for Exposure and Adaptive Capacity.

After this, the composite maps are overlain to determine the sensitivity, exposure,and adaptive capacity of the study areas to a given climate and natural hazard. This process will generate the vulnerability map for the place and for a given hazard. Hence, every sector vulnerability assessment map contains a composite map for each climate impact with the following information: Exposure, Sensitivity, Adaptive Capacity and composite map of exposure, sensitivity and adaptive capacity; this means using four(4) maps per sector and per climate hazard/impact. These can further be mapped in terms of multiple exposures to different hazards using GIS overlays, following the measurements for vulnerability.

The third part is the application of the instrument and the last part is the use of the findings to inform sectoral planning.

Table 5. Weights of the climate change variables

and the indices for VA of the Agriculture Sector.

CC-related hazards	Components of Vulnerability		
	Sensitivity (30%)	Exposure (30%)	Adaptive Capacity (40%)
Floods	0.21	0.21	0.21
Drought	0.21	0.21	0.21
Soil Erosion	0.21	0.21	0.21
Typhoons	0.21	0.21	0.21
Pests & Diseases	0.11	0.11	0.11
Sea level rise (coastal areas)	0.05	0.05	0.05
Total	1.00	1.00	1.00

Source: Adapted from ADB 2016

IV. Reference Lists and Reading Materials

Asian Development Bank (ADB). 2005. Climate Proofing: A Risk-based Approach to Adaptation. Pacific Studies Series. Manila. https://www.adb.org/sites/default/files/publication/28796/climate-proofing.pdf.

ADB- TA 8493. 2016. Climate resilience and Green Growth in the Lower Marikina River Basin protected landscape. Draft Report. Manila, Philippines: Asian Development Bank.

ADB TA PHI 8111. 2015. Climate resilience and green growth in the Upper Marikina River Basin protected landscape: Demonstrating the Ecotown Framework. Manila, Philippines: Asian Development Bank.

Adger, W.N. 2006. Vulnerability. Global Environmental Change, 16, 268–281.

Boer R, Rahman A, Faqih A, Pulhin J, Islam S. 2012.Pe- nilaianrisikoiklim di DAS Citarum. Part of TA ADB 7189 – Package E, presented during a Seminar on the Citarum River Basin Vulnerability Assessment Results, Savoy Ho- mann Hotel, Bandung 6 August 2012. (ppt file)

Intergovernmental Panel on Climate Change (IPCC). 2007. Climate Change 2007: Mitigation. Contribution of the Working Group III to the Fourth Assessment Report of the Intergovernmental Panel on Climate Change [B. Metz, O.R. Davidson, P.R. Bosch, R. Dave, L.A. Meyer (eds)], Cambridge University Press, Cambridge, United Kingdom and New York, NY, USA., XXX pp.

IPCC. 2015. Climate Change 2014 Synthesis Report. Geneva, Switzerland: IPCC.

Katzfey, J.J. 2015. Climate Scenarios for the Philippine Climate Change Adaptation Project (PhilCCAP). CSIRO, Australia.

NEDA UPLBFI. 2011. Development of Sectoral Climate Change Vulnerability and Impact Assessment Model at the macro level, development of climate change monitoring and evaluation framework and development of compendium of good and innovative adaptation practices for the agriculture and forestry/biodiversity sectors. Draft Report.

Smit, B., I. Burton, R.J.T. Klein, and R. Street. 1999. The science of adaptation: A framework for assessment. Mitigation and Adaptation Strategies for Global Change, 4, 199–213.

Smit, B. and O. Pilifosova, 2003. From adaptation to adaptive capacity and vulnerability reduction.In Smith, J.B., Klein, R.J.T., Huq, S. (Eds.), Climate Change, Adaptive Capacity and Development. Imperial College Press, London.

United Nations Development Programme (UNDP). 2005. Adaptation Policy Frameworks for Climate Change. Developing Strategies, Policies and Measures.Eds. Bo Lim and Erika Spanger-Siegfried. UNDP/GEF.

UNDP MDGF 1656. 2012. Climate change sectoral vulnerability assessment. NEDA, UNDP and Australian AID.Prepared by UP Planades. Manila, Philippines: UN Development Programme.

UNDP/MDGF/NEDA. 2012. Strengthening the Philippines institutional capacity to adapt to climate change in the health sector. Final Report Book 1. June. Manila, Philippines.

UNDP/MDGF. 2012. Mainstreaming climate change adaptation and disaster risk reduction in the forestry, biodiversity and coastal and marine sectors. June. Manila, Philippines: UN Development Programme.

United Nations Office for Disaster Risk Reduction (UNISDR).2007. Early Warning System. https://www.unisdr.org/we/inform/terminology#letter-e

WorldClim - Global Climate Data.Undated.http://www.worldclim.org/

WWF-Belize Tourism Association. 2014. Analyzing vulnerability of Belize coastal tourism sector.

Vogel, C. 1998. Vulnerability and Global Environmental Change. LUCC Newsletter 3, 15-19.

Yohe, G. and R.S.J. Tol, 2002. Indicators for social and economic coping capacity - moving toward a working definition of adaptive capacity.Global Environ. Chang.,12, 25-40.

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