# MDGF 1656

## Strengthening the Philippines Institutional Capacity to Adapt to Climate Change

# Health Sector

## Book IV

**Final Report**

April 27, 2011


**Institute of Health Policy and Development Studies**

National Institutes of Health
UP Manila

# MDGF 1656: Conduct of Climate Change Vulnerability and Impact Assessment Framework, Development of a Monitoring and Evaluation Framework/System, and Compendium of Good and Innovative Climate Change Adaptation Practices (Health Sector)

## Book IV

# FINAL REPORT

**April 27, 2011**


**Institute of Health Policy and Development Studies**
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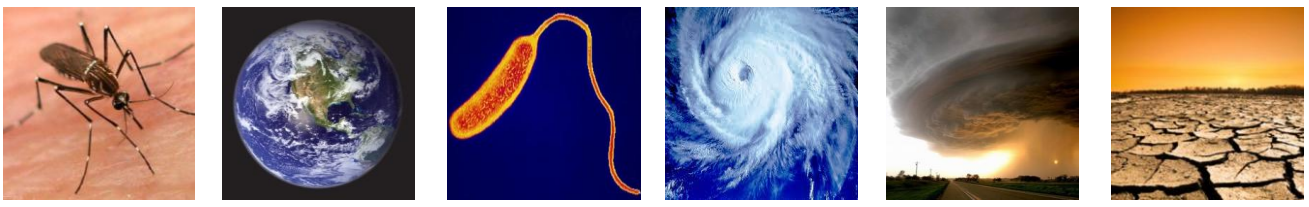


# Procedural (step by step) Vulnerability Assessment Write-up (Health Sector)

## A component of the Training Manual (Draft 01)

### Definition of Vulnerability

Vulnerability is defined by the IPCC as "the degree, to which a system is susceptible to, or unable to cope with, adverse effects of climate change, including climate variability and extremes. Vulnerability is a function of the character, magnitude, and rate of climate change and variation to which a system is exposed, its sensitivity, and its adaptive capacity" (McCarthy et al., 2001).

### Vulnerability of the Health Sector

According to the World Health Organization (WHO), climatic changes over recent decades have probably already affected some health outcomes. World Health Report 2002 says that climate change was estimated to be responsible in year 2000 for approximately 2.4% of worldwide diarrhea, and 6% of malaria in some middle-income countries. The first detectable changes in human health may well be alterations in the geographic range (latitude and altitude) and seasonality of certain infectious diseases – including vector-borne infections such as malaria and dengue fever, and food-borne infections, which normally peak in the warmer months. Warmer average temperatures combined with increased variations in climate would alter the pattern of exposure to extreme temperatures and resultant health impacts.

The Intergovernmental Panel on Climate Change (IPCC) concluded that overall, climate change is projected to increase threats to human health, particularly in lower income populations and predominantly within tropical/subtropical countries. Three broad categories of health impacts are associated with climatic conditions: (1) impacts that are directly related to weather/climate; (2) impacts that result from environmental changes that occur in response to climatic change; and (3) impacts resulting from consequences of climate-induced economic dislocation, environmental decline, and conflict. The first two categories are often referred to as climate-sensitive diseases; these include changes in the frequency and intensity of thermal extremes and extreme weather events (i.e., floods and droughts) that directly affect population health, and indirect impacts that occur through changes in the range and intensity of infectious diseases and food- and waterborne diseases and changes in the prevalence of diseases associated with air pollutants and aeroallergens.

The greater the exposure or sensitivity, the greater the vulnerability: the greater the adaptive capacity, the lower the vulnerability. An assessment of vulnerability must consider all these components to be comprehensive. An *impact* of climate change is typically the effect of climate change. For biophysical systems it can be change in

productivity, quality, or population numbers or range. For societal systems, impact can be measured as change in value (e.g., gain or loss of income) or in morbidity, mortality, or other measure of well-being (Parry and Carter, 1998).

The vulnerability of human health to climate change is a function of three components namely; sensitivity, exposure, and adaptation:

- Sensitivity, which includes the extent to which health or the natural or social systems on which health outcomes depend are sensitive to changes in weather and climate (the exposure–response relationship) and the characteristics of the population, such as the level of development and its demographic structure;

- Exposure to the weather or climate-related hazard, including the character, magnitude and rate of climate variation.

- Adaptation measures and actions in place to reduce the burden of a specific adverse health outcome (the adaptation baseline), the effectiveness of which determines in part the exposure–response relationship.

Populations, subgroups and systems that cannot or will not adapt are more vulnerable, as are those that are more susceptible to weather and climate changes. Understanding a population's capacity to adapt to new climate conditions is crucial to realistically assessing the potential health effects of climate change. In general, the vulnerability of a population to a health risk depends on factors such as population density, level of economic development, food availability, income level and distribution, local environmental conditions, health status, and the quality and availability of health care. These factors are not uniformly distributed across a region or country or across time, and differ based on geography, demography and socio-economic factors. Effectively targeting prevention or adaptation strategies requires understanding which demographic or geographical subpopulations may be most at risk and when that risk is likely to increase. Thus, individual, community and geographical factors determine vulnerability.

The cause-and-effect chain from climate change to changing disease patterns can be extremely complex and includes many non-climatic factors, such as distribution of income, provision of medical care, and access to adequate nutrition, clean water and sanitation. Therefore, the severity of impacts actually experienced will be determined not only by changes in climate but also by concurrent changes in non-climatic factors and by the adaptation measures implemented to reduce negative impacts.

## Key Steps in Vulnerability Assessment

Vulnerability assessment is a key aspect of streamlining assessments of climate change impacts to present development planning. This includes five key steps and suggests appropriate methods suitable for different levels of analysis. The five tasks link the conceptual framework of health sector vulnerability to identification of vulnerable conditions, analytical tools and stakeholders.

Vulnerability varies widely across peoples, sectors and regions. This diversity of the 'real world' is the starting place for vulnerability assessment. Distinguishing between scales helps simplify the conceptual and analytical issues:

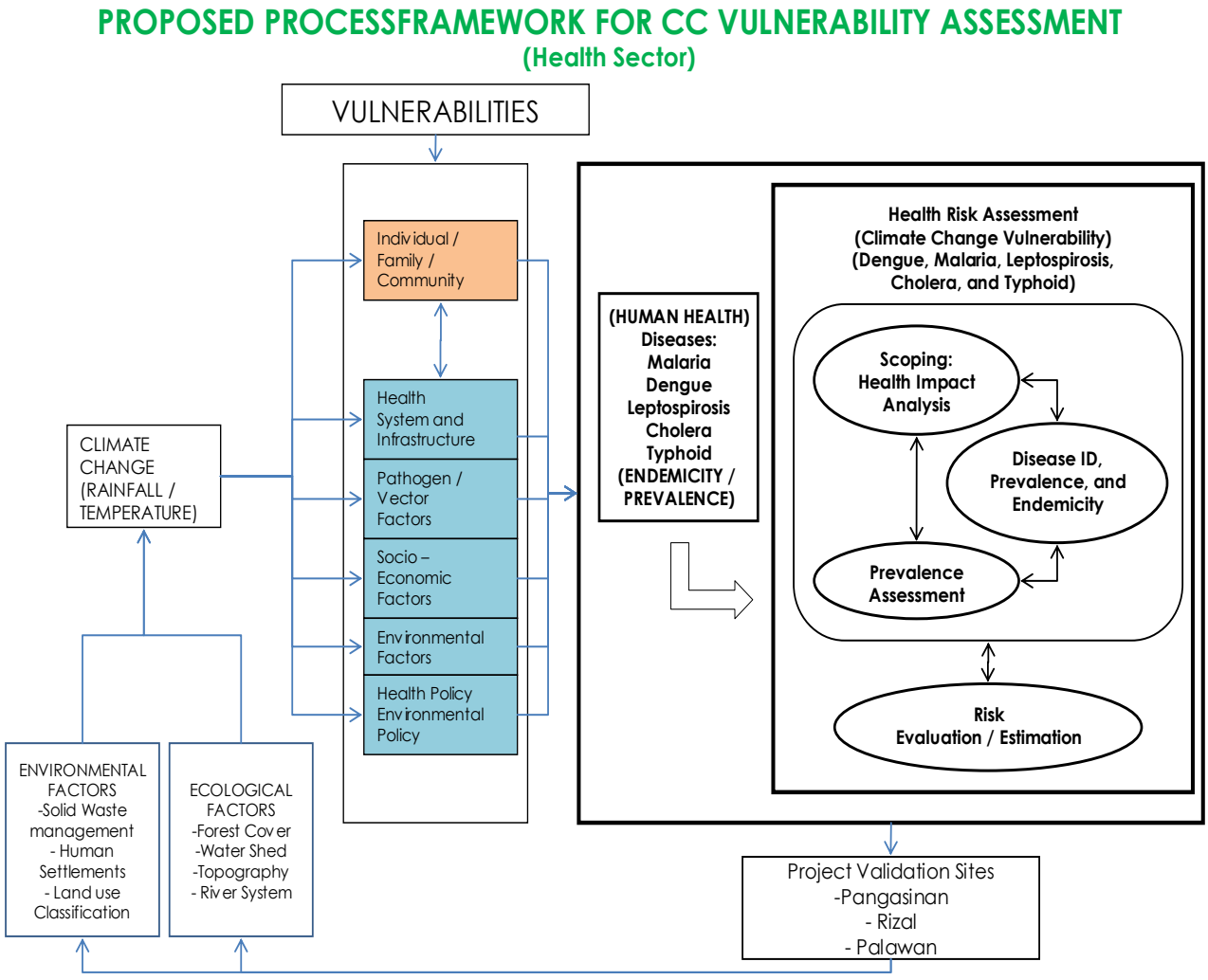
- International comparisons of vulnerability tend to focus on national indicators, for example to group less developed countries or compare progress in human development among countries with similar economic conditions.

- At a national level, vulnerability assessments contribute to setting development priorities and monitoring progress. Sectoral assessments provide more detailed and targets for strategic development plans.

- At a local or community level, vulnerable groups can be identified and coping strategies implemented, often employing participatory methods.

## Step 1: Vulnerability Frameworks and Definitions

The initial task of an interdisciplinary (vulnerability assessment) team is to clarify the conceptual framework and the analytical definitions that form the core of the assessment (see below: Proposed Process Framework for Vulnerability Assessment: Health Sector). A shared language will facilitate new insights and help communicate to key stakeholders. This task has close links with the overall scoping of the project.




The starting point should be to review existing national or local assessments that relate to vulnerability, such as national development plans, poverty reduction strategy papers, environmental sustainability plans and natural hazards assessments. If there is a common approach already in use—for instance in development planning or mapping hazards—then it makes sense to begin with that framework. It may need to be extended to incorporate climatic risks and climate change side by side with health data.

The main output of this task is for the team to level off with the core framework for the vulnerability assessment and relate this with existing local or national assessment or database framework (if available).

## Step 2: Establishing Baseline and Targeting Vulnerable Groups

The second step is to review present conditions in order to target vulnerable groups and establish a relevant database. General questions to be address in this stage includes but not limited to the following:

- Who are vulnerable?
- To what particular hazard or risk?
- Where are they located?

Available secondary data and maps should be maximized before collecting primary data. Some advanced Local Government Units may have already produced related inventories, such as poverty maps, human development indices, and environmental sustainability indices. The development baseline should incorporate two levels of analysis:

- A comprehensive set of spatial indicators of vulnerability.
- Identification of target vulnerable groups that are priority for adaptation.

Vulnerability is a relative measure; it does not exist as something we can observe and measure. Therefore, indicators can only be selected based on choices by the technical team, stakeholders and the vulnerable communities themselves.

Developing and using indicators requires knowledge of several technical issues, including their sensitivity to change, standardizing indicators for comparison, reliability of the data, mapping of indicators, coverage of relevant dimensions of vulnerability, etc.

The choice of the target of the vulnerability assessment should be related to the problems identified in scoping the project. The central concern of vulnerability assessment is people—those who should be protected from the adverse consequences of present climatic variations. These might be demographic groups (such as young children), livelihoods (urban poor in the informal economy) or populations at risk from diseases including endemic diseases in certain geographic areas.

The main output of this task is a set of vulnerability indicators and identification of vulnerable geographic areas that together form a baseline of present development. The collation of vulnerability indicators underpins the analyses and identification of priorities for adaptation.

## Step 3: Linking Baseline Information to Climate Impacts and Health Risks

The first two steps establish present conditions of development; the next step is to refine the analysis and link the development baseline explicitly to climate impacts and risks to human health.

One of the most important tools in assessing potential health risk is the vulnerability map. If risk maps of present climatic variations are already available at the local regional or national levels this should be incorporated in the vulnerability maps.

If quantitative impacts assessments are not available, it is possible to develop indicators of present climatic risks. These might be relatively simple climatic thresholds (e.g., probability of drought or flood). Historical episodes, such as the drought of record or extreme rainfall (eg., typhoon Ondoy) during historical storms can help define at-risk regions, provinces or municipalities.

In case formal models of (present) climate impacts and data on climatic risks and human health are not available, expert opinion and case examples from similar countries can be used to develop plausible local impacts scenarios. Such scenarios are exploratory—they are difficult to translate into probabilities—but are often useful in revealing potential vulnerabilities and policy responses. For instance, worst case scenarios are commonly used in disaster planning.

Generally, the output from this step is an understanding of the present probability of a range of climatic conditions and health hazards. The conjunction of the climatic hazards and development baseline comprises the present climate vulnerability.

**Step 4: Linking the Present and Future Scenarios**

At this point the vulnerability database includes climatic risks and identification of target vulnerable groups. It is a useful snapshot of present vulnerability reflected in a range of indicators. The next step is to provide a more qualitative understanding of the drivers of vulnerability—what shapes exposure to climatic risks? At what scales? This analysis links the present (snapshot) with pathways of the future--that may lead to sustainable development or further vulnerabilities.

The techniques for 'mapping' the structure of present vulnerability and how it might change in the future are likely to be qualitative in the first instance. Interactive exercises (such as cognitive mapping) amongst experts and stakeholders can help refine the initial VA framework by suggesting linkages between the vulnerable groups, socio-institutional factors (e.g., social networks, regulation and governance), their resources and economic activities, and the kinds of threats (and opportunities) resulting from climatic variations.

Extending the drivers of present vulnerability to the future typically is based on a range of socio-economic scenarios. Existing development scenarios (BAU scenario) are the best place to start: are there projections for development targets? Or sectoral scenarios may be relevant (eg., National Water Assessment reports). Otherwise, stakeholder led exercises in creating visions of the future (including worst case scenarios) are worth pursuing.

Two technical issues need to be clarified in the VA at this stage:

- Most indicators are snapshots of present status, for example GDP per capita. However, vulnerability is dynamic and indicators that foreshadow future vulnerability may be useful. For example, future wealth may be correlated with literacy and governance and only weakly correlated with present rates of growth in GDP per capita.

- The common drivers of development need to be related to the target vulnerable groups. National trends, for example in population and income, may not map directly onto the nuances of marginalization, local land tenure, markets and poverty that characterize vulnerability. Shocks and surprises may have disproportionate effects for the vulnerable population.

Outputs of this task are qualitative descriptions of the present structure of vulnerability, future vulnerabilities and include future scenarios. The last step brings together the indicators into a meaningful vulnerability assessment.

**Step 5: Outputs of the vulnerability assessment**

The outputs of a vulnerability assessment include:

- A description and analysis of present vulnerability, including representative vulnerable groups (for instance specific community or barangay at-risk of climatic or health hazards).
- Descriptions of potential vulnerabilities in the future, including analysis of pathways that relate the present to the future.
- Comparison of vulnerability under different socio-economic conditions, climatic changes and adaptive responses.

The final task is to relate the range of outputs to stakeholder decision making, public awareness and further assessments. The guiding concern is to present useful information among various stakeholders that is analytically sound and robust across the inherent uncertainties.

The first consideration is whether stakeholders and decision makers already have decision criteria that they apply to strategic and project analyses. For instance, the Millennium Development Targets may have been adopted in a development plan. If so, can the set of vulnerability indicators be related to the MD Targets? Is there an existing map of development status that can be related to the indicators of climate vulnerability?

The output should link to further steps in the Adaptation Planning Framework. The focus on representative livelihoods and multiple scales of vulnerability can form the basis of an analysis of coping strategies.

The technical team should consider how its outputs can be used over a longer term. A key recommendation is likely to be improved monitoring and collection of specific data on health and socio-economic vulnerability. A final output might be to revisit the conceptual model. Are there new insights that need to be included? Does the monitoring plan capture the range of vulnerabilities and their drivers? Would the framework need to be revised to apply to different regions or vulnerable groups (iterative nature of the vulnerability framework)? Have the priorities for vulnerability assessment changed?

## References

1. Downing, TE and Patwardhan, A., (2002). Vulnerability Assessment for Climate Adaptation. Adaptation Planning Framework Technical Paper 3.

2. Department of Transportation Federal Highway Administration Office of Environment and Planning. (2009). Climate Change Vulnerability Assessment, Risk Assessment, and Adaptation Approaches. Washington DC., USA

# *Manual of Procedures*

## *Monitoring and Evaluation*

## *for*

## *Climate Change and Health*

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# 1. Introduction

Climate change refers to a change in climate that can be identified by changes in the mean and/or variability of its properties and that persists for an extended period typically decades or longer, whether due to natural variability or as a result of human activity. There is increasing scientific evidence that climate change has an impact on human health. Projections on changes in climate, such as temperature and sea level rise, and more intense weather events such as more frequent and stronger typhoons, are seen to adversely affect the health sector.

According to the National Framework Strategy on Climate Change (NFSCC), the "health sector stands to bear the brunt of climate change, brought about mainly by the country's high vulnerability to climate change-related hazards. As diseases, disabilities and deaths are consequences of these hazards, the health sector is usually left to handle the management and rehabilitation of victims. Among the most likely impacts of climate change on the health sector include increases in morbidity and mortality due to diarrheal disease, exacerbation of the abundance and/or toxicity of cholera due to increases in coastal water temperature, and an expansion of the natural habitats of vector-borne and water-borne diseases."

In 2007, the Department of Health, in an effort to strengthen the country's disease surveillance and response system, adopted the Philippine Integrated Disease Surveillance and Response System (PIDSR), through Department Administrative Order No. 2007-0036. Among others, PIDSR was adopted to address the inadequacies of having too many disease surveillance systems that are redundant and inefficient, which duplicated efforts, and which provided inaccurate and delayed reporting that resulted in not being able to realize desired health outcomes. The adoption of PIDSR was also made in response to the International Health Regulation of 2005 which required all Member States to strengthen the core capacities for disease surveillance and response to avert occurrence and international spread of diseases and other public health threats.

Recognizing the threats posed by climate change on health, it has become imperative to monitor how the occurrence and spread of diseases are being influenced by climate parameters. A system needs to be put in place that records, monitors, analyzes and provides basis for making decisions pertinent to health in the light of projected changes in temperature, humidity, precipitation and more intense weather disturbances such as droughts, frequent and stronger typhoons, and excessive rainfall. Fortuitously, the DOH has already been implementing PIDSR, whose features can be readily adapted for M&E under a climate change scenario.

This manual is designed to provide guidance to users on how PIDSR can be expanded to increase the capacity in the health sector to make decisions that take into account climate change. Specifically, the manual will describe the procedure for collecting climate parameters and their integration with disease surveillance data, the analysis of their relationships which can be used for the design of public health response systems appropriate under changing climate scenarios.

## *1.1 Purpose of the Manual*

The manual is a supplement to the PIDSR Manual of Operations in order to provide guidance to health sector practitioners in making health decisions that take into account the influence of climate change.

Thus, it will serve as:

(a) a quick reference on surveillance across levels that include recording and analyzing climate parameters and how they affect disease occurrence and spread;

(b) a resource manual for training health and related personnel on climate change and health; and

(c) a guide for improving anticipation of health problems and planning adequate responses.

### 1.1.1 Who should use the manual?

As with PIDSR, this manual is intended for use by disease surveillance coordinators in all disease reporting units, and by all other users identified in the PIDSR Manual (2007). In addition, workers in PAGASA (especially those involved in weather forecasting and climate projection) as well as those engaged in disaster prevention and control, and government agencies tasked with environmental management may also benefit from the Manual.

## *1.2 Framework of Monitoring and Evaluation (M&E) for Health and the Impacts of Climate Change*

The framework of the proposed Health Sector Climate Change Monitoring and Evaluation System is shown in Figure 1. The centerpiece is the conceptual framework for the Philippine Integrated Disease Surveillance and Response System (PIDSR). PIDSR was adopted by the Department of Health in 2007 through Department Administrative Order 2007-0036 that was signed on October 1, 2007 by then Health Secretary Francisco T. Duque III.

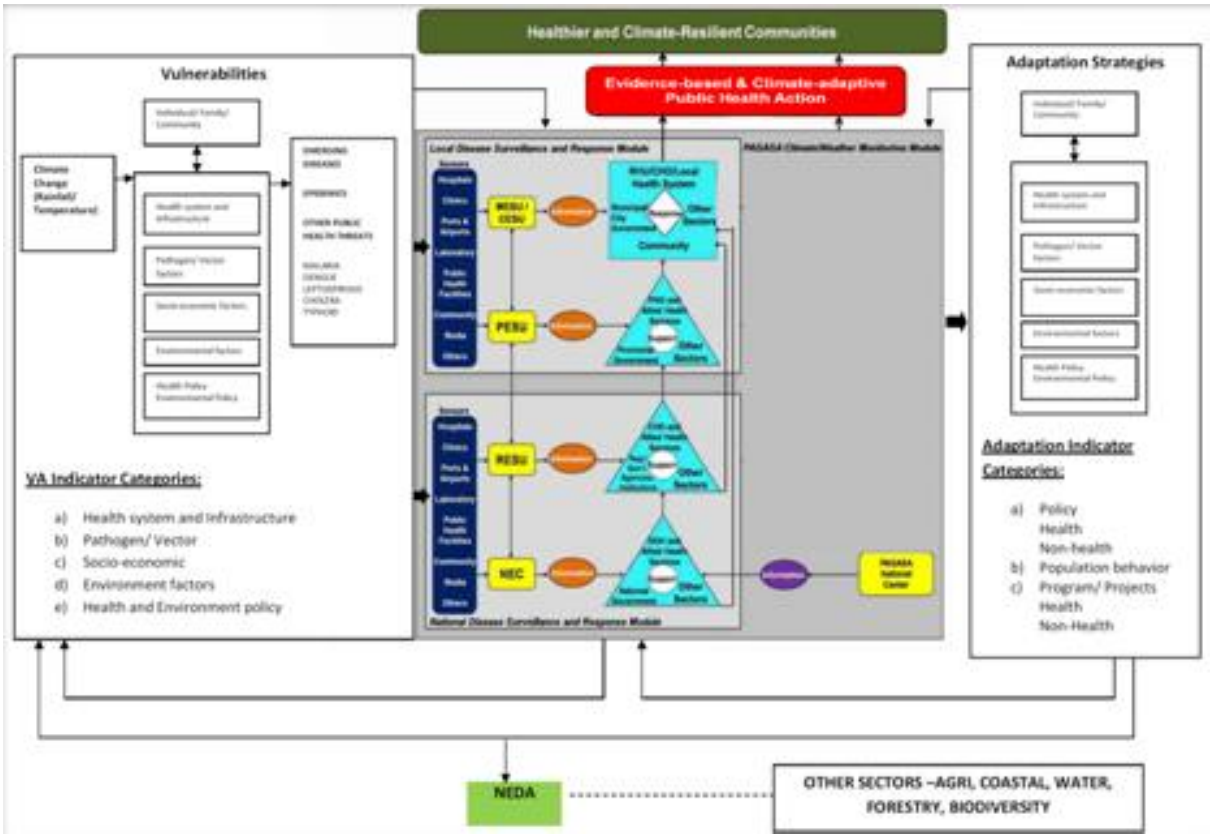


**Figure 1 Modified PIDSR framework showing vulnerability assessment on the left panel, adaptation on the right panel, and the reporting protocol in the middle panel.**

One of the driving forces for the integration of disease surveillance systems in the Philippines under PIDSR was the need for the country to meet its commitment as a member of the international community, following the adoption on 23 May 2005 of the International Health Regulations (2005) during the World Health Assembly, where the Philippines is one

of the state parties (signatories). IHR 2005 required all state parties "to carry out an assessment of public health events arising in their territories" and "then to notify WHO of all qualifying events within 24 hours of such an assessment" ( WHO, 2008). Aligning the country's disease surveillance and response system with the requirements of IHR 2005 was needed in order for the Philippines to be consistent in its application of the assessment and notification requirements under IHR 2005. Consistency with IHR 2005 was deemed as "crucial to ensure prompt communication to WHO of those events which may need coordinated international public health assessment and response" (WHO, 2008). In the light of global threats to public health such as SARS and avian flu, and given the poor public health infrastructure in the Philippines, the country could ill afford a disease surveillance and response system that was out of sync with the rest of the world.

## *1.3 Policies that support M&E for Health in the light of Climate Change*

In addition to the following policies which are mentioned in the 2007 Manual of Procedures for PIDSR (namely, Republic Act 3573, 1929; DOH Administrative Order 2007-0036; Resolution WHA48.13, 1995; International Health Regulations of 2005 Article 5-1 Surveillance; DOH Administrative Order 2005-0023; and Department Personnel Order No. 2005-1585), the following legal mandates and policies are supportive of a monitoring and evaluation in the health sector that integrates climate change:

1. Climate Change Act of 2009 (Republic Act 9729). An Act Mainstreaming Climate Change into Government Policy Formulations, Establishing the Framework Strategy and Program on Climate Change, Creating for this Purpose the Climate Change Commission, and for Other Purposes.

2. Department of Health (DOH) Circular No. 2010-0187 on June 3, 2010 on "Adaptation of Climate Change Framework for Health," which mandates all the agencies, regional offices and hospitals, and programs to "(1) develop and implement national action plans for health sector on adaptation and mitigation to climate change, (2) systematically integrate the concept of climate change and health linkage into policy-relevant instruments, (3) strengthen public health systems and disaster preparedness and response activities, particularly surveillance and monitoring systems, (4) provide early warning systems to reduce the current and projected burden of climate-sensitive diseases, (5) implement adaptation measures specific to local health determinants and

outcome concerns, and facilitate community-based resource management, and (6) support the active participation of the health sector to *National Communications to the UN Framework Convention on Climate Change* and encourage inclusion of health issues in the negotiation process."

3. Department of Health (DOH) Memorandum 2009-0250. Interim Guidelines on the Prevention of Leptospirosis through the Use of Prophylaxis in Areas Affected by Floods. October 16, 2009.
4. National Framework Strategy on Climate Change. 2010-2012. NFSCC acknowledges the profound impacts of climate change on communicable index diseases as its vectors adapt, resulting in greater vulnerability of the marginalized sectors. NFSCC mandates the health sector to "formulate proper climate-sensitive interventions in ensuring a healthy citizenry, and a disease-resilient community." The NFSCC likewise includes, as one of its strategic priorities towards attaining a climate responsive health sector, the "establishment of mechanisms to identify, monitor, and control diseases brought about by climate change; and improve surveillance, and emergency response to communicable diseases, especially climate-sensitive water-borne and vector-borne diseases."

## *1.4 Scope of the M&E on Climate Change and Health*

Apart from the health sector identified in the 2007 Manual of Procedures for PIDSR, which includes public and private, national agencies and local government units, external development agencies, and the community involved in disease surveillance and response, the M&E on climate change and health shall also involve the Philippine Atmospheric, Geophysical and Astronomical Service Agency and all its satellite weather stations (under the Department of Science and Technology) as data providers and as partners in risk assessments pertaining to health as influenced by the weather patterns, and in the long term, by climate change.

## *1.5 Goal and Objectives*

The goal of the monitoring and evaluation system that integrates climate change in the health sector is to help make communities become healthier and more climate-resilient. Thus, the goal of PIDSR, which is "achieved through the reduction of mortality and morbidity by an institutionalized, functional, integrated disease surveillance and response system nationwide" is expanded to enable periodic M&E of climate change trends to mitigate impacts on the health sector as well as to serve as basis for assessing the effectiveness of policies and measures for reducing vulnerability and increasing adaptive capacity of communities and the general population.

The above-mentioned goal for climate change-responsive M&E in the health sector is aligned with the vision for climate change in the Philippines, as enunciated in the NFSCC (2009) as follows:

***Vision (NFSCC)***

"A climate risk resilient Philippines with **healthy**, safe, prosperous and self-reliant communities, and thriving and productive ecosystems."

## *1.6 Guiding Principles*

This manual subscribes to the eleven (11) guiding principles spelt out in the 2007 PIDSR Manual of Procedures. In view of climate change and the need for the health sector to provide adequate responses to health risks associated with climate change, the following additional principles were identified to underpin the M&E Strategy for health as influenced by climate change:

***1.6.1*** It shall verify the effectiveness of the implementation of policies, programs, and projects in terms of changes and/or improvements in the situation of target groups, their behavior, application and utilization of skills, and how these changes can be attributed to interventions such as technical assistance and management services delivered by implementers.

***1.6.2*** The M&E system shall build on existing disease surveillance systems to collect data for the selected diseases and for tracking temperature and rainfall (precipitation) and should provide a mechanism for integrating, analyzing and decision-making involving the two data sets.

***1.6.3*** The M&E system must be simple, provide quick results, be cost-effective and operated in a manner that is both transparent and with clearly-defined accountabilities and responsibilities.

***1.6.4*** The M&E system must be able to provide a mechanism to facilitate the systematic communication and/or sharing of results across different levels, to include decision-makers, implementers, and the general public, especially at the level of the household, as well as for a feedback mechanism.

***1.6.5*** The M&E system shall involve a minimum amount of relevant and practical indicators.

***1.6.6*** The M&E system shall be subject to review every three years, and may be modified to take into account the lessons learned and to make it more attuned to the needs of stakeholders.

***1.6.7*** The detailed implementation of the M&E strategy shall be described under M&E operations plan, to be formulated and implemented on an annual basis by the Department of Health.

The operationalization of this additional set of principles is summarized in matrix format, as shown in Table 1. The table assigns responsibility centers, identifies appropriate tools, and lists relevant indicators that will insure that each of the principles are observed/met in the implementation of the M&E framework.

**Table 1 Matrix table showing the monitoring and evaluation principles, responsible actors and levels, relevant tools, and indicators to be collected**

| Monitoring and Evaluation Principles | Actors / Levels | Tools | Indicators Collected | Indicators to be added |
|---|---|---|---|---|
| **A. Tracking of Implementation of Policy, Programs and Projects** | ***Policy***: DOH<br><br>***Field level effectiveness***: RHUs, local governments | PIDSR aggregate report incorporated into the Field Health Service Information System (FHSIS) annual morbidity report | Health status statistics, health services coverage, notifiable diseases | Environment / climate indicators |
| **B. Build on Existing Surveillance System by Integrating Environmental Data Collection** | ***Enabling policy***: DOH & DOST<br><br>***Data analysis***: National, regional and provincial Health Offices | Yearly report showing correlations between notifiable diseases and environmental factors | Same as above | Correlation statistics<br><br>Capacity building needs on data analysis at different levels |
| **C. Promote transparency and demonstrate clearly-defined accountabilities and responsibilities.** | ***Enabling policy***: DOH<br><br>***Field level application***: Regional, Provincial, City and Municipal levels | Yearly summaries that can be readily attributed to weekly, monthly, and quarterly reports | Health systems statistics | **PAGASA** providing data services on climate parameters to health system operators |
| **D. Systematic communication and/or sharing of results across different levels.** | ALL levels | Reports, bulletins, press releases, radio broadcasts | Capacity building strategies for personnel of DRUs/ESUs; Availability of communication systems | Contact details of relevant media outlets and of health offices in various levels |
| **E. Prudent selection of relevant and practical indicators** | DOH, NDCC and Related Agencies | DAOs and other related policy issuances | Measures of usefulness of indicators | |
| **F. Systematic review and development of the M&E system every 3 years** | ***Enabling policy***: DOH<br><br>***Inputs for system modification***: All levels | M&E framework for the health sector | Results of periodic assessments | |
| **G. M&E operations plan formulation and implementation** | ***DOH***: for integration into overall DOH annual operations plan | DOH annual operations plan | Budget for M&E | |

## *1.7 Integration of M&E on climate change and health with PIDSR*

The M&E framework takes into account the influence of climate change on health is anchored on the existing M&E framework in the Health sector which is PIDSR. However, PIDSR *per se* could not be used due to certain limitations, particularly the absence of a system to collect climate related data and to relate them to disease parameters. Hence, PIDSR is being modified to reflect the importance of periodic assessments of vulnerabilities in the health sector and the monitoring of adaptation systems in the light of climate change.

A common understanding of the meaning of vulnerability and adaptation is important. To achieve this, the following definitions of these terms and other relevant terminologies have been adopted, both from the IPCC report and the Climate Change Act of 2009 (GEF, 2008; Climate Change Act of 2009):

**Vulnerability** is the degree to which a system is susceptible to, or unable to cope with, adverse effects of climate change, including variability and extremes. It is a function of the ***character***, ***magnitude***, and ***rate of climate change*** and ***variation to which a system is exposed***, its ***sensitivity***, and its ***adaptive capacity***.

**Adaptive capacity** is the ability of a 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.

**Adaptation** refers to adjustments in natural or human systems in response to actual or expected climatic stimuli or their effects that moderates harm or exploits beneficial opportunities.

As per IPCC, various kinds of adaptation can be distinguished as follows:

**Anticipatory adaptation** – Adaptation that takes place before impacts of climate change are observed. This is also referred to as proactive adaptation.

**Autonomous adaptation** – Adaptation that does not constitute a conscious response to climatic stimuli but is triggered by ecological changes in natural systems and by market or welfare changes in human systems. This is also referred to as spontaneous adaptation.

**Planned adaptation** – Adaptation that is the result of a deliberate policy decision, based on awareness that conditions have changed or are about to change and that action is required to return to, maintain, or achieve a desired state.

GEF (2008) further qualified that climate change impact or vulnerability assessment is ***ex-ante*** evaluation which should be distinguished from monitoring and evaluation of adaptation interventions which is ***ex-post*** evaluation in nature.

### 1.7.1 Vulnerability assessment and its link to the M&E framework

Assessing vulnerabilities is an ***ex ante*** analysis, which for the health sector means being able to measure susceptibility to diseases, determining potential causes that contribute to more prevalent disease spread, and identifying weaknesses in the health system that can further deteriorate due to climate change.

The starting point for defining vulnerability relative to the five climate-sensitive diseases was the epidemiological triad which consists of host, pathogen and environment, and what contributes to these factors.

Relative to host as a factor, the contributors to this component of the triad have been broken down to individual and family and/or community related factors. Individual vulnerabilities can be determined from the following: (a) standard of living, (b) disease reservoir or the current level of infection, (c) genetic make-up, and (c) personal habits. Determinants of family community vulnerability include: (a) population density and growth, (b) unemployment and poverty levels, as well as (c) migration patterns and degree of urbanization.

On the aspect of pathogen as a factor, the following are deemed as contributory causes: (a) microbe replication and movement, (b) vector reproduction and movement, (c) microbe and vector evolution, (d) feeding frequency and longevity, and (e) habitat formation.

Vulnerabilities arising from the environment may be derived from contributions from the following: (a) the state of watersheds and forest cover, (b) loss of biodiversity, (c) access to safe water, (d) occurrence of flash floods, and (e) other factors such as sanitation, solid waste management, agricultural production and government policies and regulations that impact on human settlements, land use and zoning.

It is also important to know how the health system (including health infrastructure, quality, and access to health care) and health policy and regulations are making an impact on the vulnerabilities of individuals and communities relative to the five diseases.

Apart from the disease-related vulnerabilities that emanate from the epidemiological triad associated with each of the five (5) climate-sensitive diseases, the country's vulnerability associated with the occurrence of tropical cyclone is ranked highest in the world, and third in terms of people exposed to such seasonal event (CCC, 2010). On average, twenty (20) typhoons hit the country each year. El Niño droughts and La Niña flooding have been triggered by extreme climate variability. Erosible soils along steep/unstable mountain slopes,

degraded forests and watersheds, unplanned settlements, combine with geologic/seismic dangers to put communities and individuals more prone to climate-related disaster risks.

It will be instructive to mention that the Vulnerability and Adaptation (V&A) Assessment Toolkit published by the Philippine Rural Reconstruction Movement under the Second National Communication on Climate Change (2009), identified the following communities as vulnerable to the effects of climate change on health: (a) far-flung barangays (mountainous or coastal); (b) populations that have least access to health services and are in congested/dense urban slum areas; (c) those in areas that are endemic to climate-sensitive diseases, e.g., malaria, coupled with "bad" health system; and (d) those that are culturally challenging, i.e., resistant to health education or change in their behavior towards health, brought about by culture or beliefs.

### 1.7.2 Adaptation strategies and relationship with the M&E framework

The different categories of proposed adaptation strategies correspond with the identified vulnerabilities in the health sector relative to climate change. The evaluation of adaptation interventions takes the form of an ***ex post*** analysis, which means that what is going to be measured is the effectiveness of the proposed strategies in bringing about an improved capacity of individual and communities to weather the effects of climate change. It should be evident that strategies that result in improved adaptive capacity actually reduce vulnerabilities in the long term.

The assessment of vulnerability and the formulation of adaptation strategies are best undertaken following a continuum that enables the use of the results of vulnerability assessments as inputs for decisions *vis a vis* adaptation practices. This relationship is shown in the following matrix table (Table 2) which outlines the steps in V&A assessment in the health sector using climate sensitive diseases as the identified vulnerability (PRRM, 2009):

**Table 2 Matrix table showing the Climate Change and Health V&A Assessment Flowchart**

| Climate Change and Health V&A Assessment Flowchart | | | |
|---|---|---|---|
| **Step 1**<br>**Identify/Screen health vulnerability in area/community** | **Step 2**<br>**Conduct analysis (Quantitative/Qualitative)** | **Step 3**<br>**Identify action to be taken** | **Step 4**<br>**Evaluate and feedback** |
| ■ Presence of diseases (determine climate sensitivity/consider epidemic potential)<br>►Consider number of cases, occurrence of disease | ■ Utilize sentinel sites NESSS/MET for weather parameters<br>■ Focused group discussions/KII | ■ Preventive (adaptation) over curative (mitigation) parameters<br>■ Prioritize measures<br>○ Efficiency vs. Effectiveness<br>○ Cost/timeframe<br>►i.e., information drives/mass screening, smearing for febrile people, fast lane for Dengue<br>■ Policy formulation for health impacts – climate change compliance/resilience | ■ Utilize statistical analysis and correlate adaptation measure<br>■ Identify indicators of success (intermediate and long-term)<br>■ Refine flowchart to incorporate other factors (i.e., socio-economic) |
| **Step 1**<br>**Identify/Screen health vulnerability in area/community** | **Step 2**<br>**Conduct analysis (Quantitative/Qualitative)** | **Step 3**<br>**Identify action to be taken** | **Step 4**<br>**Evaluate and feedback** |
| ■ Availability of response mechanisms<br>► Health infrastructure (human and financial/infra – health centers/hospitals | | | |
| ■ Occurrence of extreme weather events (quantity and quality) | | | |

*** (*adapted from: Philippine Rural Reconstruction Movement (PRRM). 2009. Vulnerability and Adaptation Assessment Toolkit. Philippines Second National Communication on Climate Change*)

# 2. Reporting procedure under monitoring and evaluation for climate change and health

## *2.1 Sources of reports/information*

As with PIDSR, the sources of health-related reports/information will be the following: (a) community; (b) barangay health stations (BHS); (c) rural health units (RHUs); (d) city health offices (CHOs); (e) government and private hospitals and clinics; (f) government and private laboratories; and (g) ports and airports.

However, for weather information, the sources will be the PAGASA central office (particularly the National Epidemiology Center) and the satellite weather stations located all over the country. The weather stations will supply information through the provincial health offices, which will be responsible for disseminating weather-related information to the municipal and city health offices within the province.

## *2.2 Flow of information*

Figure 2 shows the scheme as to how information is to be reported under the modified PIDSR to integrate climate change and how it will flow through the various levels and offices tasked with disease surveillance monitoring, reporting, data analysis and response formulation. The original tasks assigned to the various offices in line with PIDSR are indicated, while the new tasks are shown in red italics. Similarly, the additional information to be collected and shared within the system is shown as red arrows.

## Modified PIDSR Reporting and Response System Flow Chart w/ Climate Change

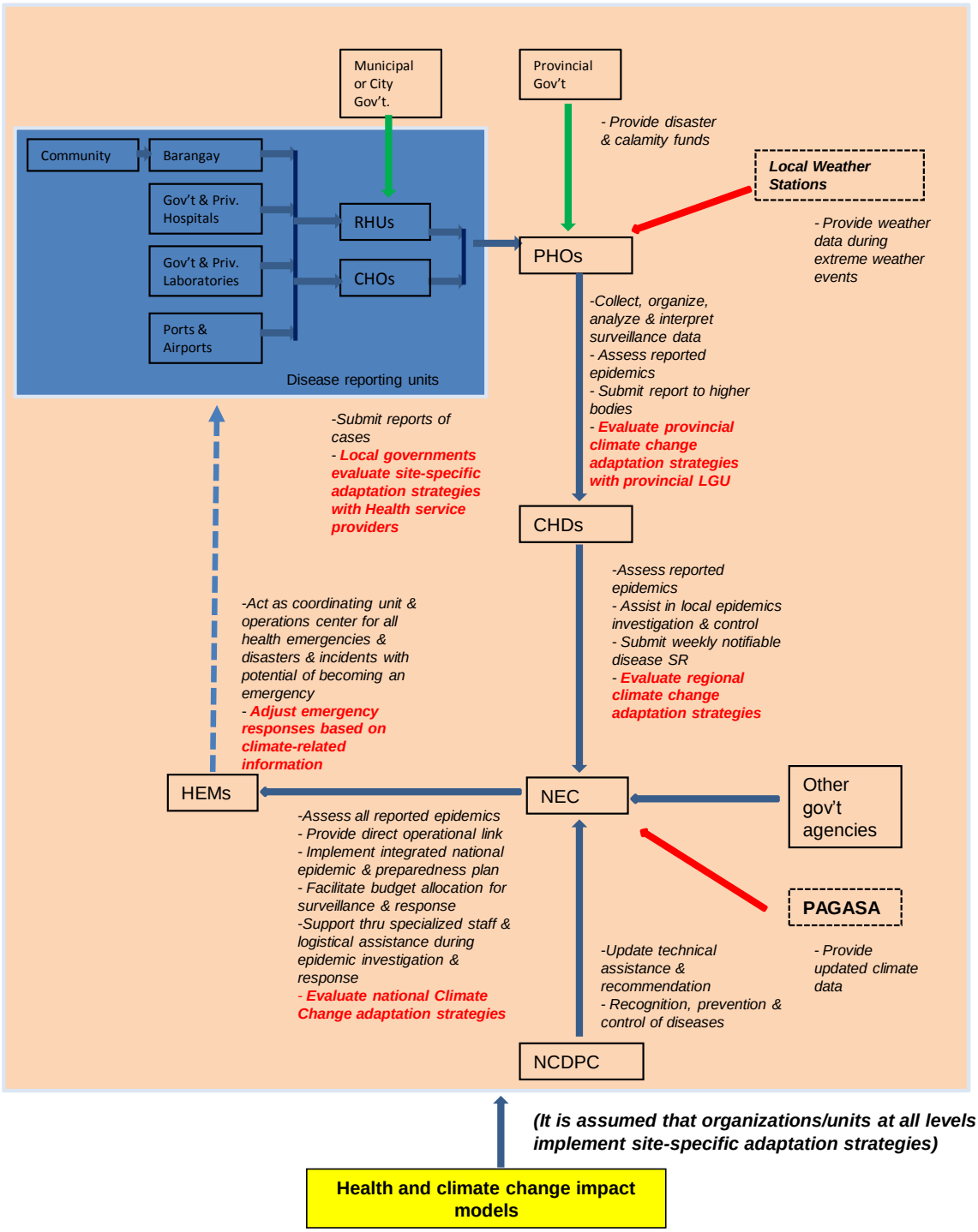


**Figure 2 Modified reporting systems and information flow, PIDSR with the integration of climate change**

# 3. Roles and Responsibilities

In addition to the basic roles and responsibilities pertinent to the manifold surveillance and response functions of the various agencies under the Department of Health (DOH) as enumerated in the PIDSR Manual of Procedures (2007), the following responsibilities are hereby added in order to monitor the impacts of climate change on the health sector. Aside from the health agencies and local government units given responsibilities under PIDSR, non-health agencies tasked with weather forecasting and climate projection are also assigned responsibilities, subject to agreements to be forged between the DOH and the DOST to which PAGASA belongs.

## *3.1 Department of Health (DOH)*

### *3.1.1* National Epidemiology Center (NEC)

Based on the PIDSR Manual of Operations (2007), the tasks of undertaking the overall design and implementation of PIDSR has been reposed upon NEC. The responsibilities associated with this function are retained in the modified PIDSR. Consequently, new tasks have been added, while most other functions have been retained, with modification to some to make them more attuned to the integration of climate change. The performance of some of the new/added/modified functions is contingent upon the participation of PAGASA and other agencies, subject to formal arrangements to be agreed upon by DOH with such agencies. The new and/or modified functions to account for climate change are as follows:

a. To receive daily weather data from PAGASA and to establish and maintain weather database for the health sector; in the case of extreme weather events such as typhoons, to receive data as frequently as these are issued by PAGASA.

b. Guided by climate-health models, determine if health data show abnormal trends that can be explained by changes in climate parameters.

c. Determine appropriate adaptation approaches and strategies to respond to observed or predicted abnormal patterns that could result in enhanced health vulnerabilities or even deterioration to epidemic levels of certain diseases that are sensitive to climate.

d. Notify/inform all health offices at all levels through HEMS and the Regional CHDs of adaptation strategies to be implemented, as well as the basis/rational for calling such strategies including the measures for evaluating their effectiveness and the reporting protocols to be complied with.

### *3.1.2* National Center for Disease Prevention and Control (NCDPC)

The following functions of NCDPC are not new but are drawn from the functions identified in PIDSR with some modification to integrate climate change:

a. Provide updates, technical advice, and recommendations on the identification of climate change related vulnerabilities; recognition of, prevention, and control of climate-sensitive diseases; and the formulation of adaptation strategies to reduce impacts of climate change.
b. Assist NEC in the development and implementation of integrated national epidemic preparedness and response plan by the health sector that takes into account the impacts of climate change.

### *3.1.3* Health Emergency Management Staff (HEMS)

a. In case of extreme weather events and national-level disasters associated with climate change, NEC shall coordinate health sector efforts to mitigate adverse impacts on health, minimize exposure to climate-enhanced vectors, and to lessen morbidity/mortality in affected areas.
b. Fine-tune/adjust health disaster emergency responses in accordance with health-climate models and up-to-date weather information.
c. Together with NCDPC, to assist NEC in the development and implementation of integrated national epidemic preparedness and response plan by the health sector that takes into account the impacts of climate change.

### *3.1.4* Centers for Health Development (CHDs)

Listed below are new/additional/modified functions of CHDs in relation to the implementation of the modified PIDSR:

a. Provide the leadership in implementing regional health vulnerability assessments and the formulation and implementation of region-specific adaptation strategies to respond to health risks to climate change.
b. In establishing, operating, and maintaining a regional disaster preparedness and response plan, CHDs must take into consideration climate-health models, the results of health vulnerability assessments, and updated weather data and adjust/fine-tune the plans to account for climate parameters and projections.
c. Correlate weather data with health statistics to detect abnormal trends, increases in vulnerabilities, and to adjust region-specific health adaptation strategies.
d. Provide technical and logistical assistance in the conduct of vulnerability assessments to climate change and in the preparation of adaptation measures at the provincial/city/municipal levels.
e. Ensure compliance at the regional/provincial/city/municipal levels in the conduct of vulnerability assessments and the formulation/implementation of adaptation measures to respond to health threats posed by climate change.
f. Coordinate regional efforts designed to mitigate adverse health effects of climate-related disasters as well as to manage epidemics brought about by climate change.

## *3.2 Local Government Units (LGUs)*

### *3.2.1* Provincial Health Offices (PHOs)

The new/added/modified functions of the PHOs in consideration of the impacts of climate change to health are as follows:

a. To receive daily weather data from the local PAGASA weather station and to establish and maintain a provincial weather database; in the case of extreme weather events such as typhoons, to receive data as frequently as these are issued by the PAGASA station. Take responsibility for disseminating weather-related information that could adversely impact health to the cities/municipalities within the province.

b. Immediately report to the region (CHD) climate change related disease occurrences as well as deaths associated with disasters brought about by climate change.

c. Provide the leadership in implementing provincial health vulnerability assessments and the formulation and implementation of province-specific adaptation strategies to respond to health risks to climate change.
d. In establishing, operating, and maintaining a provincial disaster preparedness and response plan, PHOs must take into consideration climate-health models, the results of health vulnerability assessments, and updated weather data and adjust/fine-tune the plans to account for climate parameters and projections.
e. Correlate weather data with health statistics to detect abnormal trends, increases in vulnerabilities, and to adjust province-specific health adaptation strategies.
f. Provide technical and logistical assistance in the conduct of vulnerability assessments to climate change and in the preparation of adaptation measures at the municipal levels.
g. Ensure compliance at the provincial/municipal levels in the conduct of vulnerability assessments and the formulation/implementation of adaptation measures to respond to health threats posed by climate change.
h. Coordinate province-wide efforts designed to mitigate adverse health effects of climate-related disasters as well as to manage epidemics brought about by climate change.

### *3.2.2* City/Municipal Health Offices (CHOs/MHOs)

The new/added/modified functions of the PHOs in consideration of the impacts of climate change to health are as follows:

a. To receive daily weather data from the PHO and to establish and maintain a city/municipal weather database. Take responsibility for disseminating weather-related information that could adversely impact health to the barangays within the city/municipality.

b. Immediately report to the province (PHO) climate change related disease occurrences as well as deaths associated with disasters brought about by climate change.

c. Provide the leadership in implementing city/municipal health vulnerability assessments and the formulation and implementation of city or municipal-specific adaptation strategies to respond to health risks to climate change.
d. In establishing, operating, and maintaining a city/municipal disaster preparedness and response plan, CHOs/RHUs must take into consideration climate-health models, the results of health vulnerability assessments, and updated weather data and adjust/fine-tune the plans to account for climate parameters and projections.

e. Correlate weather data with health statistics to detect abnormal trends, increases in vulnerabilities, and to adjust city or municipality-specific health adaptation strategies.
f. Provide technical and logistical assistance in the conduct of vulnerability assessments to climate change and in the preparation of adaptation measures at the barangay levels.
g. Ensure compliance at the city/municipality and barangay levels in the conduct of vulnerability assessments and the formulation/implementation of adaptation measures to respond to health threats posed by climate change.
h. Coordinate city/municipality-wide efforts designed to mitigate adverse health effects of climate-related disasters as well as to manage epidemics brought about by climate change.

## *3.3 PAGASA*

A memorandum of agreement (MOA) has to be forged between DOST and DOH that henceforth, the following functions shall be performed by PAGASA headquarters and the weather stations to enable the health sector to address the threats of climate change.

### *3.3.1* PAGASA Headquarters

a. To provide daily weather data to the DOH through the NEC and to assist the latter in establishing and maintaining a weather database containing climate parameters that are relevant to the health sector.

b. In the case of extreme weather events such as typhoons, to provide data/information to NEC as frequently as these are issued by PAGASA.

c. To provide and update NEC with information and models pertaining to climate scenarios in the future, particularly those involving climate parameters that are known to significantly impact public health.

### *3.3.2* PAGASA Weather Stations

a. To provide daily weather data to the Province, through the Provincial Health Office and to assist the latter establish and maintain a provincial weather database.

b. In the case of extreme weather events such as typhoons or intense rainfall, to provide data as frequently as these are monitored by the PAGASA station.

c. Assist PHOs in disseminating weather-related information that could adversely impact health to the cities/municipalities within the province.

# 4. Data Analysis and Interpretation

## *4.1 Integration of weather parameters with PIDSR health data*

- As in PIDSR, all reporting units will still be required to analyze their data on a weekly basis, with the only difference that analysis should include the integration of weather parameters into the health data. This will be useful in guiding the unit to correlate health occurrences and patterns with the variations in weather parameters.
- For this purpose, Figure 5 in PIDSR (Summary Table of Notifiable Disease Occurrence by Barangay and Morbidity Week) is hereby modified, and is referred to as Figure 3 in this manual. This revised form shall only be used for reporting climate-sensitive diseases. For non-climate sensitive diseases, the table without the last four rows on weather information (Figure 5 in PIDSR) should still be used.

**Figure 3 Summary Table of Notifiable Disease Occurrence by Barangay and Morbidity Week and Weather Data**

Year: _____
Notifiable Disease: (limited to climate-sensitive diseases only)
Municipality: _____
Province: _____
Region: _____
Reporting unit:_____
Name and signature of reporting staff:
_____
Contact Numbers: _____

| Names of Barangays | Category of Cases | Morbidity Weeks | | | | | | | Total cases for the year |
|---|---|---|---|---|---|---|---|---|---|
| | | MW 1 | MW 2 | MW 3 | MW 4 | MW … | MW … | MW 52 | |
| Barangay 1 | Survived | | | | | | | | |
| | Died | | | | | | | | |
| Barangay 2 | Survived | | | | | | | | |
| | Died | | | | | | | | |
| … Last Barangay | Survived | | | | | | | | |
| | Died | | | | | | | | |
| Total number of all cases (Survived and Died) per morbidity week | | | | | | | | | Grand total for the municipality or city for the year |
| Total number of Deaths per morbidity week | | | | | | | | | Grand total for the municipality or city for the year |
| Mean temperature (°C) for the week | | | | | | | | | |
| Highest temperature (°C) | | | | | | | | | |
| Lowest temperature (°C) | | | | | | | | | |
| Precipitation (mm) | | | | | | | | | |

**Added rows to include climate parameters in the weekly summary.**

The instructions to fill out the summary table are the same as the one contained in the PIDSR Manual, except for the last four rows, where the data will come from the information to be supplied by the local Pagasa Weather Station. Thus, the following guidelines apply in order to fill out the last four (4) rows:

$$\text{Mean temperature for the week (°C)} = \frac{\text{Sum of daily mean temperatures (°C)}}{7}$$

Highest temperature (°C) = highest of 7 high temperature readings for the week

Lowest temperature ((°C) = lowest of 7 low temperature readings for the week

Precipitation (mm) = total precipitation for the week (that is, for 7 days)

## *4.2 Use of computers for data storage and analysis*

As with PIDSR, all data must be encoded and tabulated using a computer. Analysis of data, including presentation of graphs, shall also be done with the use of a computer.

## *4.3 Analysis of data and correlation with weather measurements:*

The analysis of data shall be the same as with PIDSR, only that attention has to be paid to certain aspects which involve integration of weather data. Hence, practices pertaining to the need to know the strengths and weaknesses of data collection methods, the technique of starting from simple to complex analysis, and the recognition of inaccuracies in the data will still have to be given due consideration.

Pursuant to this, the analysis of epidemiological variables that allow the comparison of patterns and risks of disease at different time periods, place or among population groups, the calculation of rates of disease, the detection of epidemics for early prevention and control, projecting future occurrence of disease to facilitate prompt public health response, evaluation of public health policy, and identifying new or emerging syndromes or conditions, becomes an even more imperative task with climate change.

### 4.3.1 Analysis of data by time

Apart from answering the questions, “When does the disease occur commonly or rarely?” and “Is the frequency of disease at present different from the frequency in the past?”, analysis of data by time will also address the questions on “Whether the occurrence of disease through time is influenced by or can be associated with, changes in weather patterns?” Hence, analyzing data by time will remain an important activity, but this will have to be superimposed with information on the changes in climate parameters through time. This will both have a predictive and response functions – predictive because the analysis of changes in weather parameters through time will provide basis for predicting changes in disease trends; and response because knowing the trends in weather conditions will enable the health sector to adequately prepare for adverse health events that may possibly arise.

For purposes of incorporating climate parameters into the time analysis, Figure 6 in the PIDSR manual may be modified to appear as in Figure 4 as follows:

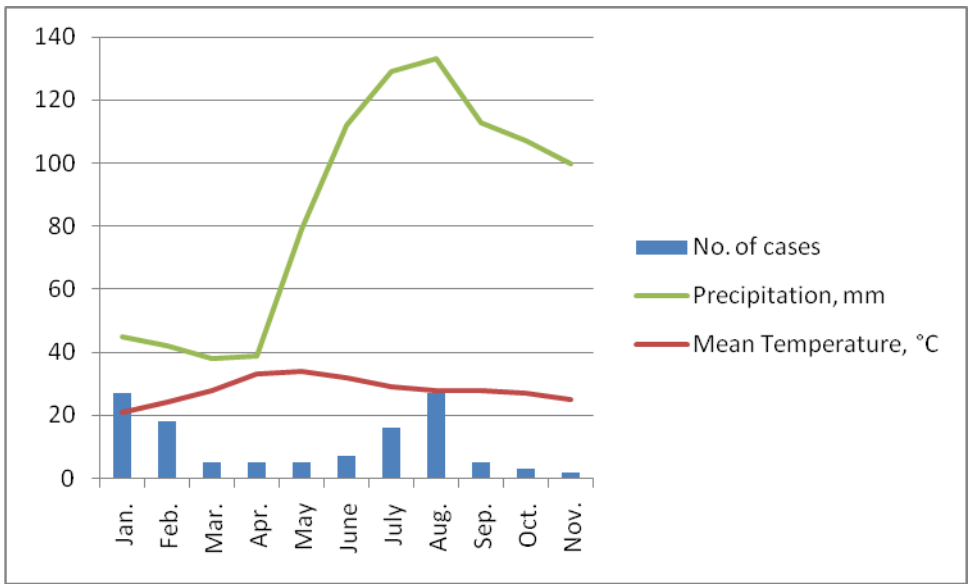


**Figure 4 Dengue fever cases in city X by month (N = ___ ); January – November, 2010 (Example only)**

Thus, with just one glance on the graph, one can already see how dengue cases can be correlated with mean temperature and precipitation for the period under consideration.

### 4.3.2 Analysis of data by place

As in PIDSR, the place analysis of surveillance data answers the question “Where are the rates of disease highest or lowest?” In addition, superimposing spatial climate information with health data would have the extra advantage of being able to either attribute to, or readily rule out climate as the cause for the more prevalent occurrence of a disease in one place over another. This can be implemented at the province level, where the capacity to prepare GIS maps exist. The PHO should work closely with the provincial unit tasked with mapping to be able to prepare maps that show location of disease occurrence *vis a vis* rainfall and temperature variations in the province at a given point in time.

### 4.3.3 Analysis of data by person

As with PIDSR, analysis by person answers the question, “Who are getting the disease?” The presumption in the integration of climate change in health is that vulnerability assessments have been made to determine which populations are susceptible to climate-sensitive diseases. Thus, undertaking analysis by person will also enable answering the following questions vis a vis occurrence of diseases and how they are being affected by climate change:

a) Are the more vulnerable groups the ones that are suffering the brunt of climate change-related diseases?

b) Have public health measures been taken to lessen the adverse impacts of climate change on the health of the more vulnerable populations?

c) Are adaptation measures adequate to enable vulnerable sectors to withstand the effects of climate change vis a vis climate-sensitive diseases?

### 4.3.4 Interpretation of surveillance and health data

As with PIDSR, this activity will entail comparison of current situation with those in other time periods (be they one week, one month, or one year ago or even longer). The instruction given in the PIDSR Manual of Procedure is to make observations on the changes in the number of cases and deaths to see whether the patterns are stable, increasing or decreasing. These will remain part of the interpretation, but at the same time, there will be a

need to correlate the information with climate information over time and across spaces. In addition, the personnel tasked with recording and analyzing PIDSR and climate data must also be able to examine health-climate models as well. Thresholds for various diseases will remain the same, but the usefulness of climate models is that they will enable the health sector to carry out precautionary health measures so that increased risks due to climate change will not breach the thresholds. Adjustments will have to be made in public health measures to be undertaken so that more adequate health responses will be in place as a way of addressing adverse climate impacts on health.

### 4.3.5 Using the results of the analysis

The integration of climate data facilitates the analysis of climate change-related disease occurrence and trends. This is especially true for climate-sensitive diseases such as malaria, dengue, cholera, typhoid and leptospirosis. In the conduct of epidemiological investigation, the analyst can more easily rule out and/or attribute the observations to, the changing weather/climate conditions.

Climate change has an adverse effect on occurrence/morbidity of humans afflicted with climate-sensitive diseases. Tracking climate parameters over time will enable reporting units and hospitals to anticipate future climatic conditions. At the same time, it will equip the health sector with a decision tool as regards to the nature, timing, and extent of public measures to undertake to lessen the impacts of climate change on health. The benefits to society will come in the following forms (adapted from PIDSR, with some modifications):

- Limit the spread and occurrence of additional cases.
- Enable adequate planning to prevent occurrence of outbreaks and improve adaptive capacity of vulnerable sectors.
- Enable cross-agency and multi-level collaboration.
- Advocate for more government support to lessen vulnerability of certain individuals and populations.
- Provide a system for engaging lower level PIDSR units to become more proactive in collecting, analyzing, and reporting disease occurrence and in providing the information critical to local or community actions designed to adapt to climate change.

# 5. Dash board indicators

"*Dashboard Indicators" by Donabedian* served as a guide in the design and selection of Monitoring and Evaluation indicators. The use of dashboards involves the collection of data at the lowest level of the chain or system (micro-system) and is aggregated up to higher levels (meso and macro- systems) to create a dashboard of measurements across the systems (Table 5). In this project, a dashboard indicator is seen as a broad indicator that summarizes other indicators at the micro-, meso- and macro-systems. It is likened to an airplane's dashboard where the pilot and his co-pilot and/ or navigator are able to see, utilize and interpret the information on real-time basis (real-time monitoring). The cockpit dashboard also shows the present and future state of the airplane through related but vital indicators. All these characteristics help the pilot make timely and wise decisions or actions or even midcourse actions to correct a condition or situation.

The M and E indicators are grouped into domains as reflected in the M&E framework. These domains are 1) Climate and Environmental Parameters; 2) Public Health and Health Service Interventions; 3) Environmental and Social determinants of Health; and 4) Health System and Infrastructure. The DOH is mainly responsible for overseeing the M&E system using one of its existing systems called Philippine Integrated Disease Surveillance and Response (PIDSR). PIDSR is the core structure within the M&E system that integrates disease and climate change factors (Figure 5). Apart from the PIDSR, monitoring and evaluation would need to be done by agencies within the system. The system is developed to support the framework in collaboration with PAGASA, NDCC, PDCC and Local Government Units.

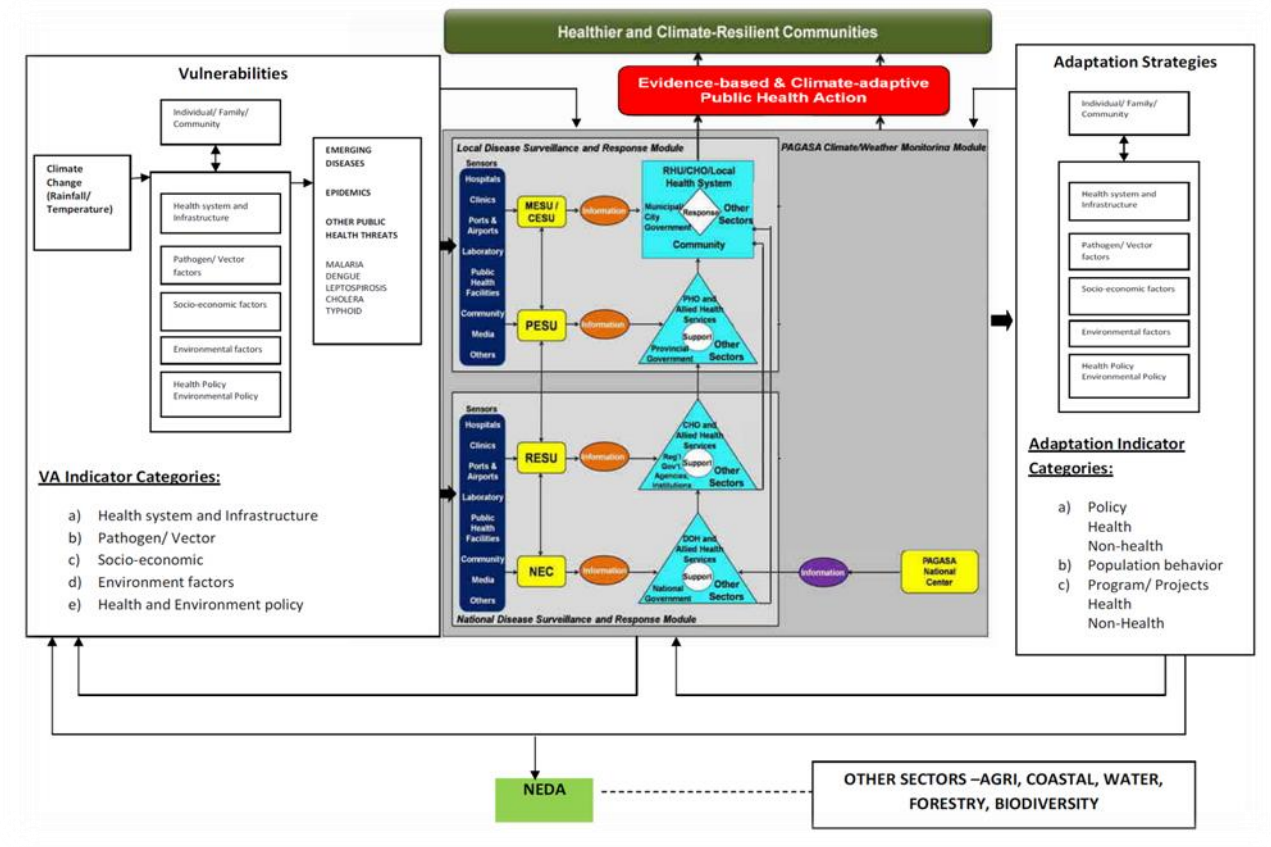


**Figure 5 ME system with PIDSR as Core**

The M&E indicators classified according to a hierarchy -- First level (objective) indictor, Second level (output) indicator, Third level (outcome) indicator and Dashboard indicator (goal). The indicators will be monitored and evaluated based on the levels of the system (barangay, municipal, provincial and national) and frequency (daily, weekly, monthly, quarterly and annually). In Table 5 agencies responsible are indicated as well as the indicators' sources of information.

For *Climate and Environmental Parameters domain*, the presence of a Memorandum of Agreement among government agencies PAGASA, DOH, NDCC and PDCC is the proposed First Level (objective) indicator that would initiate the sharing of rainfall and temperature data between PAGASA/ synaptic stations and DOH and the PDCCs and the NDCC. With data shared and analyzed, province-specific rainfall and temperature annual thresholds will be established. The utilization of Local Government Units of PAGASA data for early response planning is an outcome (Third level) indicator. The dashboard indicator is **Alert and Threshold Level** (See Table 5).

For the *Public health and health Service Interventions domain* there are two Dashboard Indicators: **1) Early Health Emergency Preparedness and 2) Access to Primary Health Care**. Under these, there are 4 outcome indicators under Early Health Emergency Preparedness and 4 outcome indicators for Access to Primary Health Care. Refer to Table 3 for the output/ second level and objective/first level indicators.

**Table 3 Dashboard and Outcome indicators for the Public Health and Health Service Domain**

| **Early Health Emergency Preparedness** | **Access to Primary Health Care** |
|---|---|
| 1. Active community participation in health emergency preparedness projects and activities | 1. Increase/ decrease in number of diagnosed cases of malaria through microscopy and rapid diagnostic test |
| | 2. # of deaths due to malaria |
| 2. Functional response system | 3. Increase/ decrease in malaria cases treated |
| 3. Adaptation strategies implemented by different LGUs | 4. Increase/ decrease in treated dengue cases |
| 4. Functional disease surveillance system integrated with PAGASA data | 5. Increase/ decrease in number of treated diarrhea cases |
| | 1. Increase/ decrease in number of leptospirosis cases treated |

For the *Environmental and Social Determinants of Health domain*, **Environmental Health and Safety** is the dashboard indicator. Under which are outcome indicators: **Integrated vector management and Effective Sanitation Programs**. The last domain, *Health System and Infrastructure*, contains 3 dashboard indicators. These are **Integrated Program on Climate Change, Climate Change Research and Development, and Policy and Program Development to address Climate Change**. Each has its outcome/ third level indicators. Refer to Table 5 for the output/ second level and objective/ first level indicators.

**Table 4 Dashboard and Outcome indicators for the Health System and Infrastructure Domain**

| **Integrated Program on Climate Change** | **Climate Change Research and Development** | **Policy and Program Development to address Climate Change** |
|---|---|---|
| Stakeholder engagement: Existing partnerships between DOH/ LGUs and other CC- related institutions | Research and development agenda at the national level | Functional policies and programs created for CC adaptation, disaster and emergency response at the national level |
| No. of funded projects on CC | % of funds/ grants in R&D for CC at the national level | Policies and programs are updated/ reviewed |
| #/ % of health facilities (hospitals, RHUs, BHS, clinics) with adaptation programs and are emergency and disaster prepared | Funds allocated at national for collaborative projects at the national levels | |

Majority of the indicators are already established and regularly collected by the DOH. However, there are indicators that will require collection of new information. Such include the following:

1. Capacity building activities
    a. Training of PAGASA and LGU HR on local data analysis
    b. Capacity building seminars at LGU level on health emergencies and early response and adaptation
    c. Capacity building seminars at LGU level for implementation of adaptation projects and activities
2. Policy and System development
    a. MOA among PAGASA/ local synaptic station, DOH and NDCC/ PDCC/ MDCC
    b. Development and institutionalization of a response network and system at LGU level for health emergency early response
    c. MOA between DOST-PAGASA and DOH for data sharing and technical assistance

d. Creation of a working group within NEC-DOH to process and analyze health and climate data

e. DOH policy on integrated vector management

f. Existing and functional programs found in LGUs on integrated vector management

g. MOA to establish partnerships between DOH/ LGUs and other CC- related institutions

h. Funding for the CC program/ projects in health at the national level

i. Health facilities (hospitals, RHUs, BHS, clinics) with adaptation programs and are health emergency prepared

j. Funds/ grants/ others sources of R&D funding for CC and health at the national level

k. Congressional bill (PNHRS) for CC and health research funding

l. Evidence based CC and projects and programs

m. Technology transfer and utilization in health

n. Administrative Orders to support programs related to CC at the DOH level

o. Implemented ordinances, rules and resolutions on CC adaptation and health emergency response at LGUs

p. DOH AO on regular monitoring and evaluation of the relevant policies and programs

3. Data to be added to PIDSR data collection:

    a. Sanitation data – toilets, sanitary permits

    b. Flooded areas in the community reported in PIDSR; Presence of areas with stagnant/ swampy water in the municipality/ city

    c. Live larvae found in selected households (Breteau index)

**Table 5 Monitoring and Evaluation Indicators**

LEGEND: LEVEL - **B**arangay, **M**unicipal, **P**rovincial, **N**ational

FREQUENCY - **D**aily, **W**eekly, **M**onthly, **Q**uarterly, **A**nnually

| DOMAINS | DASHBOARD INDICATORS (GOAL) | 3RD LEVEL INDICATORS (OUTCOME) | 2ND LEVEL INDICATORS (OUTPUT) | 1ST LEVEL INDICATORS (OBJECTIVE) | MONITORING | | POSITION/ AGENCY | SOURCE OF INFORMATION |
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| | | | | | LEVEL | FREQUENCY | | |
| **I. Climate & Environmental Parameters** | **ALERT AND THRESHOLD LEVEL** | Data on Rainfall intensity increase beyond rainfall threshold on an annual basis | Daily weather forecast information provided by PAGASA and shared with DOH and NDCC and LGUs through PDCC | MOA among PAGASA/ local synaptic station, DOH and NDCC/ PDCC/ MDCC | N, P | | PAGASA, DOH, NDCC AND PDCC | PAGASA reports/ synaptic reports |
| | | PAGASA data used by LGU for planning for early response | Timely weather related information/ trends/ warnings shared by PAGASA to DOH and NDCC and LGUs through PDCC | Trained PAGASA and LGU HR on local data analysis | N,P | M | PAGASA, DOH, NDCC AND PDCC | PAGASA reports/ synaptic reports; LGU early response plan |

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| | | Temperature increase beyond temperature threshold on an annual basis | Daily weather forecast information provided by PAGASA and shared with DOH and NDCC and LGUs through PDCC | MOA among PAGASA/ local synaptic station, DOH and NDCC/ PDCC/MDCC | N, P | | PAGASA, DOH, NDCC AND PDCC | PAGASA reports/ synaptic reports |
| | | PAGASA data used by LGU for planning for early response | Timely weather related information/ trends/ warnings shared by PAGASA to DOH and NDCC and LGUs through PDCC | Trained PAGASA and LGU HR on local data analysis | N,P | M | PAGASA, DOH, NDCC AND PDCC | PAGASA reports/ synaptic reports; LGU early response plan |
| **II. Public Health and Health Service Interventions** | **1. EARLY HEALTH EMERGENCY PREPARED-NESS** | a. Active community participation in health emergency preparedness projects and activities | Compliance to program IECs e.g. 4 o'clock habit (dengue); water disinfection and hand-washing (cholera and typhoid); Use of treated bed nets (malaria) | # HH/ barangays/ municipalities given program IECs on disasters, emergencies, effect of climate change on health and adaptation strategies | M,P | M | MHO- RHU/ BHS | RHU data (community surveys, observation) |

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| | | b. Functional preparedness system | # of capacity building seminars at LGU level on health emergencies and early response and adaptation | Development and institutionalization of a response network and system at LGU level for health emergency early response | M, P | M | Local Chief Executive, MHO | Capacity building documents and outputs from the LGU |
| | | | Emergency health response assessment proceedings during/after a disaster and feedback by the health response team | Emergency response plan by the LGU | M,P | | | LGU Plan |
| | | | % of LGU projects and activities funded and implemented on early response and adaptation, health emergency preparedness projects and activities | | M,P | | LGU, MHO | LGU accomplishments |

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| | | c. Adaptation strategies implemented by different LGUs | Presence of an adaptation plan/ strategy at the level of the barangay | % of community meetings with CC content towards formulation of the adaptation plan | M,P | | BDCC, MDCC, PDCC | |
| | | | % of adaptation projects and activities implemented | % of capacity building seminars at LGU level for implementation of adaptation projects and activities | M,P | | LGU, MHO | Capacity building documents and outputs from the LGU |
| | | | Amount of funds raised/ apportioned by the LGU for adaptation strategies | | M,P | | | |
| | | d. Functional disease surveillance system integrated with PAGASA data | PIDSR data analyzed with PAGASA data | MOA between DOST-PAGASA and DOH for data sharing and technical assistance | N | | PAGASA, DOH - PISDR | LGU and PAGASA MOA |

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| | | | Trained NEC-DOH and PAGASA HR to analyze and interpret data | Creation of a working group within NEC-DOH to process and analyze health and climate data | | | DOH | DOH AO |
| | | | | PAGASA data submitted to DOH-NEC/ PAGASA working group | N | W | PAGASA, DOH-PIDSR | PAGASA reports; PIDSR reports |
| | | | DOH Advisories released to concerned LGUs re increase/ decrease in incidence and prevalence of diarrhea, leptospirosis and vector borne diseases as reported by PIDSR | Disease and Sanitation conditions reported in PIDSR: | M,P | W, M | SI-RHU, PHO, DOH-PIDSR | RHU statistics and PHO statistics disaggregated by barangay/ municipality |
| | | | | % of HH with sanitary toilets | | | | |
| | | | | % of HH with SAFE source of water | | | | |

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| | | | | % of HH with proper garbage disposal | | | | |
| | | | | % of Establishments with sanitary permits | | | | |
| | | | | Flooded areas in the community reported in PIDSR; Presence of areas with stagnant/ swampy water in the municipality/ city | | | | RHU statistics and PHO statistics disaggregated by barangay/ municipality |
| | | | | #/% of confirmed malarial smears reported in PIDSR | | | | Community surveillance: Active case finding with index case by barangay |
| | | | | #/% confirmed dengue cases reported in PIDSR | | | | Community surveillance: Active case finding with index case by barangay |

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| | | | | #/% confirmed leptospirosis cases reported in PIDSR | | | | Community surveillance: Active case finding with index case by barangay |
| | | | | # of live larvae found in selected households (Breteau index) | | | DOH- NEC, DOH- CHD | SI Inspection report |
| | | | DOH Surveillance teams launched to investigate outbreak or health emergency situations | | | | | |
| | | | Appropriate LGU response to outbreak or health emergency | | | | MHO- RHU/ BHS | |
| | **2. ACCESS TO PRIMARY HEALTH CARE** | a. Increase/ decrease in number of diagnosed cases of malaria through | #/% of confirmed malarial smears or RDT (+) | # of probable cases of malaria | M,P,N | W,M | MHO-RHU, PHO, DOH-PIDSR | Community survey: Active case finding with index case; RHU statistics and PHO statistics; |

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| | | microscopy and rapid diagnostic test | | | | | | PIDSR Reports |
| | | b. Age -sex specific death rates | | # of deaths due to malaria disaggregated by age and sex | | | | |
| | | c. Increase/ decrease in malaria cases treated | #/% of malaria cases given complete dosage | Availability of 1st-line and 2nd-line drugs | M,P,N | W,M | MHO-RHU, PHO, DOH-PIDSR | RHU statistics and PHO statistics; PIDSR reports |
| | | d. Increase/ decrease in treated dengue cases | #/% of confirmed (serologic diagnosis) dengue cases | # of probable dengue cases | M,P,N | W,M | MHO-RHU, PHO, DOH-PIDSR | Community survey: Active case finding with index case; RHU statistics and PHO statistics; PIDSR Reports |
| | | e. Increase/ decrease in number of treated diarrhea cases | #/% of diarrheal cases identified | Sanitation condition: | M,P,N | W,M | MHO-RHU, PHO, DOH-PIDSR | RHU statistics and PHO statistics; PIDSR reports |

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| | | | | % of HH with sanitary toilets<br>% of HH with safe source of water<br>% of HH with proper garbage disposal<br>% of Establishments with sanitary permits<br>% of FIC<br>% exclusively breastfed children until 6 months | | | | |
| | | f. Increase/ decrease in number of leptospirosis cases treated | #/ % of leptospirosis cases identified | Flooded areas in the community reported to PIDSR;<br>Presence of areas with stagnant/ swampy water in the municipality/ city | M,P,N | W,M | MHO-RHU, PHO, DOH-PIDSR | RHU statistics and PHO statistics; PIDSR reports |

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| **III. Environmental and social determinants of health** | **ENVIRON-MENTAL HEALTH AND SAFETY** | a. Decreased vector population | % of Provincial, city and municipal governments engaged in integrated vector management | DOH policy on integrated vector management enacted | M,P | Q | DOH, CHD, PHO, CHO, MHO | DOH issuances |
| | | | Implementation of Bretaeau index; rat traps at community level | Existing and functional programs found in LGUs on integrated vector management | | | | Program on integrated vector management at the LGU level |
| | | b. Effective Sanitation Programs based on standards for sanitation facilities, water sources, garbage disposal | % Increase in compliance to sanitation programs | Sanitation condition: | M, P | Q | SI- RHU PHO | RHU statistics and PHO statistics |
| | | | | % of HH with sanitary toilets | | | | |
| | | | | % of HH with clean source of water | | | | |

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| | | | | % of HH with proper waste segregation and disposal | | | | |
| | | | | % of Establishments with sanitary permits | | | | |
| | | | | % decrease/ increase in food and water borne diseases | | | | |
| | | | | % of HH that participated in santitation program | | | | |
| **IV. Health System and Infrastructure** | **1. INTEGRATED PROGRAM ON CLIMATE CHANGE** | a. Stakeholder engagement: Sustained partnerships between DOH/ LGUs and other CC- related institutions (government and private) | Functional national/ local framework and implementation plan | MOA; Outputs of collaborative work and projects brought about by existing partnerships | N | Q | USEC-DOH | MOA to institutionalize the partnerships and roles of each agency; Stakeholders' workshop |
| | | | Functional working groups on CC at the national level | | | | PHO | Working group plan/ strategies/ activities |

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| | | b. %of funded programs and projects on CC in health | Amount of funding for the CC program/ projects in health at the national level | | N | A | DOH NEDA | CC research plan and outputs at level of DOH and NEDA |
| | | c. #/ % of health facilities (hospitals, RHUs, BHS, clinics) with adaptation programs and are health emergency prepared | # / % of health facilities with adaptation and health emergency plans | | N | A | DOH LGUs | Health facility plan for adaptation strategies and emergency and disaster preparedness |
| | **2. CC RESEARCH AND DEVELOP-MENT** | a. Increase in evidence based CC and projects and programs | % of research and development project proposals funded | # of R&D project proposals submitted by LGUs and institutions | N | A | DOH, NEDA and CC partner agencies | Research and development plan and outputs at level of DOH and NEDA |
| | | b. Increase in technology transfer and utilization in health | | | | | | |

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| | | c. % of funds/ grants/ others sources of R&D funding for CC and health at the national level | Increase continuous sources of funds for CC and health R&D | Congressional bill (PNHRS) for CC and health research funding passed; Continuous sourcing out funds from international community | | | | Research and development plan, funding and outputs at the level of NEDA, DOH and CC partners |
| | | d. Funds allocated at national for collaborative projects on CC and health at the national level | Funds allocated, raised and utilized for collaborative projects on CC and health at the provincial/ city/ municipal levels | | | | | Adaptation and emergency and disaster plans and projects at the LGU level |
| | **3. POLICYand PROGRAM DEVELOP-MENT to address CC** | Functional policies and programs created for CC adaptation, disaster and emergency | # of Administrative Orders to support programs related to CC at the DOH level | | N, P, M | A | DOH NEDA LGUs | DOH Administrative Orders |

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| | | response at the national level | #/ % of implemented ordinances, rules and resolutions on CC adaptation, and health emergency response at LGUs | # of policies on CC adaptation strategies and health emergency response at LGUs | | | DOH NEDA LGUs | Implementation reports |
| | | Policies and programs are updated/ reviewed | DOH AO on regular monitoring and evaluation of the relevant policies and programs | | N, P, M | A | DOH, LGUs | Monitoring reports |

# VULNERABILITY MAPS

The vulnerability map is a visual representation of vulnerable areas or “hotspots”. It is designed to provide national and local planners with a visual reference for areas that are more vulnerable to the changes in the environment, including the health sector, brought about by climate change.

Vulnerability map is part of the impact model that is at the center of vulnerability assessment. Although the vulnerability map is at the center, not all of the factors or variables identified in the model can be effectively rendered in the map. These other factors and variables would only clutter the map and make it less understandable.

In coming up with the vulnerability map, the project team initially decided to use available mapping software technology (i.e., ArcGIS) as tool to build such. Computer-aided mapping technologies have been observed by the team as common to all the three (3) provincial validation sites of the project in terms of mapping capabilities. However, during the course of gathering the necessary datasets that could be rendered in ArcGIS for the project, a number of limitations were encountered.

## Limitations to the Vulnerability Maps

The following limitations have been encountered by the project team in coming up with computer-aided vulnerability maps:

- **Unavailability of information/data** - One of the difficulties encountered by the team in its effort to gather datasets and shapefiles (GIS filetype) was the unavailability of information or data itself. It is not absolutely necessary that the data or information be in a shapefile or geo-referenced (i.e. longitude and latitude readings). It is sufficient that the data could be linked to a geographic area. For example, the open pit dumpsites data that the team was able to gather was not geo-referenced but with a specific barangay-level address, the team will be able to mark this on the map. This becomes an important piece of information for planners. However, a number of vital data sets were dropped from the list because they were either not being collected or not available for dissemination during the visit. This limits the analysis that could be done at the province and municipality level when assessing for

vulnerabilities to diseases. Table 1 presents the dataset requirements identified by the project team.

Most often, the team was able to find a map that shows the data needed in building the vulnerability map, however, the data is in picture format (*.jpg or *.bmp). These cannot be rendered or manipulated in the mapping software (ArcGIS) being used by the team. Such predicament posed serious limitations on the team's ability to electronically render, analyze and present the different data sets in a vulnerability map.

**Table 1: Dataset Requirements**

| Variables/Datasets | Agency Involved |
|---|---|
| • Rainfall<br>• Temp (Max, Min, Mean)<br>• Relative Humidity<br>• Number of Weather Stations and Locations | PAGASA-DOST |
| • Prevalence and Incidence of Diseases<br>• Age/Sex-Specific Morbidity/Mortality Data<br>• Address of Health Facilities/Coordinates if available (Longitude and Latitude of health facilities from Barangay health units to tertiary hospitals) | DOH (NCDPC, IMS)<br>DOH – PHAP (Hospital Licensing)<br>DOH-IMS (Information Management Office) |
| • Population Information<br>• Low Density/High Density Population (geographical locations) | NSO |
| • Topographic Maps | NAMRIA - DENR |
| • Forest Cover | FMB - DENR |
| • Watershed and Water Networks | DENR / DA |
| • Disaster Preparedness Index of Provinces, Municipalities | DND / DILG / PNRC |
| • Human Settlement Information | DILG |
| • Geohazard Maps | NAMRIA / MGB |

| Variables/Datasets | Agency Involved |
|---|---|
| • Rodent/Mosquito Population | Research Institute for Tropical Medicine (RITM) |
| • Landfill Information | DENR - NSWMC |
| • Road Networks | DPWH – Central Office or from Planning Offices of each Province |
| • Safe Water Access | NSO |

- **Data Sourcing** - The datasets and shapefiles that the team has been able to gather so far has been mostly sourced through official channels. However in order to facilitate the initial discussion for the project, some information were gathered through unofficial channels.

  There were also instances wherein the needed shapefiles are already available; however, securing these data is another issue. What is being shared for the project is just a portion or just the picture format of it.

- **Incompatibility of existing map formats for use in ArcView -** The official maps from NAMRIA are currently rendered in AUTOCAD. Although they are currently in the process of converting these files to shapefiles, the file format for ArcGIS, this is a long and tedious process. It would take the team approximately 50 weeks to convert the AUTOCAD files for Palawan which is composed of 50 map sheets or files at a rate of 1 week: 1 map sheet. This is the shortest time estimate given to the team by the NAMRIA if the AUTOCAD file were "clean" or needed fewer adjustments. But there is no assurance that the Palawan files are clean.

  According to NAMRIA, among the three focus areas, Palawan is the least priority when it comes to conversion because it is not a "geohazard area" unlike Pangasinan and Rizal where some of the map sheets have been converted to shapefiles. This is a special concern for the team because, even if shapefiles are available, they are not complete that would allow for a comprehensive analysis of the province. To illustrate, Figure 1 shows the flood and landslide prone areas in Pangasinan based on available NAMRIA maps. It can be seen that two large chunks of Pangasinan (Dagupan City and Infanta areas) cannot be rendered on the map.

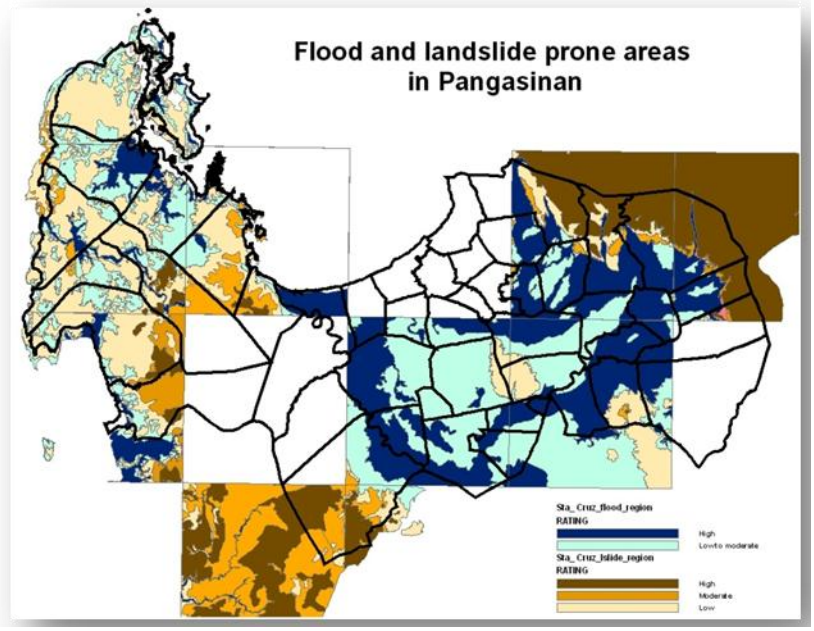



**Figure 1: Flood and landslide prone areas in Pangasinan**

- **"Misalignment" of some maps to NAMRIA maps.** The team has been able to get shapefiles but, when rendered on ArcGIS, they are misaligned. This is particularly true for the provincial and municipality boundary files, which shows the administrative boundaries of the different municipalities and provinces. As can been seen in Figure 2, the boundary shapefiles are "misaligned" when super-imposed over the NAMRIA-produced shapefiles, such as the forest cover map. Technically, this could be fixed by manually adjusting the boundary files. But this will never be fully aligned with the NAMRIA-based files.

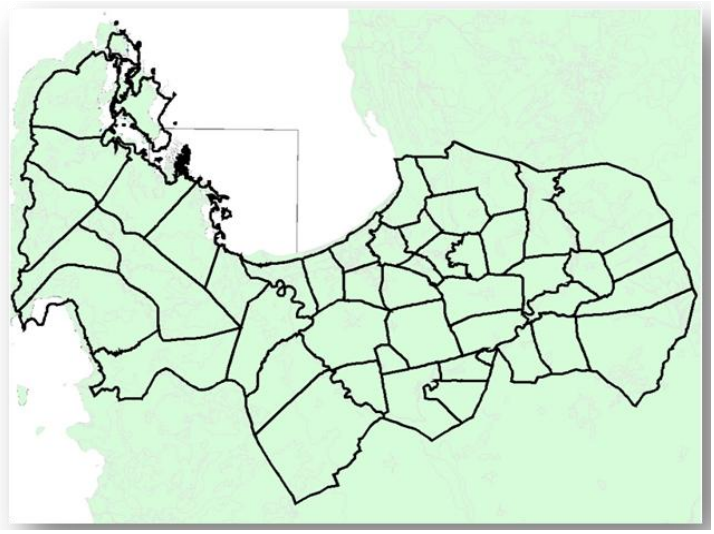


**Figure 2: Pangasinan Provincial and Municipal boundaries rendered over the forest cover shapefile**

- **No available digitized barangay boundary maps.** The team also has difficulty in securing digitized barangay maps. Such limitation posses a problem since, ideally, incidences of the diseases should be mapped out in a specific location at the barangay level in order to come up with a more evidence-based analysis of its demographic or environmental characteristics.

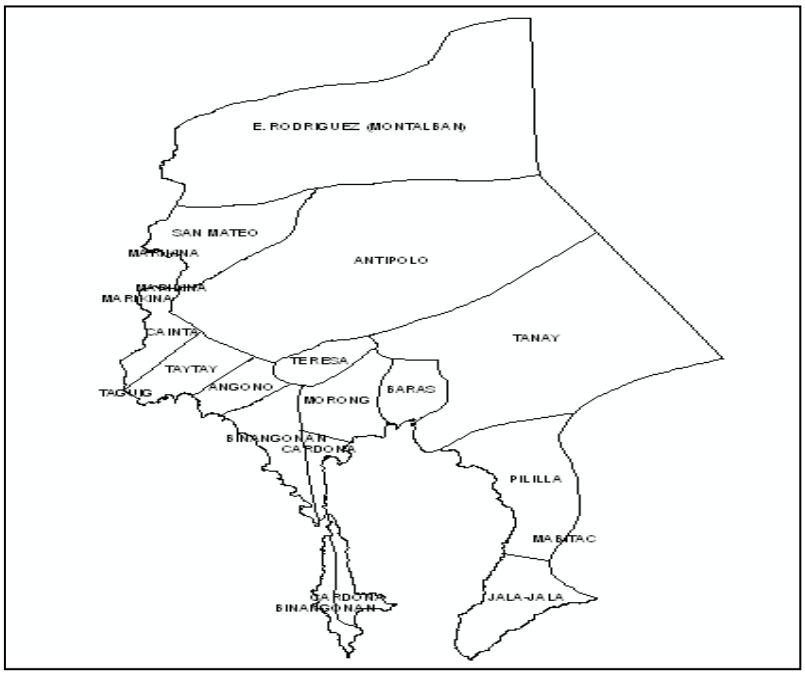
- **Use of mapping software tool only at the national and provincial level**. Mapping software technologies are only available and being used for planning activities at the national and provincial level. Although there are few cities and municipalities in the country which are also using mapping software technologies, however, their use is only limited to purposes such as tax mapping and development planning. And since there is now a paradigm shift in terms of planning hierarchy from *top down* into *bottom up*, it is important to also equip these local planning offices (i.e. municipalities) with the necessary tools to guide them and carry their respective mandates in addressing issues in their own localities.

## Alternative Method for the Vulnerability Map

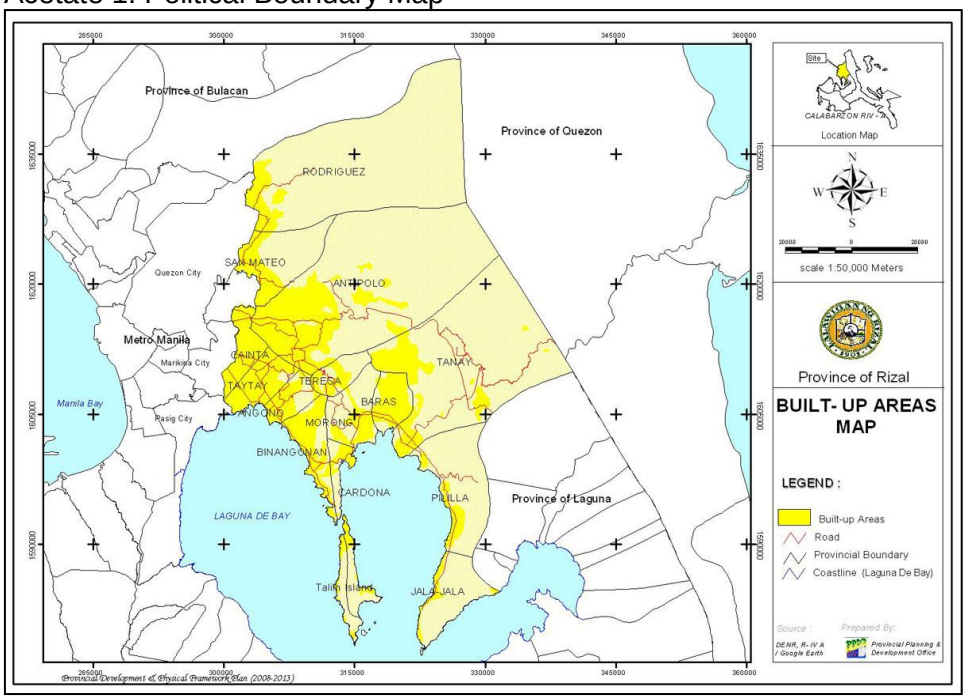
Ideally, the vulnerability map being envisioned by the team should be rendered and analyzed electronically. The use of Geographic Information System (GIS) software such as ArcGIS allows the team more room for modeling the vulnerability assessment. But given the limitations presented above, the team has decided to shift to a more traditional method of rendering, analyzing and presenting the vulnerability maps. A more manual methodology allows the team to integrate data in different formats (shapefiles, pictures, print outs) into a common platform – acetates or similar materials. This conventional method hopes to also address the issue of technical readiness in using ArcGIS software of some municipalities in the study area. Through the use of acetates and overlay of the various variable layers (or maps) being considered in this study, local planners and decision makers will be able to participate in the planning process and at the same time appreciate the visual presentation of the vulnerabilities in their respective jurisdictions.

For instance, local planners could overlay the political boundary map (Acetate 1 in Figure 3) together with other maps/layers such as built-up areas (Acetate 2), flood prone areas (Acetate 4), and solid waste disposal (Acetate 5) in order to see the locations that are vulnerable to, say, leptospirosis. Or they can further analyze why incidences of leptospirosis

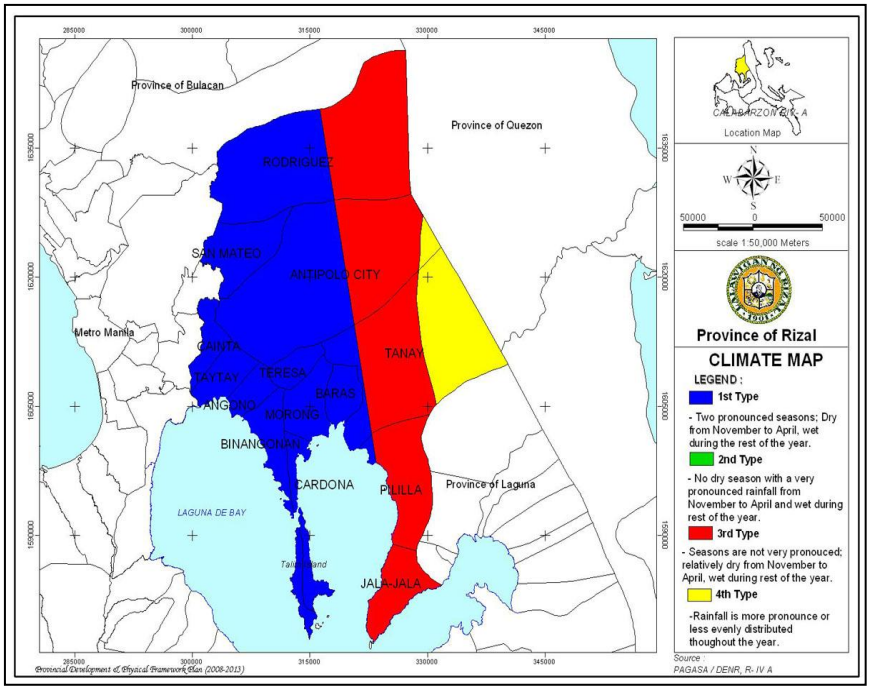
are high to some areas by looking at the demographic and environmental conditions in these areas. One factor could be that these areas are the same areas that are flood prone or where landfills or dumpsites are located.



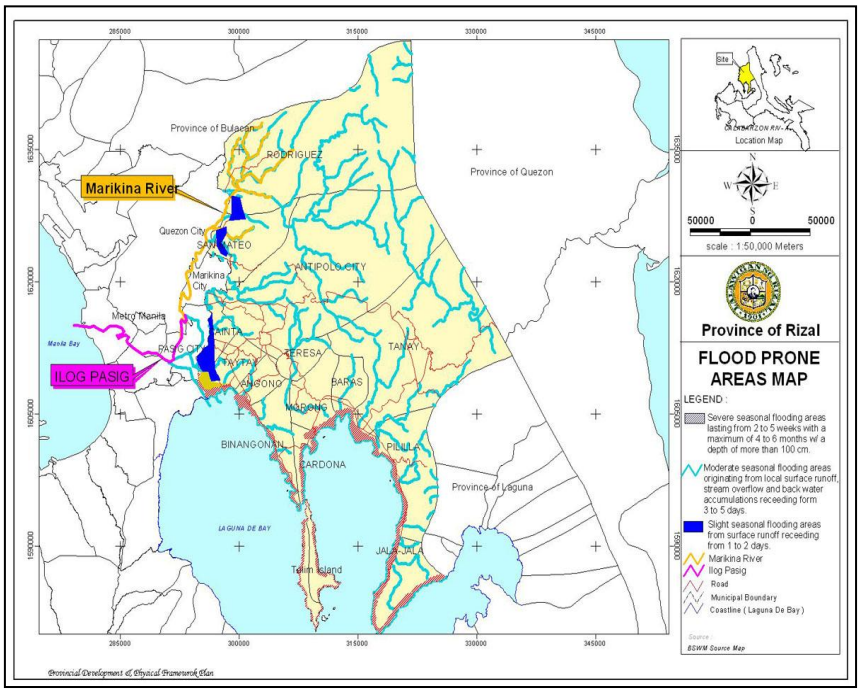

Acetate 1: Political Boundary Map



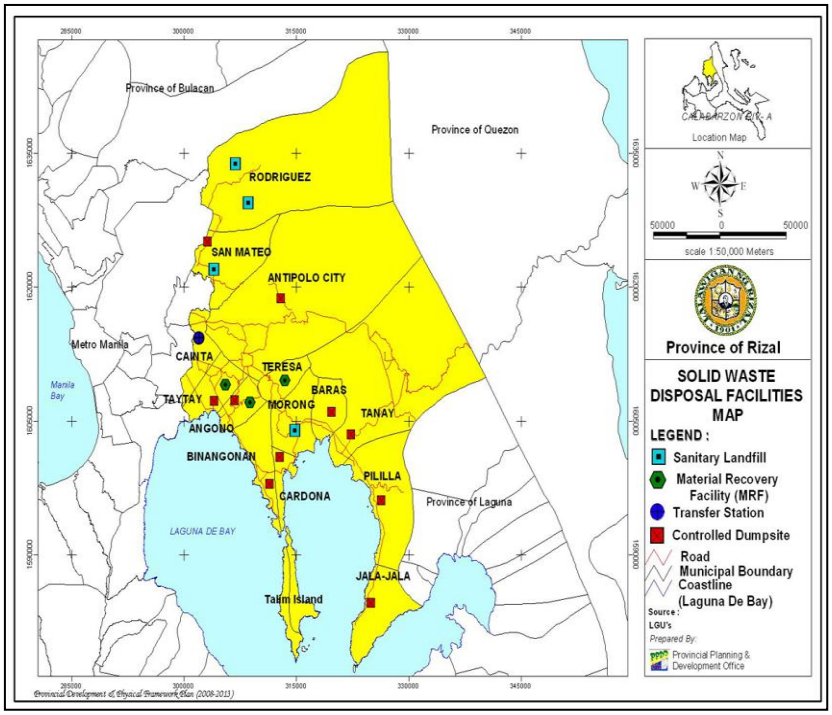

Acetate 2: Built-up Areas Map



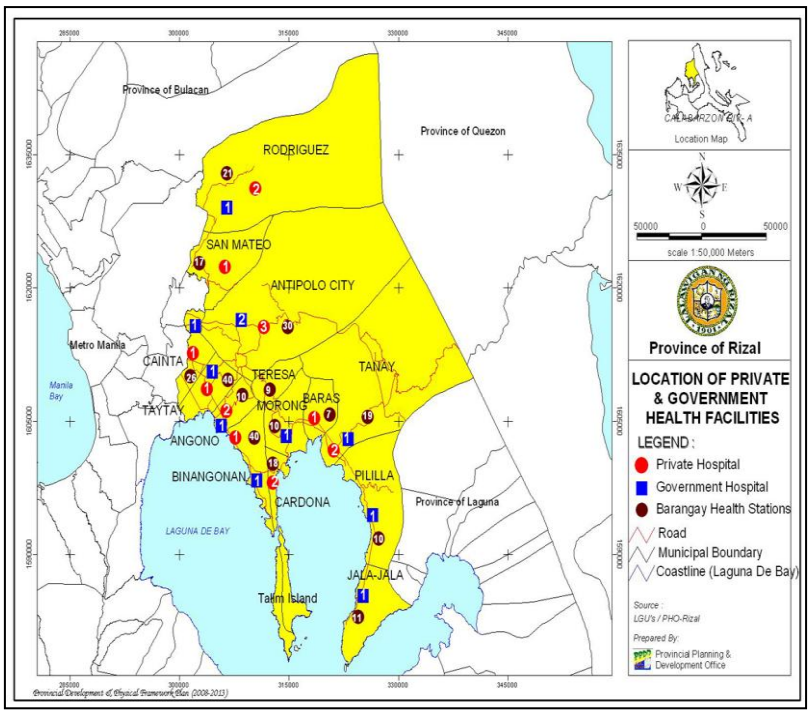

Acetate 3: Climate Map




Acetate 4: Flood Prone Areas Map




Acetate 5: Solid Waste Disposal Map




Acetate 6: Health Facilities Map

**Figure 3: Sample Maps of Rizal Province in Acetate platform**

### *How to Build the Vulnerability Maps: Step-by-Step Process*

One of the important outputs of this study is the development of vulnerability maps. As stated earlier, the vulnerability maps being envisioned by the team should be rendered, manipulated, and analyzed in ArcGIS (or utilizing available mapping technologies) to provide national and local planners an enhanced appreciation and understanding on what and why particular locations in their respective areas/territorial boundaries are vulnerable to specific diseases brought about by extreme weather conditions.

However, in the course of discussion with the different stakeholders, there was a consensus that the team should always consider the fact that not all Local Government Units (i.e., municipalities, barangays) are capable of generating vulnerability maps based on computer software primarily because of the lack of equipment and technically-skilled government employees who could operate such software. Given this additional consideration, the following basic steps could be adopted by the planning office of the respective local government units. The identified steps, however, could be enhanced by concerned offices based on their needed requirements.

**Step 1**: Identify the information or datasets that are available in the locality. What are the datasets needed which are available on-hand and those that have to be secured from other offices? Table 1 presents some of the initially identified data requirements to come up with a vulnerability map.

**Step 2**: Prepare the baseline maps. The baseline map of the locality (i.e., province, municipal) which could be sourced from their respective development and management plans will be scanned or duplicated manually using acetate or similar materials. The baseline map could be just the political boundaries of the LGU or it could contain additional data information such as networks of rivers and roads which could be drawn or included manually using colored pentel pens.

**Step 3**: Select the climate change parameters that you want to focus on. The PAG-ASA has readily available climate change parameters such as rainfall, temperature and relative humidity. Additional information such as climate map, location of storm surges and sea level rise will also be helpful in presenting the relationship of climate change and the health of the population in that locality (vis-à-vis the incidence of related diseases). Using the baseline map as guide, each type of these climate change parameters should be plotted into separate acetates as color-coded layer of event.

**Step 4**: Make an inventory of the assets and service facilities available in the area. These include location and type of health facilities, available solid waste disposal system, access to safe water, and built-up areas. Relevant datasets such as human settlement information, forest cover, and other environmental factors deemed necessary could also be included and mapped each feature separately into the acetate. These additional information could be manually drawn/included in the acetate map using colored pentel pens. Use legends to properly label these information being drawn/included.

**Step 5**: Map-out the incidence of diseases in the area. After collecting the data on diseases from the municipal or provincial health office, each type of disease (i.e., dengue, malaria, leptospirosis, cholera, and typhoid) will be mapped-out and presented as separate layers of the map. Again, these additional information could be manually drawn/included in the acetate map using colored pentel pens. Use legends to properly label these information being drawn/included.

**Step 6**: Overlay the various acetates containing the data layers that one wants to analyze. Using the acetate baseline map as a platform, one can overlay with it 3-4 more acetates in order to see and analyze why certain areas/groups in the municipality or province are vulnerable to specific diseases.

The importance of vulnerability maps is that it could be used as a tool for planning investments for infrastructure, resettlement, reforestation, and so on. Moreover, planning officers could also be guided further on what specific measures and strategies to introduce to target/address climate change vulnerabilities.