

Vulnerability Assessment of Mangrove Ecosystems to Climate Change in Southeast Asia

Kristine Garcia¹, Joko Prayitno², and Kok Foo Kwan³

¹World Agroforestry Center-Philippines, 2F Khush Hall, International Rice Research Institute, College, Laguna 4031, Philippines

²Institute for Environmental Technology, Agency for the Assessment and Application of Technology (BPPT), Indonesia

³Malaysian Meteorological Department, Jalan Sultan, 46667 Petaling Jaya, Selangor, Malaysia

K.Garcia2@cgiar.org; tingarciaensci@gmail.com

INTRODUCTION

Southeast Asia (SEA) harbours 34-42% of the world's total mangroves on earth (Giesen *et al.*, 2007). Mangrove ecosystem is a unique ecosystem inhabited by many marine organisms such as fishes, crabs, zooplanktons and phytoplanktons. In addition, SEA's mangroves are the most species-diverse in the world with 52 species endemic to SEA's mangrove habitat including 42 trees and shrubs (Giesen & Wulffraat, 1998; Giesen *et al.*, 2007). Conservation of mangrove is important for sustainable fish production and for protection against coastal abrasion. Mangrove ecosystems and its biodiversity are threatened by climate change. Climate change components that affect mangroves include sea-level rise, extreme weather, precipitation, temperature, atmospheric CO₂ concentration and ocean circulation patterns. Of all the components, relative sea-level rise and extreme weather is thought to be the greatest threat (Gilman *et al.*, 2008).

This study aims to assess the vulnerability of mangrove ecosystems in SEA region to impacts of future climate in terms of habitat sensitivity, biodiversity and sustainability of fish production. The current habitat and biodiversity status of important mangrove ecosystems in selected sites in Indonesia and Philippines will be assessed through primary and secondary data gathering. Data on climate factors such as sea-level rise, extreme weather, temperature, precipitation and CO₂ concentration and its scenario for 40 years based on several regional climate models will be used for impact assessment. We will consider the components and measures of exposure, sensitivity, and adaptive capacity of mangrove ecosystems to impacts of climate change and then assess their vulnerability. The impacts of climate change on the sustainability of fish production in selected mangroves ecosystems will be investigated and analyzed through historical data collection and will include the degree that it is exposed to social-economic demand.

It is anticipated that the results of the study will help decision makers in formulating climate change adaptation strategies for maintaining mangrove ecosystems biodiversity and sustainability of fish production.

Keywords: mangrove ecosystems, climate change, sustainability, vulnerability, adaptation

OBJECTIVES

The main focus of this study is to assess the vulnerability of selected important mangrove ecosystems to climate change in Southeast Asia. Specifically, it aims to:

- Develop climate change scenarios for biophysical impact assessment and
- Conduct socio-economic impact of climate change on fish production
- Raise awareness among local and national level policy and decision makers about the potential impacts of climate change on mangroves biodiversity; and
- Assist in devising policies that can reduce depletion of mangroves and sustain fish production.

SIGNIFICANCE

There are sizeable mangrove forests along coastlines of Southeast Asian countries that are vulnerable to climate change. Mangrove forests are not only ecologically important for biodiversity sustainability but also have socioeconomic dimensions for humankind. The mangrove forests in Indonesia and the Philippines are shrinking at an alarming rate due to a combination of natural causes and human exploitation. This in turn has reduced marine productivity in terms of fish, shrimp, crab and many other marine lives. Climate change impact aggravated this shrinking in the Southeast Asian mangroves. Research efforts are needed for more detailed understanding of climate change vulnerabilities to mangroves of Southeast Asia.

METHODOLOGY

- **Study site selection and characterization:** Identifying appropriate study sites in two countries with particular consideration on the availability of climate and biodiversity data for the site through primary and secondary data gathering using remote sensing.
- **Scenario development:** Climate change scenarios will be developed with the help of Malaysian Meteorological Department, using PRECIS regional climate model.
- **Study of impacts of climate change to mangrove biodiversity:** Data will be used to study current and future impacts of climate change on mangroves biodiversity with particular interest in species distribution.
- **Assessment vulnerabilities of mangrove ecosystems dependent communities/Sector:** Socio-economic impact of climate change on fish production will be assessed using data obtained from questionnaires, interviews and secondary data.
- **Final workshop for sharing results, policy recommendation and report writing:** Country reports with policy recommendations will be prepared and synthesized to get a regional report. These reports will be shared with policy and decision makers through a final workshop.

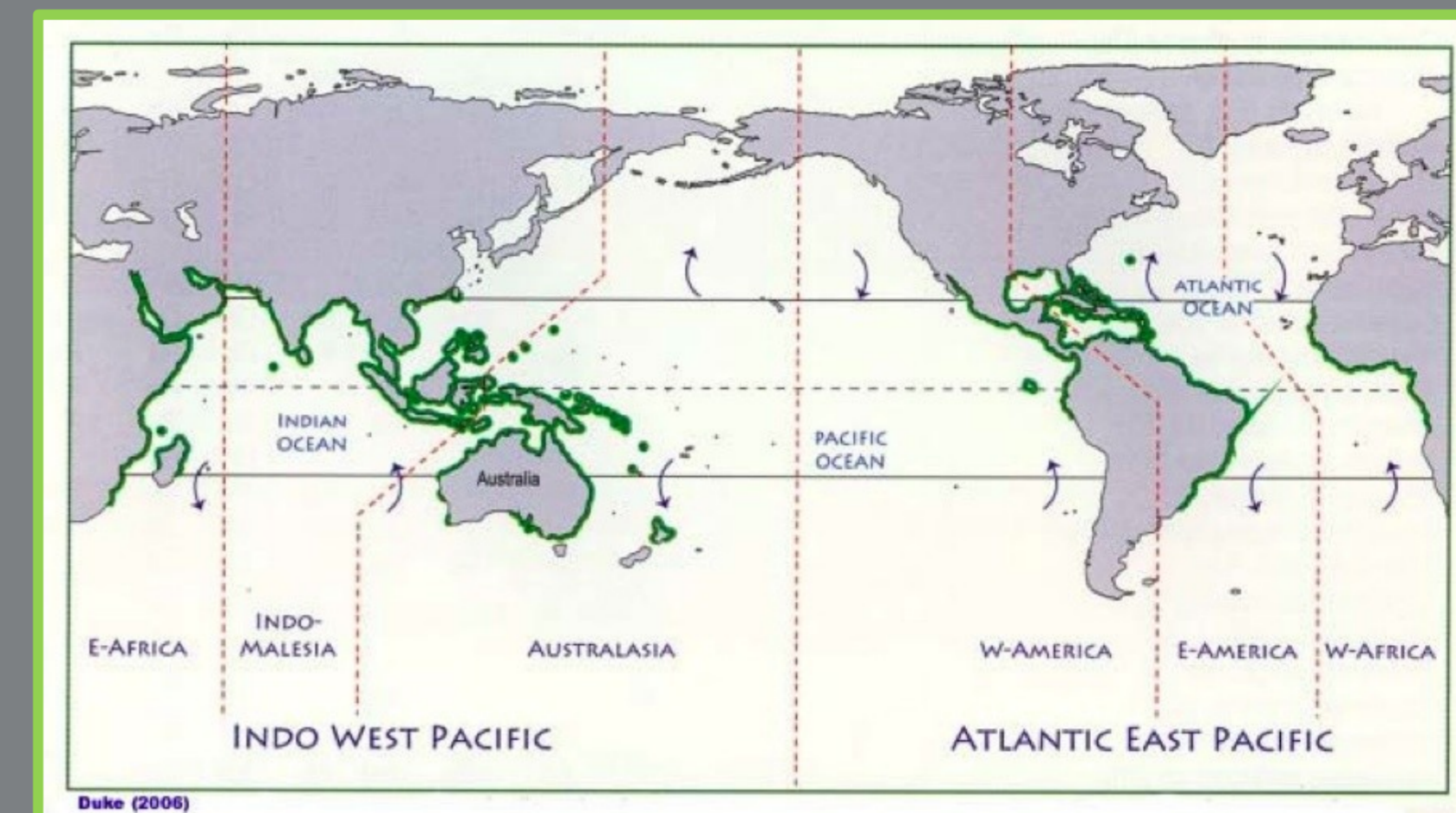


Figure 1. Distribution of mangroves in the world. According to the most recent estimate this accounts for 0.7% (13.8m) of total tropical forests of the world (Giri *et al.*, 2010).

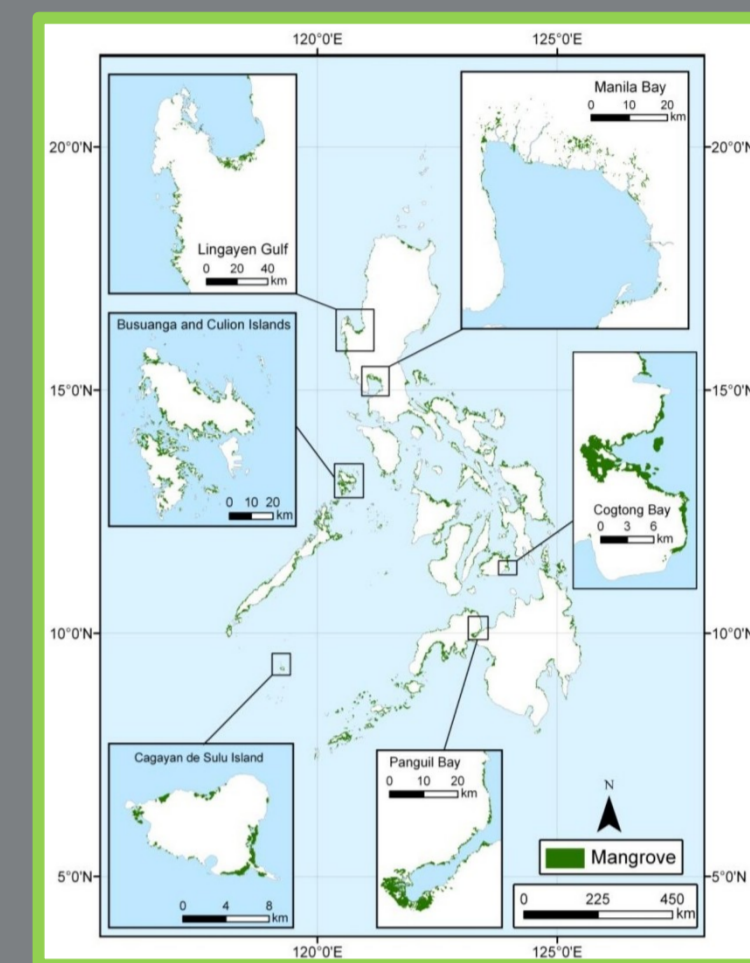


Figure 2. Spatial distribution of mangrove forests of the Philippines for 2000 (Long and Giri, 2011).

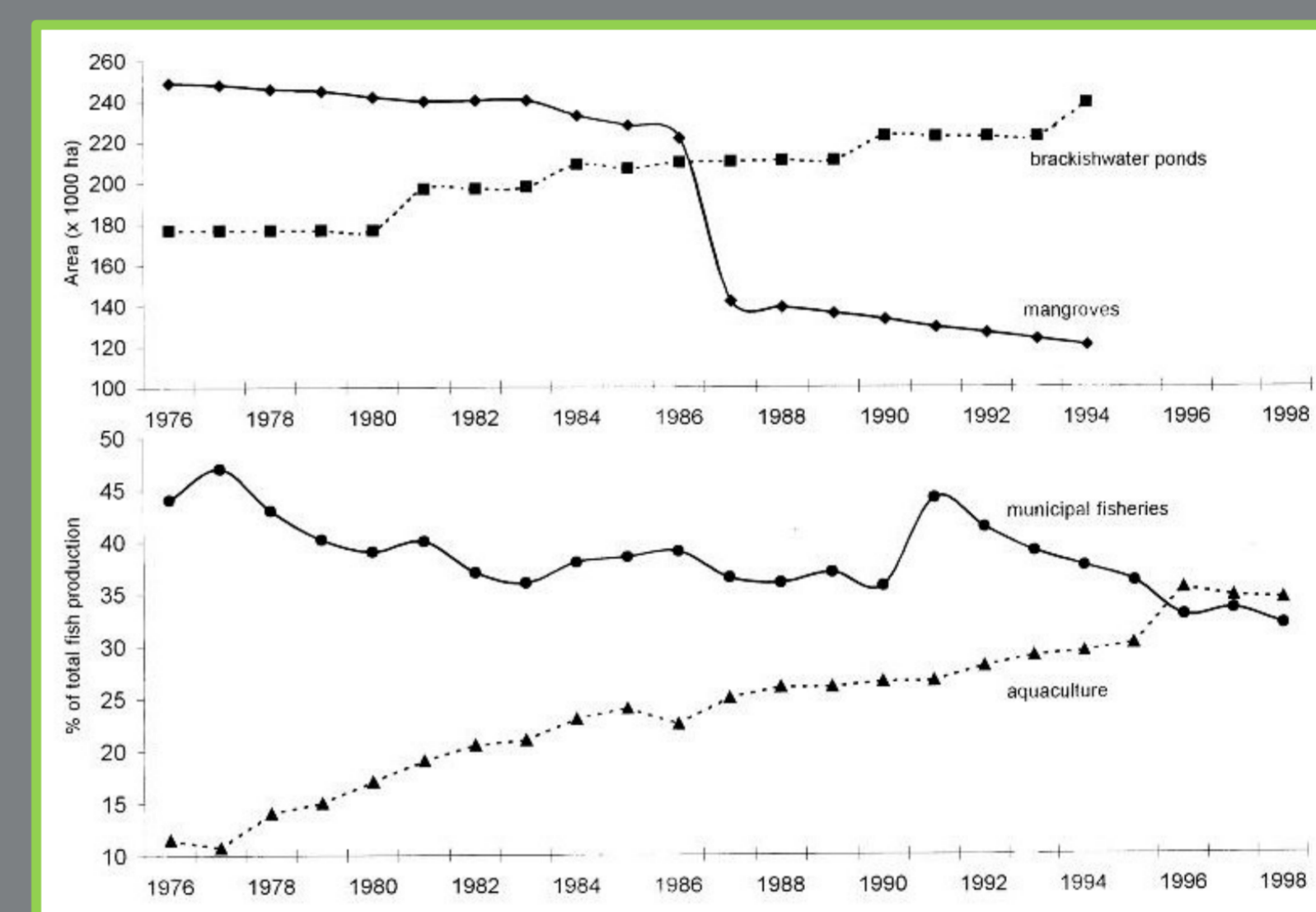


Figure 3. Changes in (a) mangrove and brackish pond area and (b) contribution of municipalities fisheries and aquaculture to total fisheries production in the Philippine (Primavera, 2000).

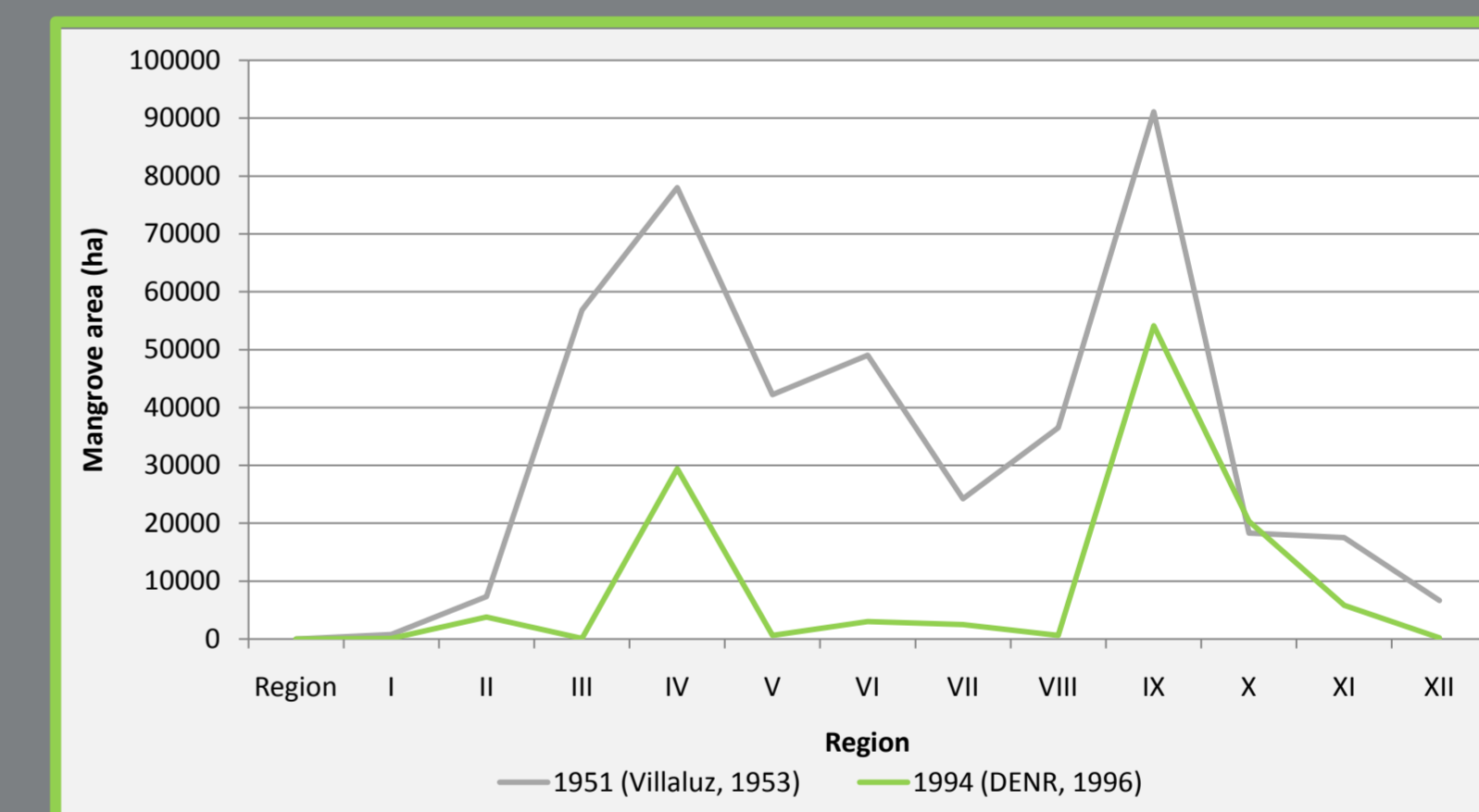


Figure 4. Trend of mangrove areas in the Philippines by region, 1951–1994 (Primavera, 2000).

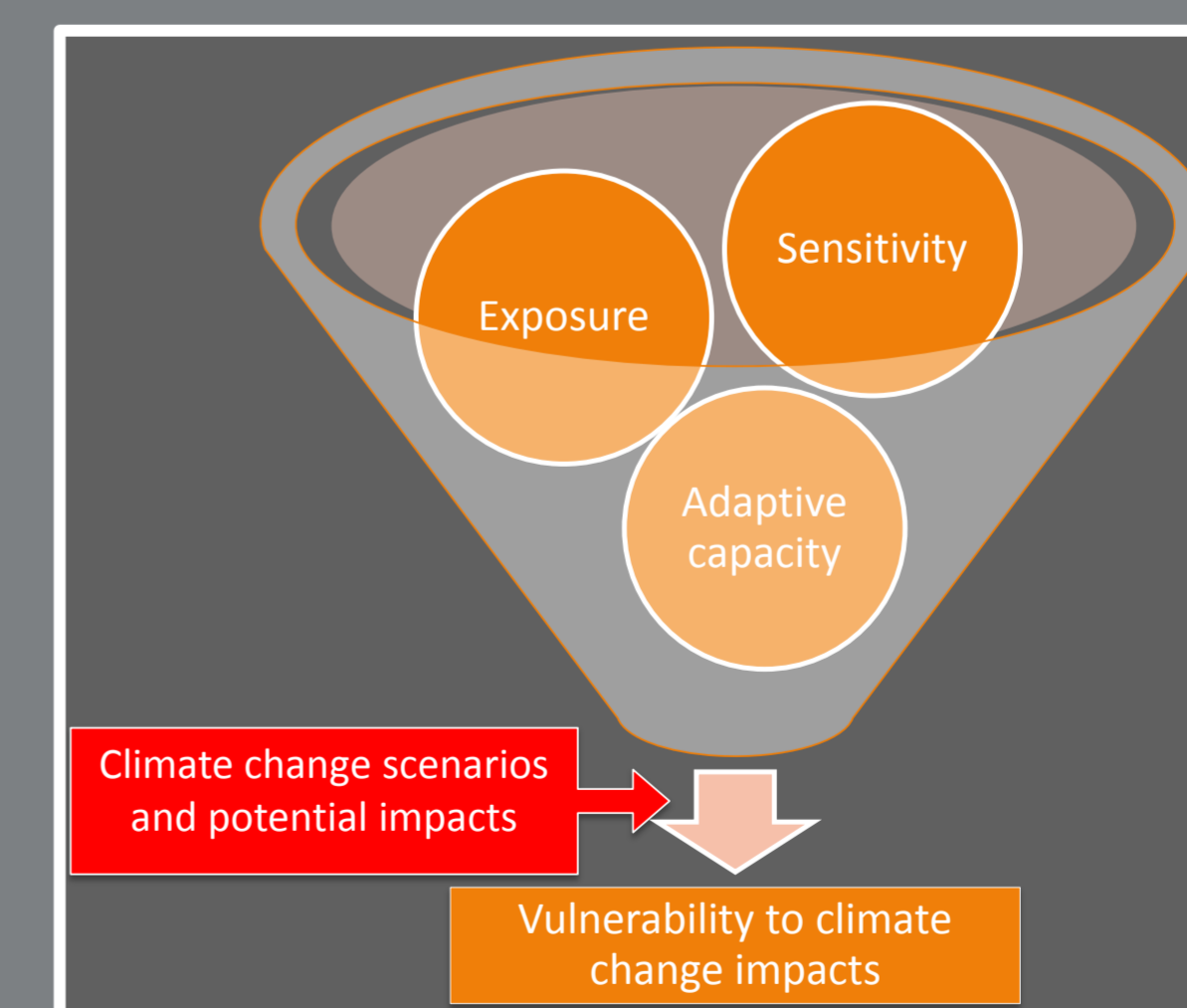


Figure 5. Framework of the study.

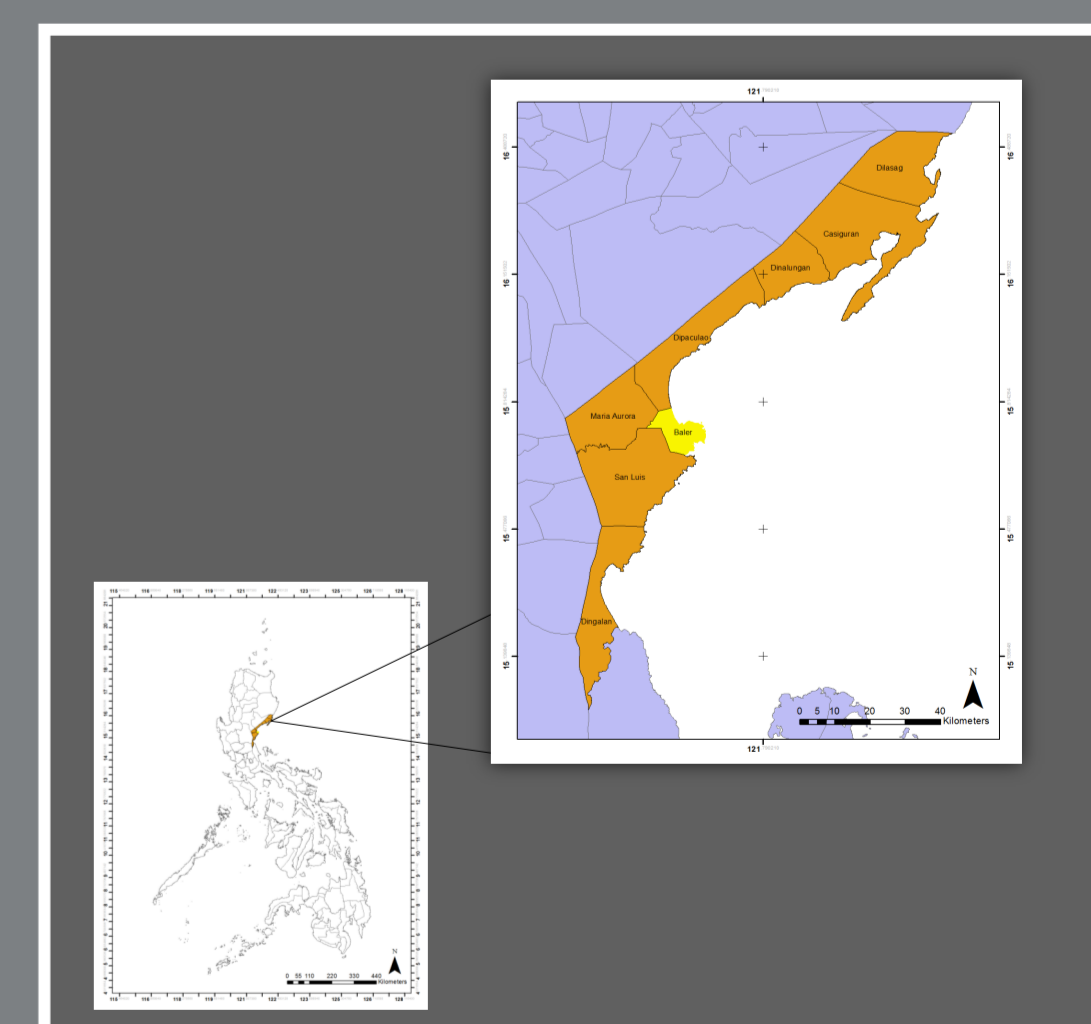


Figure 6. Proposed project site in the Philippines.

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