

Guide for Assessing Socio-Ecological Vulnerability to Climate Change and Ecosystem-Based Adaptation (EbA) Practices

Adapted for Locally Managed Marine Areas (LMMAs) – MIHARI Network



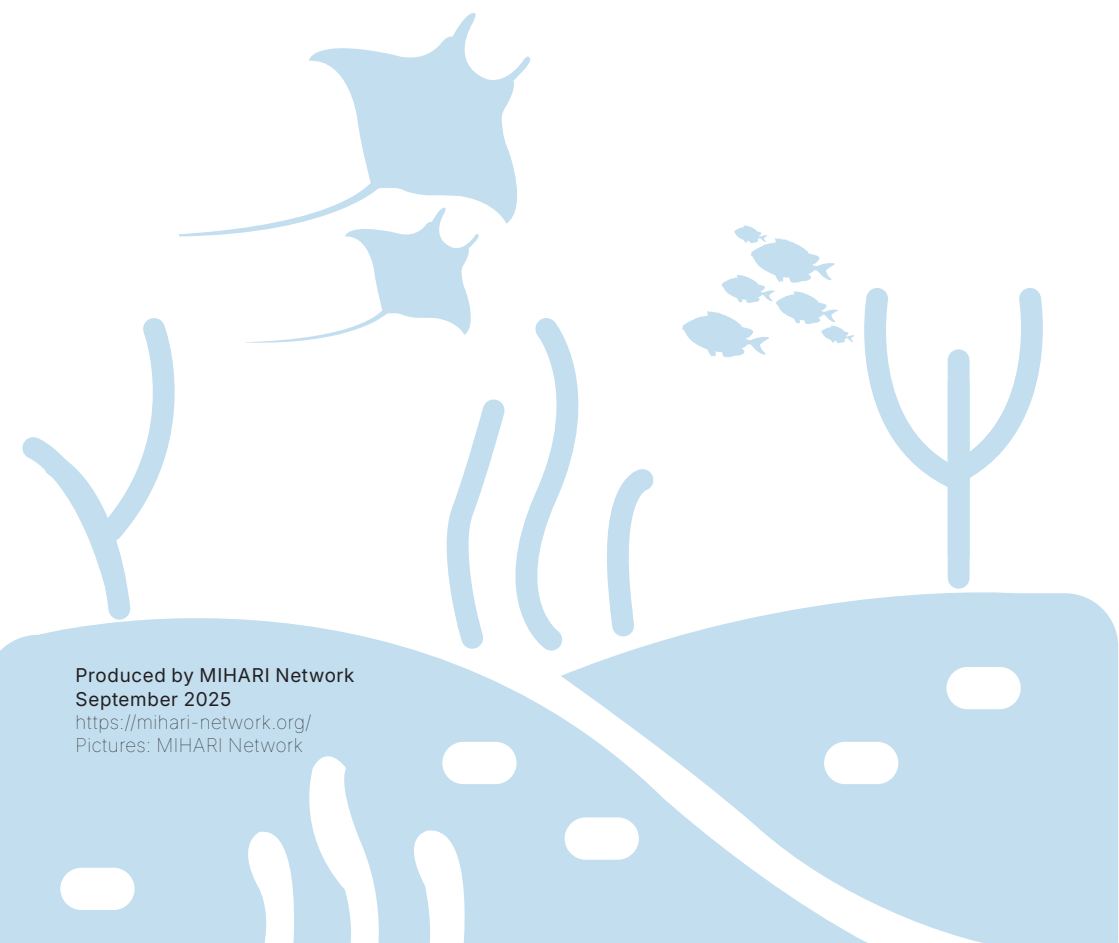
This guide for local communities was produced by the MIHARI Network in September 2025, as part of the project "Strengthening the Socio-ecological and Socio-economic Resilience of LMMAs to Climate Change through the Protection of Key Ecosystems and the Diversification of Livelihoods." The project is funded by Blue Action Fund and implemented in collaboration with Blue Ventures Madagascar, WWF Madagascar, and other partners.

The guide aims to support coastal communities in the sustainable management of marine and coastal resources by sharing effective, locally appropriate practices that help address the impacts of climate change.

Produced by MIHARI Network
September 2025

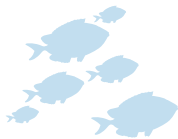
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Pictures: MIHARI Network



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GLOSSARY

MIHARI:	Mitantana HArena andRanomasIna avy eny Ifotony (Community-Based Marine Resource Management Network)
LMMA:	Lamina enti-Mitantana ny Morontsiraka sy An-dranomasina (Locally Managed Marine Area)
CCVA:	Climate Change Vulnerability Assessment
EbA (AfE):	Ecosystem-based adaptation (Fampifanarahana mifototra amin'ny rohivoary)
NGO:	Non-Governmental Organization





The social and ecological vulnerability of Madagascar's coastal areas represents a major challenge in the face of climate change.



To better identify and address this vulnerability, the CCVA (climate change and social vulnerability) method analyzes vulnerability factors across three main areas:



Exposure



Adaptive capacity



Sensitivity

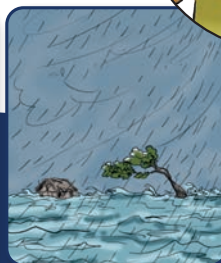
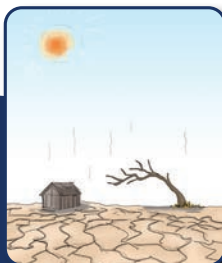
Climate Change refers to the rapid increase in the earth's average surface temperature and large-scale alterations in climate patterns, primarily caused by the rise in greenhouse gas concentrations in the atmosphere.

While some variations occur naturally, most of the current changes are human-induced, driven by activities that alter atmospheric composition and land use.

ANKEHITRINY



TALOHA



Traditionally, climate is defined as the average of meteorological parameters (pressure, temperature, wind, precipitation, cloud cover, etc.) observed locally over a period of about 30 years.

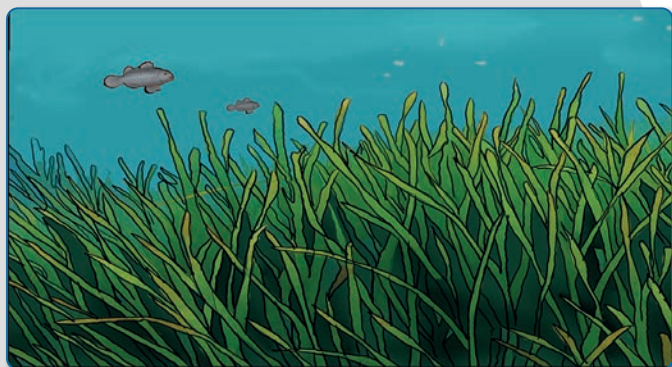
These characteristics help define a region's environmental profile, as well as the types of livelihoods (fishing, farming, etc.) that are suited to it.

A good understanding of local climate conditions therefore enhances the community's capacity to adapt to climate change.

Ecosystem-based Adaptation (EbA) is an approach that uses biodiversity and ecosystem services—such as mangroves, coral reefs, coastal forests, and wetlands—to help communities adapt to the impacts of climate change.



Mangroves



Seagrass meadows



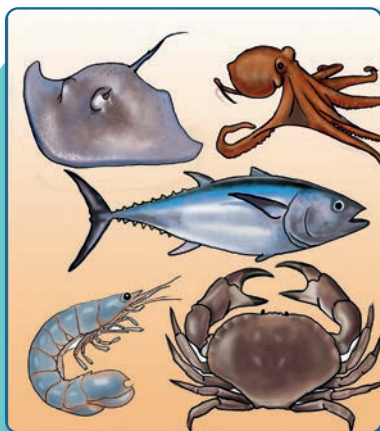
Coral reefs



Climate Change Vulnerability Assessment (CCVA) is a method used to understand how climate change affects communities and ecosystems.



Preventing flood



Tracking the recovery of marine resources



Monitoring mangrove health and productivity



Sharing information on a monthly basis

III. The three dimensions of vulnerability

Dimension	Definition	Simple indicators
Sensitivity  	- Climate change is defined as a long-term alteration of normal climatic conditions resulting from increased concentrations of carbon dioxide (CO₂) and other greenhouse gases in the atmosphere. - The accumulation of these gases leads to a gradual rise in the earth's average temperature. - This phenomenon leads to new and increasingly severe climatic events, such as unusually high temperatures and intense heatwaves, shifts in rainfall and seasonal patterns, rising sea levels, and disruptions to farming, fisheries, and local livelihoods that vary across regions.	Increase in temperature Rise in annual and seasonal average temperatures Growing number of days exceeding normal temperature thresholds (heatwaves) Changes in Rainfall and Precipitation Patterns Variations in annual average rainfall Increase or decrease in the number of dry or wet days compared to normal averages Disappearance or excess of rainfall, leading to phenomena such as floods and droughts Sea level rise Annual increase in sea level (in centimeters) along the coastline Coastal degradation and erosion Social and economic consequences Decline in agricultural and fisheries productivity as a result of climate change Evolution of traditional practices and strengthening community preparedness for climate hazards.
Adaptability  	Climate adaptation capacity refers to the ability of communities to cope with the effects of climate change by implementing strategic solutions that enable them to live with its impacts while reducing vulnerability and minimizing negative consequences through targeted action plans and infrastructure development.	- Capacity to Adapt Agricultural and Fisheries Practices Example: Number of farmers cultivating drought-resistant varieties of rice and vegetables - Indicator: Percentage of farmers applying new climate-adapted techniques. - Capacity to Cope with Disasters and Manage Natural Resources Example: Construction of water storage structures like ponds or tanks; adoption of food preservation methods - Indicator: Number of households or communities with protective structures against hazards (e.g., floods, droughts). - Capacity to Adjust Lifestyles Example: Modification of work schedules; relocation to safe areas during flooding events - Indicator: Number of individuals or households adopting adaptive measures in response to changing climatic conditions. - Participation in and Access to Information and Training Example: Participation in training sessions on climate change and adaptation techniques. Indicator: Percentage of individuals or groups trained in resilience and adaptation practices. - Capacity for Collaboration and Networking Example: Creation of community groups for environmental protection or solidarity networks. Indicator: Number of active community networks or partnerships supporting climate adaptation efforts.
Exposure 	The consequences of climate change refer to adverse events resulting from climate change, such as floods, droughts, high waves, or extreme rainfall, which have direct effects on the environment, population and communities, housing, economic activities (agriculture, livestock farming) and natural resources.	- Affected Population Example: Number of people affected or at risk due to flooding, drought, or ocean surges. Indicator: Percentage of the population within a given affected area. - Affected Buildings and Infrastructure Example: Number of houses or schools damaged by floods or storms. Indicator: Number of buildings or percentage of infrastructure impacted. - Affected Agriculture and Fisheries Example: Hectares of crops lost or reduced yields due to drought, flooding, or extreme rainfall; decrease in the quantity and quality of fish caused by ocean warming and acidification; disruption of fishing seasons due to wind and wave conditions. Indicator: Hectares or percentage of production lost. - Affected Natural Resources Example: Damage to freshwater sources, forests, or food resources. Indicator: Percentage of resources affected or lost. - Frequency and Recurrence of Extreme Events Example: Number of floods, droughts, or storm surges occurring annually; incidence of cyclones or severe storms. Indicator: Number of extreme events recorded per year.

Step	Main activity	Methodology
Observation	Identify changes in climate, fishing, and marine conditions.	- Discussions - photos - maps
Analysis	Understand causes and effects	- Tables - shared experiences
Classification	Prioritize risks and critical zones	Participatory mapping
Proposal	Identify locally appropriate and sustainable solutions.	- Village meetings - Brainstorming
Plan of action implementation and Monitoring	Implement and observe results	Creation of community monitoring committees

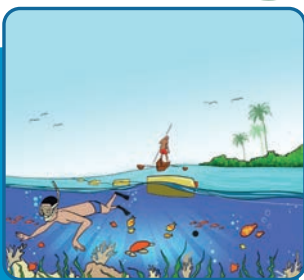
V. Examples of Ecosystem-based Adaptation (EbA) Actions



Replanting mangroves



Establishing sustainable fishing zones



Community-based Reef Monitoring



Training in responsible fishing practices



Promoting alternative livelihood (e.g., beekeeping, sustainable agriculture)



- Mobilize and motivate community members
- Strengthen and share knowledge through collective learning
- Organize and coordinate meetings and discussions

-MIFAMPIRESAKA MIARAKA NY AZO ATAO



Encourage open dialogue

MANARA-MASO NY FAMPIHARANA SY NY VOKANY

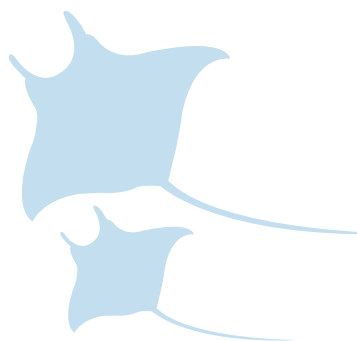


Monitor implementation and results

Maintain communication with partners (NGOs, MIHARI Network)



VII - Annexes



- Data Collection Methods

Method	Participants	Activities
Focus group	6 - 8 people per LMMA	Weighting of domains and indicators
Key information Interview	Local leaders, Association Presidents, etc ...	General survey on climate change
Household survey	20 - 40 heads of household per LMMA	Household-level data collection



Low vulnerability
Moderate vulnerability
High vulnerability





- Written questionnaire

Describe the impact of the following indicators on your livelihoods:

- Changes in rainfall patterns
- Sea level rise
- Air temperature variation
- Humidity changes
- Ocean acidification
- Shifts in ocean currents
- Extreme heat waves
- Periods of drought
- More frequent and intense cyclones
- Marine thermal anomalies

Indicator	Consequences
Changes in rainfall patterns Impacts in livelihoods	
Changes in sea level Impacts in livelihoods	
Changes in sea surface temperature Impacts in livelihoods	
Changes in wind patterns Impacts in livelihoods	



• Quantitative Questionnaire

What is the current number of people in your household? (please specify the number per age group and gender)			
Age	Man	Woman	Total
0 to 5 years max 5 taona ny farany			
6 to 14 years Manomboka 6 taona ary 14 taona ny farany			
15 to 65 years Manomboka 15 taona ary 65 taona ny farany			
65+ years Mihoatra ny 65 taona			
Total number of people in the household:			

• Single Choice Question

How much do you trust the following groups or instructions? (Select only one answer)					
Community members	Local leader	Marine management associations	NGOs	Businesses	Government authorities
	Zokiolona, Komitim-pokontany, chef campement, Ampanjaka		working in the community	simple or fishing	fokotany, mayor, district, delegate
☐ Not reliable	☐ Not reliable	☐ Not reliable	☐ Not reliable	☐ Not reliable	☐ Not reliable
☐	☐ Somewhat reliable	☐ Somewhat reliable	☐ Somewhat reliable	☐ Somewhat reliable	☐ Somewhat reliable
☐ Moderately reliable	☐ Moderately reliable	☐ Moderately reliable	☐ Moderately reliable	☐ Moderately reliable	☐ Moderately reliable
☐ reliable	☐ reliable	☐ reliable	☐ reliable	☐ reliable	☐ reliable
☐ Fully reliable	☐ Fully reliable	☐ Fully reliable	☐ Fully reliable	☐ Fully reliable	☐ Fully reliable



Household sources of income - Do you agree with the following statement?

It is not difficult for me to give up fishing and engage in land-based activities

If «YES», to what extent do you agree with this statement?

☐ ☐ ☐ ☐ ☐

Strongly disagree

Somewhat Disagree

Don't know

Somewhat agree

Strongly agree

- Please answer with date



Date and place

Date

YYYY - MM - DD

If you are fisherman, which marine resources do you depend on?

I don't mind giving up this activity

☐ Large fish

☐ Small fish

☐ Crab

☐ Octopus

☐ Shrimp

☐ Sea cucumbers

☐ Others

☐

☐

Which fishing tools or equipment does your household use?

Mark as applicable

☐ No canoe

☐ Non-motorized canoe

☐ Motorized canoe

☐ Others

☐

Which of these types of gear does your household use?

Mark as applicable

☐ Outrigger canoe

☐ Longline

☐ Trolling (line fishing)

☐ Net with mesh size over 2

☐ Net with mesh size under 2

☐ Mosquito net

☐ Gillnet

☐ Small mesh net

☐ Trap net

☐ Cast net

☐ Scoop net

☐ Hand line

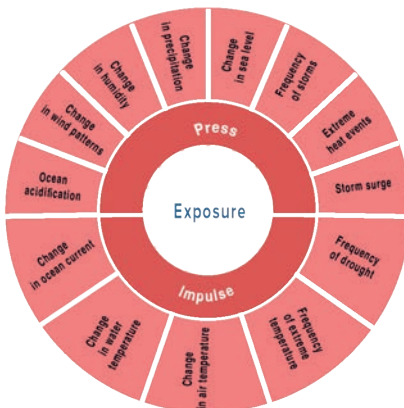
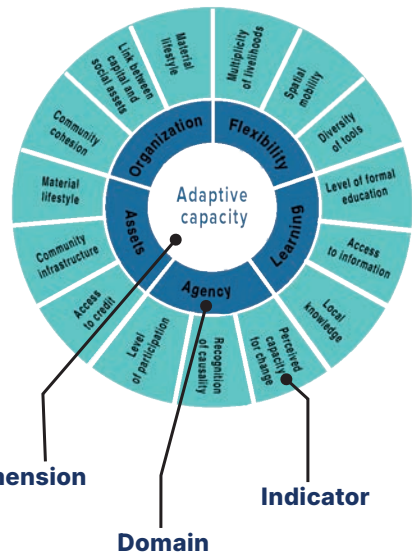
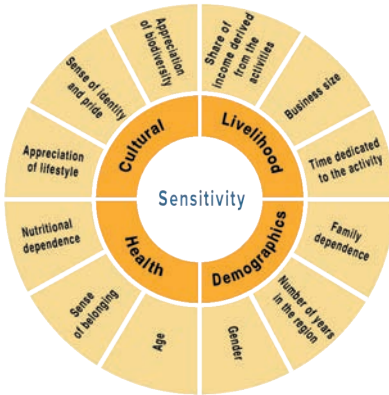
☐ Others

☐

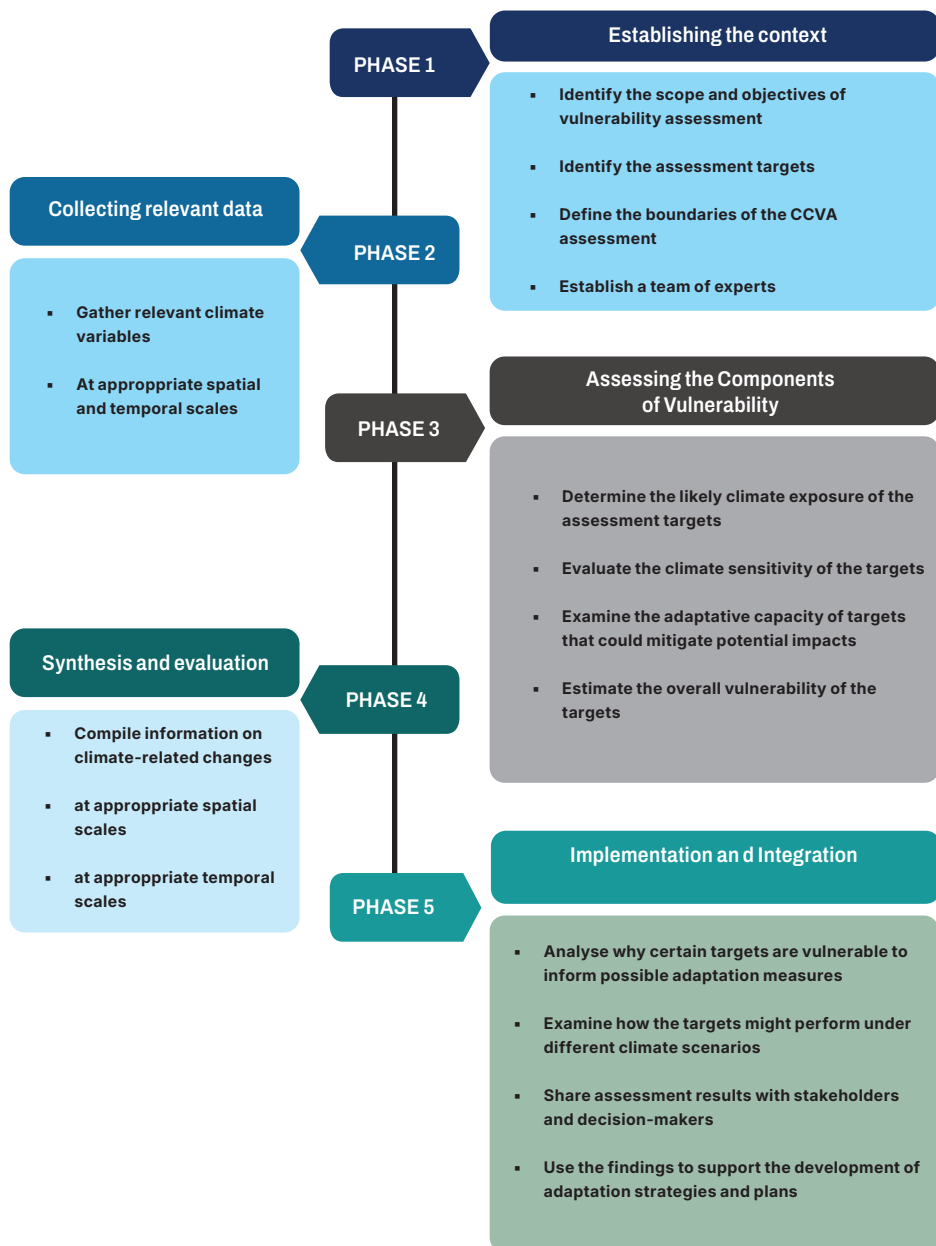
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- Three Dimensions of Vulnerability Framework



- Flowchart of the Five Phases of a CCVA Cycle and Steps for Conducting Robust, Context-Specific, and Policy-Relevant Vulnerability Assessments of Socio-Ecological Systems



MIHARI

Locally-Managed Marine Area - Madagascar Network

Created in 2012, MIHARI is Madagascar's national network of Locally Managed Marine Areas (LMMAs). It brings together more than **280 LMMA units** across **4 coastal regions of Madagascar**.

VISION

Marine and coastal resources are sustainably managed for the well-being of LMMA communities and future generations.

MISSION

To strengthen the LMMA network for the long-term management of marine areas by building community capacity, improving livelihoods, advocating for their interests, and facilitating knowledge sharing.

STRATEGIC FOCUS AREAS

- Advocacy for LMMA community rights
- Building the capacity of LMMA communities.
- Capacity building for LMMA communities
- Promotion of solidarity
- Conservation, restoration, and protection of natural resources
- Development of alternative income-generating activities

REGIONAL SUBDIVISION OF LMMAS IN MADAGASCAR

The MIHARI network operates in **10 of Madagascar's 13 coastal regions**. It is organized into **5 regional subdivisions**.





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Réseau MIHARI

