

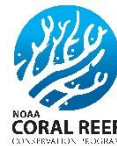
# SocMon/SEM-Pasifika for Climate Vulnerability Assessment

An addendum to the Global Coral Reef Monitoring Network (GCRMN)  
Socio-economic Manual for Coral Reef Management

Supin Wongbusarakum  
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THE UNIVERSITY  
OF THE  
WEST INDIES  
CAVE HILL CAMPUS  
BARBADOS, WEST INDIES



This addendum, *SocMon/SEM-Pasifika for Climate Vulnerability Assessment*, is an update to the Global Coral Reef Monitoring Network (GCRMN) Socio-economic Manual for Coral Reef Management (Bunce et al. 2000). These simple, user-friendly guidelines have been developed through the Centre for Resource Management and Environmental Studies (CERMES) at The University of the West Indies (UWI), Cave Hill Campus, Barbados, to assist coastal and marine resource practitioners and managers to apply social vulnerability assessments for understanding communities' vulnerability to and how they might plan to adapt to, changing climate. The guidelines complement the Global Coral Reef Monitoring Network (GCRMN) Socio-economic Manual for Coral Reef Management, the regional SocMon guidelines and 2011 Climate Change Indicators addendum, and should be used together with them when developing any socio-economic assessment or monitoring programme with focus on climate change vulnerability, impacts and adaptation.

#### Technical advice and guidance

The Global SocMon initiative ([www.socmon.org](http://www.socmon.org)) can provide technical advice, guidance and share experiences on the incorporation of SocMon/SEM-Pasifika into climate vulnerability assessments. Contact Peter Edwards at [peter.edwards@noaa.gov](mailto:peter.edwards@noaa.gov) for further information.

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#### Downloadable copies

Copies of *SocMon/SEM-Pasifika for Climate Vulnerability Assessment* can be downloaded from the global SocMon website ([www.socmon.org](http://www.socmon.org)).

#### Comments and feedback

Comments on this addendum and feedback on how it was applied would be most appreciated. Please send to Maria Pena at [maria.pena@cavehill.uwi.edu](mailto:maria.pena@cavehill.uwi.edu).

#### Author affiliation and contact information

Supin Wongbusarakum: Sustaining Nature, Honolulu, Hawai'i 96816, USA.

[supinw@gmail.com](mailto:supinw@gmail.com)

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## PURPOSE AND TARGET READERS

This addendum intends to serve the original objective of SocMon/SEM-Pasifika to improve site management of coastal and marine areas by providing simple, user-friendly guidelines. It is based on a 2011 guideline titled, *Indicators to assess community-level social vulnerability to climate change: An addendum to SocMon and SEM-Pasifika regional socioeconomic monitoring guidelines* (Wongbusarakum and Loper 2011) and selected recent literature that extensively reviewed publications on social adaptive capacity (e.g. Cinner et al. 2018; Whitney et al. 2017; IPCC 2014). The fields of climate vulnerability assessment and social adaptive capacity assessment are growing quickly, resulting in a diversity of assessment tools and frameworks (Whitney et al. 2017). This addendum does not intend to provide a comprehensive summary of these tools or frameworks, but to provide succinct information on the main social components of climate vulnerability, a small set of possible socioeconomic indicators for social vulnerability assessment to climate change, and some examples of how related data may be collected and used in management.

The intended main audience for this document includes coastal managers, governmental and non-governmental staff for coastal conservation and community development, researchers, and community facilitators or members who are interested in and able to conduct socioeconomic assessments to help understand a community's vulnerability to changing climate, and how it might plan to adapt.

## BACKGROUND

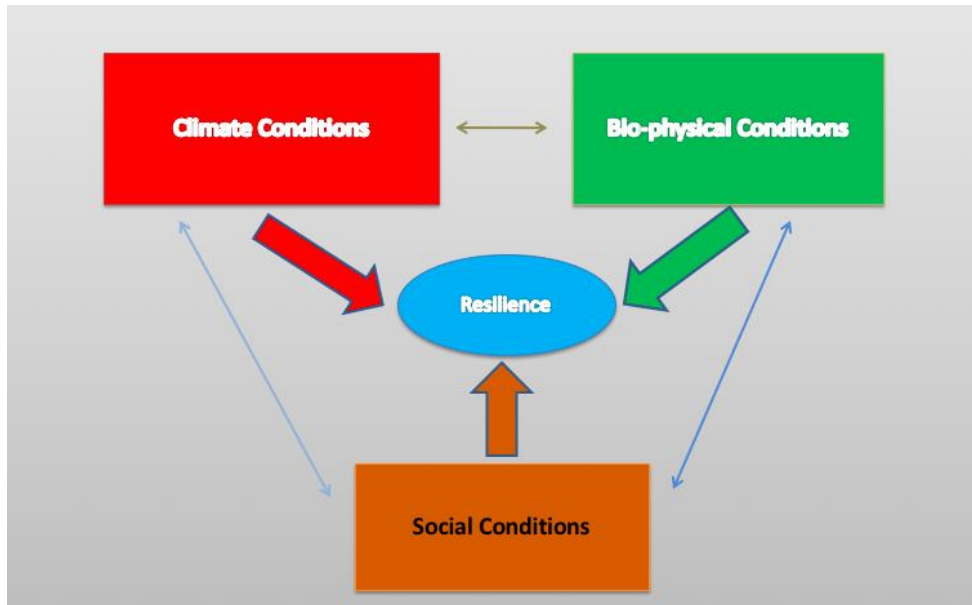
Climate is changing and impacting coastal communities. Projections point to large, potentially dramatic changes that are likely in this century (IPCC 2014). It has become evident over the last decade that many coastal and island sites are increasingly experiencing serious climate-related events and impacts. The last 30 years have been the warmest in the last 800 years in the Northern Hemisphere, while warming of the ocean has averaged 0.11°C per decade between 1971–2010 (IPCC 2014). Since 1980, 58% of severe climate-driven bleaching events have been recorded during four strong El Niño periods (1982–1983, 1997–1998, 2009–2010, and 2015–2016) with the remaining 42% occurring during hot summers in other El Niño–Southern Oscillation (ENSO) phases (Hughes et al. 2018). Additionally, about 70% of coastlines worldwide are projected to experience sea level change within +/- 20% of the global mean, which is expected to be higher than today in the range of 40 – 75 cm (Widlansky et al. 2015; IPCC 2014). Climate impacts may be slow and gradual in nature, such as sea level rise, shoreline change, sea and air surface temperature rise, ocean acidification, and shifts in species' abundance, migration patterns and seasonal activities. However, climate impacts can also be acute and sudden, such as mass coral bleaching, typhoons, floods, droughts, and coastal inundation following king tides or high surge events.

Changes in biophysical systems are having impacts that cascade through ecosystems, ultimately affecting nature's ability to provide the goods and services on which coastal communities depend. Social systems and sectors that depend on the marine environment and resources have

to adapt to changes, ranging from the shifts in geographical distribution and productivity of important fishery species, to potential losses in the tourism value (recreation and aesthetic) of important marine habitats such as coral reefs and beaches, to reduced effectiveness of protective features such as barrier reefs and mangrove forests, and to declined resources that are critical for cultural values and traditional practices (IPCC 2014; Poloczanska et al 2013). A wide range of social dimensions of coastal communities are being affected, including natural resource dependent livelihoods and industries (e.g. fisheries and aquaculture), food security, safety of lives and property, public health, connections with place, cultural heritage, and sense of identity. Probably the greatest challenges from a changing climate are those faced by people who have livelihoods closely linked to the health of the marine environment, who are nutritionally dependent on access to marine resources, or who live by the coast and are directly affected by a combination of sea-level rise and extreme weather events (Allison and Bassett 2015). Ten percent of world's population relies heavily for income from fisheries and aquaculture (FAO 2016a; Allison and Bassett 2015). Many of those are small-scale fishers' dependent on coastal and marine resources. Many of these are women, who are engaged in post-harvest activities (Hijioka et al. 2014).

#### **WHY ASSESS SOCIAL VULNERABILITY?**

Coastal managers worldwide have begun to address climate-related issues and impacts and now widely recognize the importance of building social-ecological resilience to changing climate (Figure 1). Understanding social conditions and their changes is equally important in climate and vulnerability assessments as is knowledge of climate conditions and climate change impacts that is focused mainly on biological, physical, and environmental aspects. While climate change has such encompassing impacts on the social, cultural, and economic dimensions of coastal communities, the vulnerability and adaptive capacity of such communities are under-investigated (Béné et al. 2016; Allison and Bassett 2015). Better understanding climate impacts on human dimensions can supplement the socioeconomic knowledge gained from regular SocMon/SEM-Pasifika based monitoring and ensure that coastal management strategies and activities are sufficiently well-informed to effectively cope with and prepare holistically for consequences of the changing climate. In most cases, the resilience of ecosystems and human systems are interdependent: building resilience in one will increase it in the other. The relationship of people to impacted physical environments and ecosystems and their capacities for coping with and adjusting to new situations play a fundamental role in their level of vulnerability to climate events and impacts. Armed with good knowledge about the nature of these linkages and the implications of different management options, coastal resource managers and community leaders have the best chance of identifying strategies that improve ecosystem resilience without exacerbating social vulnerability or maladaptation.



**Figure 1: Factors impacting social-ecological resilience to changing climate**

From a social science perspective, a better understanding of the social vulnerabilities associated with climate change impacts on coastal communities would include:

- people’s knowledge and perceptions of climate impacts on coastal and marine habitats and resources, and on their own well-being;
- level of their dependence on the impacted resources, their strategies for adapting to changes; and
- their support for resource management and/or adaptation policies.

Social sciences (including sociology, anthropology, political science, and economics) can contribute to understanding human and social dimensions of environmental issues (Bennett et al., 2017). They are also useful in facilitating dialogues about possible responses to a changing climate in different social, cultural, and political settings (Allison and Bassett 2015).

**Understanding social vulnerability to climate change**

“Understanding and mapping the linkages between social and ecological systems can be complex, but even a basic understanding of social vulnerability and its drivers can substantively inform future planning for coastal and marine management. Conventional vulnerability assessments have focused mainly on biological, physical, and environmental aspects. But the relationship of people to impacted physical environments and ecosystems and their capacity to cope with and adjust to the new situation play a fundamental role in the level of vulnerability to climate events and impacts. In other words, communities with varying capacity to respond to climate events will likely yield different levels of vulnerability. It is therefore important that biophysical and socioeconomic assessments be integrated and complement each other, to provide a holistic understanding of vulnerability to climate change.”

**Source:** Wongbusarakum and Loper (2011).

## DEFINING TERMS IN SOCIAL VULNERABILITY ASSESSMENT

The vulnerability framework recommended in much climate literature (including Marshall et al. 2010; USAID 2009; Turner 2003) covers three main factors: exposure, sensitivity, and adaptive capacity. These collectively determine the level of vulnerability to climate change impacts. Adger (2006) defines vulnerability as “the state of susceptibility to harm from exposure to stresses associated with environmental and social change and from the absence of capacity to adapt”. The human dimension, which is the focus of this addendum, is gathered to provide better understanding of the *social* aspects of exposure, sensitivity, and adaptive capacity of the assessed community.

In a social context, the following terms are defined as follows:

**Exposure** usually refers to the “product of physical exposure to natural hazards” (Moser 2009). Applying this definition socially, exposure is the extent to which a community, or parts of the community, comes into contact with climate events or specific climate impacts. Specifically, this includes who is most exposed in areas of residency and resource use that are subject to different climate events and impacts. For example, families and houses near the high-water mark may have high exposure to rising sea levels. Coastal sago palm plantations or near-shore taro patches may have high exposure to salt-water intrusion and inundation. Shallow reefs, habitats that coastal communities depend upon for their livelihoods, that are subject to full sun in areas of low wind may have high exposure to increases in sea surface temperature and be impacted by coral bleaching.

**Sensitivity** is the degree to which a community is negatively affected by changes in climate events and impacts. Sensitivity is largely determined by the condition of the resources people are dependent on, and by the degree of dependency on those resources. For example, communities with more intact habitats (e.g. reefs) are more like to be less sensitive than those with degraded one. Additionally, the more a community is dependent on a resource, and the worse the condition of the resource, the more sensitive the community will be. If exposed reefs are the main areas of fishing and marine tourism that provide food and income for a community, that community is highly sensitive to the mass coral bleaching that results from a rise in sea surface temperature.

While *exposure* and *sensitivity* determine the potential impact of a climate-induced change and can partly be examined through biophysical monitoring, the perceptions of communities on both, especially at a local scale or in areas where there is lack of adequate down-scaled biophysical data, could help identify who within the communities or to what and where they may be more exposed or sensitive to climate hazards.

**Adaptive capacity** refers to the potential or capability of a community to adjust to damage, take advantage of opportunities, or to respond to the consequences (adapted from IPCC 2014:118). Frameworks for social adaptive capacity have increasingly received attention as a critical factor in determining vulnerability (Cinner et al., 2018; Whitney et al. 2017; Cinner et al. 2015; IPCC 2014). Adaptive capacity has been recognized as challenging to assess and under-researched (Engle 2011) due to being both complex and multi-faceted. It may be influenced strongly by a

few key characteristics, or by a wide range of social characteristics. Examples include a community's sociocultural, economic, and political conditions; availability and access to resources; individual and communal capacities; knowledge and innovations; barriers to adaptation; relevant governance and institutional arrangements; and the ability of people to act on what they value (Cinner et al., 2018; Whitney et al. 2017). For example, a well-informed village with a strong traditional leader who is able to develop good plans and make decisions that help and involve all members of the community to respond to climate events will likely show high adaptive capacity. A household that has diversified sources of income and supplementary livelihood options and access to different types of assets and resources will likely have higher adaptive capacity to impacts of climate change than those that do not.

The complexity of social adaptive capacity requires us to take into consideration different social characteristics of individuals, households, and communities simultaneously. Information related to social adaptive capacity is highly useful, moreover, because it helps determine the vulnerability of people to climate change, and thus provides guidance on what really needs to be addressed in development planning and implementation to ensure that strategic adaptation considerations are well integrated. An understanding of social adaptive capacity is crucial to avoiding the negative impacts of poorly planned activities that may sometimes worsen impacts on those who are most vulnerable.

Effective adaptation thus needs to improve and **enhance adaptive capacity** while **decreasing exposure and sensitivity** to climate events and impacts.

## CLIMATE-RELATED SOCIOECONOMIC INDICATORS

Indicators in this addendum are related to each of the above components: exposure, sensitivity, and adaptive capacity (Table 1). Because they are not exhaustive, it is important for the users of this guide to determine which are relevant to their context and whether there might be additional indicators that should be monitored. Social vulnerability can be assessed at different scales, ranging from households, villages, municipalities (cross communities or ecosystems), national or regional levels (Whitney et al. 2017). It is important that the indicators selected or developed are robust and applicable to the scale that will have meaningful policy and management applications (Adger and Vincent 2005 in Whitney et al. 2017). Input from local communities on most relevant indicators should always be sought and integrated to ensure the validity of adaptive capacity assessment findings (McLeod et al. 2016).

Users of these guidelines are also encouraged to always revisit the indicators in the main SocMon or SEM-Pasifika, as several of them can also help assess different factors of climate vulnerability. For instance, *location of coastal and marine activities* is an existing SocMon/SEM--Pasifika indicator that provides information on **exposure** to climate events and impacts, as it identifies the areas where livelihood activities take place. In another example, the existing indicator *perceived condition of resources* is closely related to the **sensitivity** factor of vulnerability, as it provides information on what people think about the conditions of the natural resources on which they depend. Monitoring perceived condition of resources can also point to trends and changes in these resources, as well as revealing non-climate and cumulative impacts on these



resources that need to be taken into consideration to address additional climate threats. Several other existing indicators in the management /governance and stakeholder sections of SocMon and SEM-Pasifika may be revised to address local climate change issues at the community level as well.

**Table 1: Social indicators for climate vulnerability assessment**

Indicator categories (literature)	Example of variables	How information might be used
<b>EXPOSURE (E)</b> <b>Purpose:</b> <ul style="list-style-type: none"> <li>Understand types and levels of perceived impacts of different climate events on coastal households and communities</li> <li>Prioritize adaptation efforts to address the groups of people, activities and infrastructure that are most threatened by climate impacts and events</li> </ul>		
<b>E1. Perceived climate change impacts</b> <i>(Wongbusarakum &amp; Loper 2011; McLeod et al. 2015)</i>	<ul style="list-style-type: none"> <li>Perceived climate impacts on communities, resources, livelihood types and activities, community infrastructure</li> </ul>	Understand specific impacts and their levels on different components
<b>E2. Vulnerable groups to climate impacts and threats</b> <i>(Wongbusarakum and Loper 2011; Jepson &amp; Colburn, 2013)</i>	<ul style="list-style-type: none"> <li>Proportion of vulnerable demographic groups, including socially or economically marginalized groups</li> <li>Proportion of vulnerable groups in high risk/impact areas (e.g. household living or conducting livelihoods in the areas)</li> </ul>	Identify who may need the most attention/assistance in climate change adaptation
<b>SENSITIVITY (IES)</b> <b>Purpose:</b> Understand levels of negative effects on social-ecological systems by changes in climate events and impacts		
<b>S1. Dependence on coastal and marine resources</b> <i>(Wongbusarakum and Loper 2011; Jepson and Colburn 2013)</i>	<ul style="list-style-type: none"> <li>Types and levels of ecosystem services</li> <li>Proportion of households with livelihoods (income and subsistence) dependent on impacted/threatened resources</li> <li>Types of industries dependent on impacted/threatened resources</li> <li>Proportion of those with cultural connection, sense of place, or sense of identity</li> </ul>	<ul style="list-style-type: none"> <li>Identify livelihoods, economic, and security sensitivity to climate threats</li> <li>Prepare for impacts on changed ecosystem services and how human well-being may be affected (e.g. livelihood alternatives)</li> </ul>
<b>S2. Perceived resource conditions, habitat health, and ecological health</b> <i>(Wongbusarakum &amp; Pomeroy 2008)</i>	Perceived conditions of key resources coastal households depend on	<ul style="list-style-type: none"> <li>Provide information on natural resource condition and ability to absorb impacts</li> <li>When considered with exposure, understand ecological vulnerability</li> </ul>
<b>ADAPTIVE CAPACITY (A)</b> Understand potential or capability of a community to respond and adjust to impacts of changing climate		

<p><b>A1. Diversity and flexibility</b>  <i>(Wongbusarakum and Loper 2011; Allison &amp; Ellis 2001; Whitney et al 2017; Kalikoski 2010; Cinner 2012; Cinner 2013; Cinner et al 2018)</i></p>	<ul style="list-style-type: none"> <li>• Livelihood/occupational diversity/ multiplicity (e.g. current livelihood structures, income diversity of household, economic opportunities)</li> <li>• Alternative and supplementary livelihoods</li> <li>• Occupational mobility (e.g. changes of employment/livelihoods within last 5 years; perceived availability of and willingness to take on or move to new occupations or alternative livelihoods)</li> <li>• Diversity of livelihood methods/gears/technology/locations</li> <li>• Place attachment</li> <li>• Migration patterns</li> <li>• Willingness to change</li> <li>• Flexibility to change strategies</li> </ul>	<p>Identify current and future possibilities and needed resources (especially for livelihoods) for adaptation to climate change or other exogenous shocks</p>
<p><b>A2. Learning and knowledge</b>  <i>(Wongbusarakum and Loper 2011; Whitney et al 2017; Cinner 2018; McLeod et al 2015; Kalikoski 2010; Cinner 2012; Gomez-Baggethun, et al. 2012; Berkes, et al 2016)</i></p>	<ul style="list-style-type: none"> <li>• Knowledge and perception of climate hazards</li> <li>• Access to, and use of, climate-related knowledge</li> <li>• Information sources</li> <li>• Knowledge, practices, tactics and mechanisms used to anticipate, respond or adapt to climate impacts, and effectiveness of these elements</li> <li>• Perceived solutions</li> <li>• Recognition of causality and human agency</li> <li>• Capacity to generate, absorb, and process new information about climate change, adaptation options, and ways to live with and manage uncertainty</li> <li>• Ability to recognize and respond to change</li> <li>• Traditional or local and current practices among community members and fishers to respond to climate impacts and other stressors.</li> <li>• Intergenerational learning capacity</li> <li>• Innovation</li> </ul>	<ul style="list-style-type: none"> <li>• Make use of existing knowledge (traditional, local, scientific) and means of knowledge transmission</li> <li>• Identify current and possible uses of climate information Tailor types of outreach and education program to address climate hazards</li> <li>• Fill gaps in informational content, communication tools, learning approaches, and networks</li> </ul>
<p><b>A3. Leadership, governance and institutions</b>  <i>(Wongbusarakum and Loper 2011; Whitney et al 2017; Portela et al. 2012; Wongbusarakum &amp; Pomeroy 2008; McLeod et al 2015)</i></p>	<ul style="list-style-type: none"> <li>• Presence of and access to institutions that support risk management and adaptation</li> <li>• Effectiveness of community leaders in addressing climate hazards and adaptation planning</li> <li>• Effectiveness of coastal management in achieving environmental and social goals (including policies, tools, rules and regulations, enforcement)</li> <li>• Levels of participation and quality of decision-making processes</li> <li>• Accountability of managers and governance bodies</li> </ul>	<ul style="list-style-type: none"> <li>• Understand strengths, weaknesses, opportunities, effectiveness and gaps of governance, leadership and institutions in natural resources (esp. fisheries) and climate adaptation</li> <li>• Utilize local support from community leaders in adaptation work</li> <li>• Understand level of stakeholder participation in management and decision-making</li> </ul>

<p><b>A4. Availability and access to resources/assets/capitals</b>  <i>(Whitney et al 2017; Kalikoski 2010; Cinner 2013; Cinner 2018; Pollnac &amp; Crawford 2000; IPCC 2007; Himes-Cornell and Kasperski 2014; Wongbusarakum and Loper 2011</i></p>	<ul style="list-style-type: none"> <li>• Presence of material assets/possessions (e.g. general household material assets and fishery specific, e.g., boats, gear)</li> <li>• Human capital (knowledge, skill)</li> <li>• Financial capital (money, sources of credits)</li> <li>• Natural capital</li> <li>• Social capital <ul style="list-style-type: none"> <li>○ Levels of trust</li> <li>○ Social cohesion or Ability to act collectively</li> <li>○ Social networks</li> <li>○ Gender and race relations</li> </ul> </li> <li>• Physical capital (infrastructure, housing, tools and technology, energy and water supplies, markets)</li> </ul>	<ul style="list-style-type: none"> <li>• Understand types and levels, and gaps of resources/assets/capitals needed for adaptation and levels of access to them</li> <li>• Indicate overall level of community adaptation (higher equity = higher adaptive capacity)</li> <li>• Identify potential networks to serve as conduit for climate-related information and assistance</li> <li>• Collaborate with existing networks that might support adaptation and planning</li> </ul>
<p><b>A5. Determining agency</b>  <i>(Cinner 2018; Brooks, Adger &amp; Kelly 2005; Kalikoski 2010; Thompkins et al 2005; Wongbusarakum &amp; Loper 2011; Anderson &amp; Wongbusarakum 2011</i></p>	<ul style="list-style-type: none"> <li>• Agency to determine whether to change or not to change</li> <li>• Capacity to anticipate change and develop response strategies. Response of fishers to a hypothetical 50% decline in catches due to climate-related stress</li> <li>• Capacity to plan, learn, change and reorganize in response to climate hazards (similar to one in learning and knowledge)</li> <li>• Ability of community to (self) (re)organize</li> </ul>	<ul style="list-style-type: none"> <li>• Better understand (and as a reminder) how (social and cultural) local values drive decisions on changes and</li> <li>• Take into consideration and incorporate local knowledge and practices in planning and management</li> <li>• Understand the degree to which community is able and willing to reorganize and restructure in the face of impacts</li> <li>• Determine level of self-reliance within a community</li> <li>• Identify areas that need to be strengthened for adaptation work, including empowering people and removing barriers</li> </ul>

**Indicators examples**

This section of the document intends to provide examples for selected variables in Table 1, clarifying the ways related data can be collected and how the information might be used for coastal management and climate adaptation. Most of the examples came from actual climate-related socioeconomic assessments in the Pacific island region in the recent years. The indicators, choices of answers, and data collecting methods should be modified to the management site so that they are relevant to, and appropriate for, the specific context, scale of the impact, and scale of analysis that would be useful for coastal management.

## E1. Perceived climate change impacts

This indicator helps coastal management understand household perceptions of the types and degree of impacts associated with the different climate-related events. The knowledge not only allows coastal management to prioritize their actions, but also to help provide information that may be needed for the communities to better respond to certain current impacts and prepare for future ones. While oceanographic and biophysical monitoring are tracking these changes, the perceptions of local communities can help in localizing the impacts when other data types do not provide the degree of resolution needed for effective local management.

### Examples of survey questions:

1. Please rate the degree of severity to which each of these impacts relate to your households. Choices are: 0 = no impact, 1 = very low, 2 = low, 3 = moderate, 4 = high, 5 = very high.

Activities and events	0. No impact	1. Very low	2. Low	3. Moderate	4. High	5. Very high	Don't know
<b>Climate impacts</b>							
Typhoon/storm							
Coastal/shoreline erosion							
Sea level rise							
Low tide event							
Seawater getting warmer							
Coral bleaching							
Changes in ocean chemistry that makes coral weaker and hard to grow							
Changes in rainfall patterns resulting in increased sedimentation							
Drought/ Shortage of fresh water							

2. Have the following been impacted by climate hazards?

	Yes or no	By what type of hazard	What is the severity level? Please rate using 1= mild, 2 = moderate, or 3 = significant
Location of your home			
Location of your livelihood activities			
Jetty			
Coastal roads			
Fish landing sites			

	Yes or no	By what type of hazard	What is the severity level? Please rate using 1= mild, 2 = moderate, or 3 = significant
Water reservoir			
Community center			

**E2. Vulnerable groups to climate impacts and threats**

Different groups in the same community or region may experience different levels of vulnerability to changing climate. *Demographically vulnerable groups* are those that, because of their particular demographic or socioeconomic characteristics, are more vulnerable than others in the broader community. Particular demographic characteristics (e.g. household size, migration status, income level, education and literacy levels) may result in varying levels of exposure to certain types of climate hazards, how sensitive people are to hazards (e.g. age, health condition, occupation, or dependency on impacted resources), and their adaptive capacities (e.g. attitudes and knowledge, skills, access to assets, social affiliation, and willingness and ability to change). There might be groups of households or communities in hazard-prone geographical areas due the locations of their homes and their livelihood activities. Community facilities and infrastructure can also be exposed to different climate events. In many societies, gender issues and understanding of different levels of impacts by climate change and natural disasters among men, women and other groups are critical to help design and implement climate strategies, policies, and projects (UNFCC, n.d.; UNDP 2011).

Key informants can be interviewed to determine which segments of the population may be most at risk to different types of climate events, where they are, and how to reduce those risks. The informants might include community leaders, representatives from certain demographic groups (such as women, elders, and ethnic groups), representatives of occupational groups (fishers, tourism businesses, farmers), and those who serve the community in certain capacities (such as health care workers, utility service providers, directors of emergency relief organizations, church leaders). Existing secondary sources can also be used, such as government census and existing demographic reports, to get information on the relative proportion of vulnerable groups within the community.

The information helps point out groups that may be more vulnerable, and are generally less able to prepare, respond to, or adapt to climate hazards. Particular adaptive capacities of these groups should be taken into consideration. Often the factors that keep people economically and socially marginally keep them vulnerable (Cinner et al. 2018), so addressing root causes may support adaptive capacity. These groups may include migrated families who may not understand the local language and lack local social support networks, people with economic hardships and limited access to resources, or certain ethnic groups. Existing demographic information, such as those from census, may help understand levels of literacy, education, sex, and age in developing more appropriate types of outreach and methods of informing respective groups about climate and risks. Information on occupations and education levels could be useful for developing programs that enhance adaptive capacity, such as alternative livelihood training. In other communities,

high outmigration of young people could be an indicator of few acceptable or available livelihood options, which could alert decision and policy makers to develop programs to address this issue.

**Examples of survey questions:**

1. How long have you lived in the community where you now reside? \_\_\_\_\_ years
2. How many people in your household cannot read or write? \_\_\_\_\_
3. How many people in your household are in poor health or require special needs? \_\_\_\_\_
4. Compared with other families in your community, how would you rate the economic status of your household?
5. \_\_\_\_\_ Below average                      \_\_\_\_\_ Average                      \_\_\_\_\_ Above average
6. Does your household have access to the following?

<b>Back-up for basic necessity and infrastructure</b>	<b>Yes or no</b>
1. Back-up for electricity	
2. Back-up for drinking water	
3. Tools to catch or grow food	
4. Land vehicles	
5. Boat/canoe	
6. Radio	
7. Telephone	
8. Internet access	
9. First-aid kits	
10. Access to shelter	
11. Access to health care	

## S1: Dependence on coastal and marine resources

*Dependence on coastal and marine resources* is the extent to which households are dependent on coastal and marine resources for different goods and services. This information affords insight into the importance of different ecosystems and resources to the community in terms of food security and income, social and cultural practices, physical protection, and other services. In recent literature (e.g. Cinner et al., 2016), high dependency on coastal resources, in combination with a few other factors, has been shown to contribute to places where ecosystems are substantially better. Cross-referenced with information on resource conditions, this information can also be used to identify threats and possible negative impacts to particular resources on which a community depends heavily. When cross-referenced with information on livelihood alternatives, it can help managers understand the range of possibilities and the limitations of a diversified economic structure at the site, and thus assist in developing realistic scenarios for mitigating problems related to food and income security. For example, if a household's sources of protein and cash income are primarily dependent on fishing and harvesting in reef areas, the impacts of mass coral bleaching or other forms of reef degradation are likely to threaten its food security and income source. Alerted to this, managers may begin working toward adaptation strategies that support alternative livelihoods that are not reef-dependent.

Relevant Different data collection methods to help identify the types of resources and services vulnerable to climate change may include:

- **Community mapping:** Community members are invited to create maps that show (1) the types and location of natural resources that they depend upon, (2) community infrastructure and services, (3) areas where key social and economic activities take place, and (4) areas impacted or threatened by climate hazards (see Rambaldi 2010).
- **Seasonal calendar:** Community members or representatives of occupational groups are invited to review annual seasons and climate events (e.g. rainy/dry season) and associated uses of natural resources and social activities (e.g. traditional ceremonies or local customs). This can provide an understanding of potential social and natural impacts from changes in seasonal events, and how to prepare to deal with them.
- Having identified the resources and services that are vulnerable to climate hazards, ask **key informants** to identify the major activities conducted by households in the area (i.e., fisheries, tourism, aquaculture, etc.). Then ask them to estimate the percentage of each good and service produced that is used for personal consumption or income generation. Ask key informants also about the importance of ecosystems that may provide physical protection to the community (e.g., reefs and mangroves).
- A **household survey** can be used to list resources, related goods and services, and percentage of dependency in terms of both personal consumption and income generation. The importance of cultural values and the services and physical protection provided by the ecosystem can also be recorded.

**Examples of household survey questions**

1. From the list below, please select the ones that you and other household members depend on for food or income and fill out how many adult males and females in your household depend on these activities to make a living.

Possible activities for a household to make a living	Q9 Check	Q10 Number males	Q10 Number females
Fishing			
Harvesting other seafood besides fish			
Farming, including livestock			
Handicrafts			
Food stands			
Salary from employment with governments			
Income from employment in tourism			
Income from other businesses/sources, please specify _____			
Private business owners – stores			
Remittances (money from relatives who live off island)			
Food exchange within community or family			
Public assistance for food or housing			
Pension/social security			
Others, please specify _____			

2. Which are the 3 most important income sources for your entire household (not just yourself)?

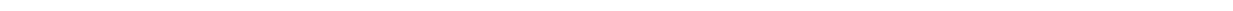
1<sup>st</sup> most important \_\_\_\_\_

2<sup>nd</sup> most important \_\_\_\_\_

3<sup>rd</sup> most important \_\_\_\_\_

3. Is the number one most important livelihood activity above being negatively impacted by any big climate-related threat in the past 5 years?  Yes  No

If yes, what is the most important threat?





4. Does your family own land where you can grow crops or raise livestock for household consumption or sale?

- Yes  No

If not, do you have access to land where you can grow crops or raise livestock for household consumption or sale?

- Yes  No

5. If you were not able to do your current job or livelihood, what would you do for food and income?

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## S2. Perceived resource conditions

Perceived resource conditions refer to perception of current status of the selected resources that are important economically, socially, or culturally to the communities. Where biological or physical monitoring data exist, the different data sets can be used to compare and complement each other and help identify the both management actions and outreach and educational needs. It is important to keep in mind that many resources are impacted or threatened not only by climate, but also by man-made causes such as pollution, sedimentation, overfishing, destructive fishing methods, and coastal development. In areas where such non-climate factors are present, the cumulative impacts need to be taken into consideration as well.

Different data collecting methods may be use, including:

- **Secondary sources:** scientific reports on climate change, impacts and threats, and states of local resources such as coral reefs, beaches and coasts, crops, and forests.
- **Physical and biological assessments and monitoring:** This data can provide an understanding of physical resources, current biological conditions, and changes. It can also help identify climate-related problems and threats to physical areas, species, and ecosystems.
- **Key informants,** particularly with those who have intimate relationships with coastal and marine resources, such as fishers and those who are involved in marine tourism activities.
- **Survey** for the household members or special groups who fish or harvest marine resources to rate their perception of different resources they use or have knowledge about.

### *Example of survey questions*

1. In your opinion, how is [each of the following natural resources] currently doing? You have choices of 1 very bad, 2 bad, 3 neither bad nor good, 4 good, 5 very good, or “Don’t know”.
2. How would you say the condition of [each of the following] has changed over the last 10 years?  
You have choices of 1 = a lot worse, 2 = slightly worse, 3 = no change, 4 = slightly better, 5 = a lot better, or “Don’t know”.

Resources	Q1 Current Condition (1-5)	Don't know	Q2 Change in condition over last 10 years (1-5)	Don't know
1. Ocean water quality (clean and clear)				
2. Coral reefs				
3. Upland forests				

	Q1 Current Condition (1-5)	Don't know	Q2 Change in condition over last 10 years (1-5)	Don't know
<b>Resources</b>				
4. Mangroves				
5. Seagrass				
6. Beaches/Shoreline				
7. Size of fish in general				
8. Amount of fish in general				
9. Groupers (Serranidae spp.)				
10. Humphead Wrasse ( <i>Cheilinus undulatus</i> )				
11. Bumphead Parrotfish ( <i>Bolbometopon muricatum</i> )				
12. Bluespine unicornfish ( <i>Naso unicornis</i> )				
13. Jacks (e.g. <i>caranx melampygus</i> )				
14. Sharks				
15. Tunas				
16. Oysters				
17. Giant Clams				
18. Turtles				
19. Trochus				
20. Sea cucumbers				
21. Octopus				

## A1 Diversity and flexibility

Occupational or livelihood diversity or multiplicity examines the number of types of occupations and livelihood activities a household engages in to support subsistence and generate income. *Livelihood* is “made up of the capabilities, activities and assets (including both material and social resources) that contribute to a means of living” (Carney 1998). This information provides an understanding of both household and community level vulnerability, and is useful for livelihood development and intervention. Households that rely on a single economic sector for their livelihood (e.g. tourism or fishery) may be more vulnerable to climate impacts than those that have a more diversified economy, especially if they are highly dependent on sensitive resources. Damaged or degraded resources could make it difficult to recover from an impact. Diverse income sources may also indicate higher willingness to change occupations in the face of hazards or other impacts. For example, research has shown that households with higher numbers of income sources are more likely to leave declining fisheries than those with fewer income sources (Cinner et al. 2009).

In the context of uncertainty related to changing climate and other major disturbances, the importance of alternative and supplementary livelihoods and their sustainability are becoming more important. *Alternative livelihoods* are activities that household members could engage in to support their families if they were no longer able to pursue their current livelihood. *Supplementary livelihoods* are activities that might add to existing livelihoods. A livelihood is considered sustainable when “it can cope with and recover from stresses and shocks and maintain or enhance its capabilities and assets both now and in the future, while not undermining the natural resource base” (Carney 1998). Sustainable livelihood frameworks cover social, natural, financial, human and physical capitals (IMM 2008; Benson and Twigg 2007). The less sustainable a household’s current livelihood is due to the climate impacts, the more important it is to develop alternative and supplementary livelihoods. Understanding households’ perceived livelihood options can greatly inform adaptation strategies that may make use of household’s means, knowledge, and capabilities; or creating enabling conditions and giving access to needed resources.

Research has shown that the availability of alternative livelihoods seems to lower perceived vulnerability and increase perceived resilience; households with alternative livelihoods do not rate their vulnerability to extreme events as highly as those without (Wongbusarakum 2010). An understanding of available alternative and supplementary livelihoods can also assist managers in designing new management and adaptation strategies so that new livelihoods can be developed and existing ones enhanced. The gathered information can also point to the types of training and capacity needed, which might be useful for designing a livelihood program that can help reduce pressures on impacted coastal resources by using more resilient or untapped resources. A community’s more vulnerable demographic groups might be better supported to achieve alternative or supplemental livelihoods.

*Livelihood diversification* might be a critical adaptation strategy to climate change impacts. It focuses on the process of creating diverse livelihood strategies, and on related opportunities and challenges. Related factors might include level of attachment to one’s profession, skill level, interest and willingness to change occupation or residence, availability of access to resources

that would help create new livelihoods, economic opportunities (availability of demand, and access to market), and sociocultural norms (e.g. those related to gender and age groups), that may support or inhibit livelihood diversification, local customs related to resource access and tenures, and social relations.

Several data collection methods can be used as follows.

- **Household survey.** Before developing the survey, consult with local residents who are knowledgeable about the range of livelihoods in the area, and include these choices in the instrument. The respondent might be the head of household or another member who knows about the types of livelihood pursued by each household member. Conduct a household survey in which respondents are asked to identify possible alternative and supplementary livelihoods for their household, and (optionally) why each alternative livelihood was selected.
- Data collecting methods, such as **seasonal calendar** and **key informant interviewing**, can provide in-depth information about livelihood diversification strategy in the community. The information is useful for identifying changes in normal seasonal patterns that may be associated with climate change, and to consider the impacts of future climate scenarios on seasonal events. It can also provide insight into how resources can best be managed, and what type of adaptation should be planned with seasonal limitations and opportunities taken into consideration. Record any stories or anecdotes that illustrate why family members are or are not engaged in certain livelihood activities. Find out from key informants whether the livelihood options are seasonal, temporary, or potentially long-term. Also, ask key informants whether there might be potential livelihood options at the community level of which households are not yet aware (such as a sustainable aquaculture project under development, or a government project on aqua or mariculture). Summarize the requirements, opportunities, and constraints of each livelihood option and its potential sustainability.

For example, in a coastal or island community, it is not uncommon for some younger adults to be engaged in seasonal employment outside the village to earn cash income—in a city, for example. A seasonal calendar can provide a visual timeline that gathers information about when certain weather patterns normally occur, and what seasonal events (fruiting season, tourism season, spawning aggregations) are associated with specific times of year. It can also provide information on such local practices as seasonal closures for certain species (see examples of participatory tools and methods on the LEAP tool (Gombos et al. 2016).

**Example from a household survey for fishing communities**

1. What is your level of agreement on the following? 1 = strongly disagree, 2 = disagree, 3 = neither agree nor disagree, 4 = agree, 5 = strongly agree

Diversity and flexibility	1 = strongly disagree	2 = disagree	3 = neither	4 = agree	5 = strongly agree	I don't know
My household depends heavily on fishing						
My household is able to change fishing methods if necessary						
My household is able to move to different fishing sites if necessary						
In the last 5 years my household has developed new ways to use coastal and marine resources						
There are economic opportunities my household can take advantage of.						
My household is willing to learn and try different types of livelihood activities in response to climate impacts and hazards						
My household can access resources for a new type of livelihood						
Fishing is important for my household. It is a part of who we are.						
Migration is common in our community						

## A2. Learning and knowledge

Several indicators can be examined for learning and knowledge. For example, *knowledge and perception of climate hazards* assesses a household's awareness, understanding and perception of susceptibility to climate-related risks that have the potential to cause harm. This information can inform managers relevant actions. For example, if there is little awareness of climate threats, programs need to be developed to inform people and help them prepare to cope. Priority in adaptation planning should be given to those hazards that have severe impacts at the household level, with a special focus on households that have identified themselves as being unable to cope with them.

To compare awareness of household vulnerability and recorded climate hazard impacts, information can be gathered first about local climate hazards (types, character, frequency, and degree of community impact) from existing secondary sources such as meteorological services, newspaper articles, scientific research, climate reports, hazard mitigation plans, and emergency declarations. Interviews can also be conducted with people who have knowledge of climate events and the impacts over the past several decades, such as local residents, technical experts, climate scientists, and others who have been involved in working with the community to prepare for and recover from climate disasters (village leaders, community elders, government officials, disaster mitigation officers, long-term project staff, etc.).

Another indicator *access to and use of climate-related knowledge* measures household access to different sources of information related to climate change, climate variability, and its impacts, and how this information is used. It also includes access to any type of early warning system and can include past experience, traditional or local knowledge of climate patterns and events, as well as other sources of education, media, and communications. The data provide an overview of a community's access to climate information. This tells managers how best to reach the community or particular households. It also helps identify gaps and problems. Greater access to, and use of, climate-related information should increase adaptive capacity by better preparing community members to cope with climate change.

To collect data, you may ask key informants to list all possible sources of climate information that are available locally or that can be accessed from a distance. This list is then used to create a household survey. Respondents identify which of the sources is used by their household to access climate information, and are then asked to explain how the information is used.

**Example from a household survey**

1. From the following information sources, please check the one(s) from which you get your climate information and whether you use the information from the source(s) and how.

Sources of climate-related knowledge	Check if you <i>get</i> climate information from this source, and n/a if the source is not available for your household	Check if you <i>use</i> this information, describing briefly how the information is used
Meteorological services		
Newspapers		
Radio		
TV		
Internet		
School/teachers		
Visiting climate scientists/experts		
Village leaders		
From family and friends		
Government information		
Other (please specify) _____		

2. If you have access to climate information sources, but do not use the information, please tell us why.

\_\_\_\_\_

3. Please tell us if there are any types of information that you need but cannot access, and what the barriers are to accessing the information.

\_\_\_\_\_

4. What is your level of agreement on the following? 1 = strongly disagree, 2 = disagree, 3 = neither agree nor disagree, 4 = agree, 5 = strongly agree



Learning and knowledge	1 = strongly disagree	2 = disagree	3 = neither	4 = agree	5 = strongly agree	I don't know
In my family, local and traditional knowledge for managing and sustaining fisheries are passed on from elders and parents to young people.						
My household uses traditional practices to help adapt to changing climate.						
My household is able to get information when we need to better cope with climate impacts on fisheries.						
Our community is aware of the causes and impacts of climate change.						
In the past, traditional knowledge and practices helped our community to successfully cope with climate events and impacts.						
Today, traditional knowledge and practices are adequate to help us now successfully cope with climate risks and impacts.						
I know how changing climate may impact fisheries in the future.						

### A3. Leadership, governance and institution

*Leadership, governance and institution* is a broad indicator category that assesses a variety of characteristics that together indicate the processes by means of which decisions are made to serve the best interests of the community and stakeholders. *Leadership* assesses the presence of community leaders or government officials who can mobilize climate change responses and resources to support adaptation, and their effectiveness or credibility. This indicator is important because communities with strong, trustworthy, effective leaders will be more able to adapt. *Governance* and *institution* are related to resource management and climate adaptation. Natural resource governance refers to “the norms, institutions and processes that determine how power and responsibilities over natural resources are exercised, how decisions are taken, and how citizens – women, men, indigenous peoples and local communities – participate in and benefit from the management of natural resources” (IUCN 2018).

Indicators in this category are best measured through both key informant interviews and household surveys. For example, for the indicator *effectiveness of community leaders in addressing climate hazards and adaptation planning*, ask key informants which community leaders are engaged in climate change, including which sectors they represent (private sector, environment, technology, grassroots organizing, etc.). Consider asking about these leaders’ approaches and achievements in handling climate-related issues, depending on the sensitivity of this question in the local context. Then, in a household survey, ask a series of attitude questions to assess the degree to which household respondents are ready to affirm the existence of community leaders who can effectively guide and direct members to prepare, respond to, and adapt to climate hazards; to identify who these leaders are; and how determine how effective/trustworthy they are perceived to be. Also ask about the level of stakeholder participation in management, and their satisfaction with the decision-making process. The way decisions are made has significant bearing on the outcome of those decisions. The effectiveness of leadership will impact how change is undertaken within a community. Trust of government will impact how receptive communities are to new adaptation strategies and livelihood initiatives. Meaningful participation of community members in the management process will improve the chances of success in any new climate-related initiatives, not only in terms of buy-in but as it ensures that all have a voice in decisions that could affect their lives.

**Example of a survey question**

1. For each statement, please rate your level of agreement.

1 = strongly disagree, 2 = disagree, 3 = neither agree nor disagree, 4 = agree, 5 = strongly agree

	1 = strongly disagree	2 = disagree	3 = neither	4 = agree	5 = strongly agree	I don't know
Leadership, governance and institutions						
Our community leaders have successfully led us through climate hazards in the past.						
Our community leaders are interested in climate change issues and the impacts on our community.						
Our community has leaders who have knowledge and skills to effectively take charge of climate change adaptation.						
I trust our leaders to lead the community through climate change adaptation.						
Our community leaders/government officials inform us of national or regional climate change policy or initiatives that may impact our community.						
Our leaders suggest to us what we can do to adapt to changing climate.						
Our community leaders inform us where we can get climate-related information.						
Our leaders can provide us with the resources we need to adapt to climate change						
Our leaders encourage community members to take part in climate adaptation planning.						
My voice is heard in community planning for climate change adaptation.						
I have had the opportunity to participate in community-level decision-making						
Our coastal and marine resources are managed sustainably under formal or traditional rules and regulations or other forms of protection						

#### A4. Availability and access to resources, assets, and capitals

Availability and access to resources, assets or capitals plays an important role in social adaptive capacity of the community facing climate impacts. *Assets* include physical capital, such as materials for households and specific livelihoods, infrastructure, housing, tools and technology, energy and water supplies, markets, and natural capital or resources. It also covers non-material assets/capitals, such as human capital (e.g. knowledge, skills, experiences, good health), financial capital (wealth, money, source of credits), and social capital (ability to act collectively, social networks, connections, trust, social safety nets). Natural resources/capitals often serve as the foundation for products and ecosystem service. Levels of access to natural resources may vary from people to people within the same community due to traditional or legal rights, ownership and other types of institutional arrangements. Resources could also be referred to benefits provided by government or community assistance programs (such as cash benefits, training in alternative livelihoods, information about climate change, and disaster relief packages).

This information can help predict adaptive capacity of the households and communities, and identify particularly vulnerable households, which may need more attention in the event of a serious climate event. Data on access to resources among different socioeconomic groups can also be compared with perceptions of resource condition (an indicator in existing SocMon and SEM-Pasifika) or level of climate knowledge; this may highlight key areas to target for adaptation strategies. For example, if the leading clan claims resources are good, but others who do not have access to the best reefs claim that resources are poor, we have identified a key issue. This kind of feedback may also highlight where certain groups have better access to resources, and information about those resources, than others. Not only can this help determine adaptation actions related to equity, it can also help identify those with the deepest understanding of the resource, to help inform and develop adaptive strategies.

#### **Example of a survey question**

*For each statement, rate your level of agreement.*

1 = strongly disagree, 2 = disagree, 3 = neither agree nor disagree, 4 = agree, 5 = strongly agree

Availability and access to resources, assets and capitals	1 = strongly disagree	2 = disagree	3 = neither	4 = agree	5 = strongly agree	I don't know
My household has access to land and sea resources that we can use or sell.						
Access to the reefs and sea is fair and equitable for all community members, including women.						
My household has friends, relatives, and other community groups who support us through difficult times.						

Availability and access to resources, assets and capitals	1 = strongly disagree	2 = disagree	3 = neither	4 = agree	5 = strongly agree	I don't know
Our community members work well with each other in times of natural disasters or difficulties.						
Our community is able to access support from outside agencies or organizations that can help us effectively cope with climate change impacts.						
There are sources of credits our household can access when needed.						
There are accessible markets for our products.						
Our household has the knowledge and experiences to deal with natural disasters.						

In relation to social capital, formal and informal networks are institutional and social networks that could contribute greatly to preparedness, response, and recovery. *Formal institutional networks* may include those that are formalized with clear structure and supported by governmental authorities or institutions, such as hazard mitigation networks, health service networks or protected area networks. *Informal networks* are often formed through social connections in a group that shares common values, interests, engagement, or purpose. They could be large families, clans, church groups, women’s groups, or occupational groups. In some communities, informal social networks might help them to be less vulnerable to hazards, as well as being their only source of disaster assistance. Such networks may have been in place for a long time, but only recently begun to address climate hazards. In other communities, such networks may have already dealt with climate-related hazards that regularly impact the community. In the Pacific, such as on Namdrik Atoll in the Marshall Islands, traditional leadership institutions are being reinforced as they are used to reconnect to ancestral practices that help the community deal with climate hazards (Ishoda 2011). In communities where religious affiliation is strong, religious services or meetings might be a means of reaching people, and support from religious leaders may be crucial for local participation and successful project implementation. Knowing the availability and quality of these networks could help gauge a community’s adaptive capacity, as these networks will provide security during times of change (shelter during disasters, financial support, and basic social support during difficult times). If no networks are available, or if existing networks have challenges or problems, these are areas that could be addressed to improve a community’s adaptive capacity.

Consider the totality of climate change issues facing the community. Is there a network or community group adequately addressing each issue? For example, if the community is facing sea level rise and coral bleaching, but there is only a network to watch for coral bleaching, there may be a need for a group that can monitor sea level rise.

To collect data, identify key informants and ask them to describe formal and informal networks, their supporting role in climate adaptation and hazard mitigation, their history and length of time of supporting preparation for climate hazards, and their effectiveness. Key informants may include members or leaders of the networks themselves, community leaders, and representatives from groups who have first-hand experience with climate impacts and adaptation. Information on processes, opportunities, problems, and challenges in relation to the role of networks should be recorded. In the case of formal networks whose purpose is hazard mitigation or climate adaptation, it is important to learn from both those who implement activities and those who are affected by and have first-hand perceptions of the quality and effectiveness of the program.

***Examples of semi-structured questions for key informants***

1. Are there any groups of people or organizations that support climate change preparedness or help with the recovery after an event? If so, could you please describe who they are, how long have they exist, and what are their activities?  
Possible follow-up questions:
2. What is the percentage of the community participating in each of the groups/organizations?
3. Who participates?
4. How successful are these groups/organizations in helping the community?
5. Do you see any gaps in their work or the resources they would need? If so, could you describe?

## A5. Determining agency

Determining agency refers to ability of people to act on what is valued as important and to bring about change. In the context of social adaptive capacity, it may include capacity or ability of community to anticipate change and develop response strategies, capacity to learn, plan (or re-plan), re-organize and change in response to climate hazards. This indicator category is important as adaptive capacity is not only about having the necessary resources, but also about the willingness to act, and capacity to mobilize the resources into adaptive actions (Cinner et al 2018). Management may build agency for adaptive capacity by incorporating local knowledge in developing adaptation options, empowering people through participatory processes in co-management and adaptation planning, or removing barriers that may inhibit people's ability to exercise agency (Cinner et al 2018).

*Ability of a community to reorganize* is an example of an indicator under the *determining agency* category. It refers to the degree to which it is able collectively to learn, plan, and make necessary changes to cope with climate-related impacts in such a way that the main functions of the community are sustained. This may require restructuring organizations, changing plans, shifting priorities, adjusting roles, carrying out activities in a different way, or applying lessons from the past to better face a climate hazard. *Degree of community reorganization* is a function of factors including cooperation and collaboration among community members, planning for climate change, level of collectivism in the culture, community leadership, shared goals and responsibilities, and access to and support from other sources in reorganization.

Data can be collected from key informants such as community members and leaders who are involved in collective activities, and they should be interviewed on issues related to the interest and ability of community members to work together to address external stresses. These could be related to climate or natural hazards. The key informants are asked to share their perspectives on how well the community is able to reorganize in working collectively to confront the consequences of climate hazards, how it coordinates and collaborates, and the nature of shared goals and responsibilities among the leaders and members.

Survey questions can be included if a household survey is conducted to test whether community members share the same perspective as key informants. If the household survey reveals different perspectives than those of community leader informants, it could indicate a disconnect between the community and its leaders, an issue that perhaps should be explored, for example, by sharing the results of the household survey with community leaders or key informants.

**Example of a survey question**

1. On a scale of agreement from 1 to 5 (1 = strongly disagree, 2 = disagree, 3 = neutral, 4 = agree, and 5 = strongly agree), please rate the following:

Determining agency	1 = strongly disagree	2 = disagree	3 = neither	4 = agree	5 = strongly agree	I don't know
My household is willing to learn and do things differently in response to climate impacts and hazards.						
I would like to do more to help sustain our fisheries.						
My household is able to reorganize to respond to a new situation.						
Our community is able to coordinate activities to respond quickly to the impacts of a natural event/hazard and a new situation.						
Our community has institutions that support us when we need to reorganize to cope with new situations or problems.						
Our leaders involve us in decision making that affects our community.						
Members of my household participate in management planning and decision making related to resource management.						

In the following scenarios that could last up to a year, what would you do?

2. If there is a natural disaster and fish and sea foods are reduced to 50% of the usual amount
3. What if there is hardly any fish or seafood left?
4. What does your household need when you have to cope with climate impacts on fisheries?
5. What is the most important barrier for your household to cope with or adjust to climate impacts on fisheries?



## FROM VULNERABILITY ASSESSMENT TO ADAPTATION PLANNING

Social vulnerability assessment is a process that engages those who are impacted by changing climate to provide input on their strengths, weaknesses, opportunities, and limitations in addressing climate events and impacts. The indicators above provide a first step toward assessing aspects that may contribute to community vulnerability and adaptive capacity. They are meant to be directional and relative, allowing for comparisons among different socioeconomic groups within a community or among communities, as well as changes over time. These indicators will need to be refined. Some locally developed indicators may be more appropriate, and can be elaborated based on our models. The effort to develop such social and economic indicators should be a rewarding, collaborative experience and provide a critical component to the overall vulnerability assessment process. The community engagement that informs these indicators will vary in depth and purpose according to locality and context. Sharing the results of any assessment with the participating community is very important. These indicators can potentially help communicate why certain adaptation strategies are recommended. Feedback can also help empower people to take action and mobilize their own resources and skills for the benefit of the community.

There is no single threshold that determines whether a community is considered vulnerable to climate change. That is why social indicators can help identify where to invest limited resources. For example, if assessment shows that many within a community are unaware of potential climate change impacts, but do have diverse sources of income, perhaps a climate change awareness campaign is called for. On the other hand, if some demographically vulnerable groups are aware of climate change impacts but have fewer income sources and perceive their community to be less equitable, climate adaptation strategies may involve improving access to resources and supplemental livelihood options. Over time, socioeconomic monitoring can help measure whether adaptation strategies have made a positive impact on reducing vulnerability, whether awareness of climate change impacts has been raised, or whether vulnerable demographic groups have better access to resources and more diverse livelihood strategies in place.

For coastal managers, results of the social vulnerability assessment will provide a better understanding of the conditions and characteristics of resource-dependent communities at their site, and point to opportunities for climate adaptation as well as problem areas that need to be addressed. But to fully develop locally appropriate adaptation strategies, and continue adaptive management that takes changing climate and its impacts on the community and the local natural resources into consideration, an integrated assessment is most likely required. Social information should complement climate prediction data and information on the physical and biological impacts of changing climate. Such an integrated approach allows for a more complete picture of the different facets of site vulnerability, well-informed management decisions, and holistic adaptation planning for climate change.

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