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Process for Integrating Local and Indigenous Knowledge Related to Hydro-Meteorological Hazards with Science: Experiences from Coastal and Small Island Communities in Southeast Asia

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ABSTRACT: Communities living in archipelagic Southeast Asia face daily threats from impacts of hydro-meteorological hazards and climate change. A project focusing on local and indigenous knowledge was implemented in Indonesia, Philippines and Timor-Leste with the objective of increasing the resilience of coastal and small island communities against climate change and hydro-meteorological hazard impacts. Building the capacities of scientists, local communities and policy makers to integrate local and indigenous knowledge is important to enable them to fully harness this knowledge. This paper describes a process for integrating local and indigenous knowledge with science that emerged out of this project. We believe that such a community-led process is a practical and positive way to promote the use of local and indigenous knowledge. Moreover, by regularly undertaking this process of knowledge integration, it becomes possible for us to take advantage of the dynamic nature of local and indigenous knowledge. For such knowledge and practices to be an important component for climate change adaptation, they need to continuously evolve according to changes in the environment and climate. Finally, it is only when such knowledge is continuously transmitted to the younger generations that it can strengthen community resilience.

KEYWORDS: *local and indigenous knowledge, hydro-meteorological hazards, climate change, knowledge co-production, knowledge integration*

Introduction

Communities living in archipelagic Southeast Asia face daily threats from impacts of hydro-meteorological hazards and climate change. Research implemented in Indonesia, Philippines and Timor-Leste demonstrated that coastal and small island communities have amassed a wealth of knowledge and practices related to the climate, environment, and hazards through their extended histories of interactions with their coastal environment. We believe that harnessing local and indigenous knowledge is key to increasing the resilience of coastal and small island communities to the impacts of climate change and hydro-meteorological hazards. To fully harness this knowledge, it needs to be integrated with science and technology, through a process during which scientists, practitioners, and communities jointly undertake observation, documentation, analysis and validation of local and indigenous knowledge.

In this paper, we briefly describe a process for integrating local and indigenous knowledge with science, because we believe that such a process will: (a) enable promotion of the use of local and indigenous knowledge; and (b) allow recognition of the dynamic nature of local and indigenous knowledge. For such knowledge and practices to be an important component for climate change adaptation, they need to continually evolve according to changes in the environment and climate. Such dynamic knowledge needs to be transmitted to the younger generations so that it can strengthen community resilience.

Methodology

The APN-funded project was led by the United Nations Educational, Scientific, and Cultural Organization (UNESCO) Office in Jakarta in close partnership with partners in Indonesia, Japan, Philippines and Timor-Leste. The project took place in the second phase of a large project that focused on local and indigenous knowledge related to hydro-meteorological hazards and climate change in coastal and small island communities. The term "local and indigenous knowledge" used in this project is defined as "understandings, skills and philosophies developed by societies with long histories of interaction with their natural surroundings. For rural and indigenous peoples, such knowledge informs decision-making about fundamental aspects of day-to-day life" (UNESCO undated).

The research component of the UNESCO project was implemented in two phases. In the first phase, knowledge and practices related to climate change adaptation and climate-related hazards were identified and documented in three communities in each

HIGHLIGHTS

- Knowledge and practices of local communities can increase the resilience of those living in coastal and small island communities against impacts of hydro-meteorological hazards and climate change.
- For this to happen, such local and indigenous knowledge needs to be integrated with scientific knowledge, using an appropriate, community-led process, such as the one developed out of our research that we call "LIVE Scientific Knowledge".
- After knowledge is integrated using "LIVE Scientific Knowledge", local and indigenous knowledge can then be popularised and used, by local communities as well as by scientists and policy makers.
- Local and indigenous knowledge needs to continuously evolve according to changes in the environment and climate, which can be an important component for climate change adaptation.

Country	Site name (province or district)	Impacts of hydro-meteorological hazards and climate change observed by communities	Research methods used and dates
Indonesia	Bedono Village, Sayung, Demak (Central Java)	Coastal abrasion and floods (since late 1990s, attributed to building of wave breakers); land subsidence (attributed to industrial land conversion); sea-level rise; strong winds.	Small group interviews to identify and document LINK; FGDs for community validation (December 2011 – Apr 2012; April 2013)
	Kendahe villages, Sangihe Island, Sangihe Regency (North Sulawesi)	Coastal abrasion (attributed to high waves); floods; strong winds and high waves (attributed to typhoons and sea storms).	Interviews and participatory mapping to identify and document LINK (December 2011 – April 2012)
	Lipang Village/Island, Sangihe Islands (North Sulawesi)	Drought and freshwater shortages (due to lack of freshwater source and rainfall), high waves and strong winds (attributed to monsoons), coastal abrasion (worsened since the 1980s, attributed to sea-level rise and westerly winds).	Semi-structured interviews with key actors, and participatory mapping to identify and document LINK (December 2011 – March 2012)
	Pangastulan Village, Buleleng Regency (Bali)	Coastal abrasion (attributed to high waves and heavy rainfall during rainy season); floods (attributed to storm surges and flash floods of nearby river after heavy rains).	Interviews and participatory mapping to identify and document LINK (January – March 2012)
	Pulo Breueh Island and Pulo Nasi Island, Pulo Aceh Islands (Aceh)	Sea storms and strong winds (from tropical cyclones); Coastal abrasion and salt water intrusion (attributed to strong winds and high waves).	Participant observation and interviews with key informants to identify and document LINK; FGDs and a workshop for community validation (November 2012 – March 2013)
Philippines	Angono Municipality (Rizal)	Floods have been observed as getting worse (attributed to more frequent and stronger typhoons, heavier rains, and heavy siltation).	Participant observation, interviews with key informants, and FGDs to identify and document LINK; key informant interviews, FGDs and a workshop for LINK validation (December 2011 – March 2012; November 2012 – February 2013)
	Perez Municipality, Alabat Island (Quezon)	Floods (attributed to regular and strong typhoons and torrential rains). Unpredictable and changing weather patterns have been observed.	
	Rapu-Rapu Island (Albay)	Floods and landslides (attributed to regular and strong typhoons, deforestation, and soil erosion). Changing weather patterns, including stronger and more frequent rainfall/typhoons have been observed.	
Timor-Leste	Lau-Hata Village (Liquiça)	Floods and landslides (attributed to heavy rainfalls). Sea-level rise, extended dry season, and heavier rainfalls have been observed.	FGDs and key informant interviews to identify and document LINK; FGDs for community validation of LINK (December 2012 – April 2013).
	Maluru-Beaço Village (Viqueque)	Drought (caused by extended dry season), strong winds, and heavy rainfall. Sea-level rise has been observed.	
	Raimea Village (Covalima)	Floods (attributed to heavy rainfall), drought, and storms.	

Table 1. Research sites 2011-2013 (adapted from Hiwasaki et al., 2015).

country. Involved in the action research were community leaders and groups (such as youth and women's groups), traditional and religious leaders, local and national governments, local and national non-governmental organisations (NGOs) and local academics and experts.

In the second phase, local and indigenous knowledge went through a validation process by communities and scientists. Focus group discussions (FGDs) and workshops were organised for community validation and for establishing scientific explanations to the local and indigenous knowledge. In the Philippines, the results of the scientific explanations were taken back to the communities, and the communities compared the outcomes of their validation with the explanations provided by the scientists. Table 1 provides more information on research sites and research methods used.

Results and Discussion

Integrating Local and Indigenous Knowledge with Science

From the action research, we developed a process which we have termed "LIVE Scientific Knowledge: Local and indigenous knowledge and practices Inventory, Validation, and Establishing Scientific Knowledge". This community-led process involves identifying, documenting, and validating local and indigenous knowledge and integrating it with science.

Preparation

The first step in this process is choosing people from the local community to become researchers, and training them on the process, methodology and key scientific terms. The people chosen should be gender balanced and trained so that they are comfortable using the different research methods. Data-gathering forms can be used, one for each type of local and indigenous knowledge (e.g., observations of animal behaviour, observations of celestial bodies, observations of the environment, material culture, and traditional and faith-based beliefs and practices). It is important for all local researchers to use the same data-gathering form to enable both the systematic gathering of data and the standardisation of data collected.

Data Gathering

In this phase, local researchers identify informants, observe the local and indigenous knowledge that they have identified in their communities, and record observations in data-gathering forms.

Analysis and validation

Each documented local and indigenous knowledge undergoes the following six steps: (1) analysis and interpretation; (2) data analysis; (3) community validation; (4) scientific explanation; (5) taking back the results of the scientific workshop to the community; and (6) categorisation of local and indigenous knowledge (Figure 2).

I LINK which can be scientifically explained/validated, and related to DRR and/or CCA	II LINK which cannot be scientifically explained/validated, but related and relevant to DRR and/or CCA
III LINK which can be scientifically explained/validated, but not related to DRR and/or CCA	IV LINKs which cannot be scientifically explained/validated, and not related or relevant to DRR and/or CCA

Figure 2. Categorisation of local and indigenous knowledge (LINK) on disaster risk reduction (DRR) and climate change adaptation (CCA) and its relationship to scientific validation.

Science Integration

Local and indigenous knowledge with a scientific explanation (LINK Category I) is combined with empirical data from the field. This can be done by the community in close cooperation with scientists.

Popularisation and Utilisation

After local and indigenous knowledge is integrated with science, it can be disseminated through information, education and communications (IEC) materials to be used by communities themselves, by scientists for further research, and by practitioners and government entities for disaster risk reduction and management plans, etc.

The process described above is an integrated, community-led process of observing, documenting, analysing, validating and integrating local and indigenous knowledge, after which this knowledge can be widely disseminated, both within and outside communities. We believe this process can be easily adapted and implemented by other communities in island Southeast Asia or elsewhere.

The Importance of Integrating Local and Indigenous Knowledge with Science

We present this process for knowledge integration for two reasons: first, because we believe that this is a practical and positive way of promoting the appropriate use of local and indigenous knowledge. Secondly, regularly documenting and validating local and indigenous knowledge enables communities to identify local and indigenous knowledge that helps increase community resilience. Local and indigenous knowledge, just like science, has interacted with external forces and incorporated non-local information and practices (including scientific knowledge) over time and is thus dynamic and complex (Cruickshank, 2005). Such dynamic knowledge needs to be transmitted to the younger generations so that it can strengthen community resilience. Using a process such as this will also make room for the knowledge and practices to continuously evolve according to changes in the environment and climate, which would be an important component for climate change adaptation.

Recent discussions in the field of traditional knowledge stress the importance of considering "traditional knowledge as a process, rather than content" (Berkes, 2009). Combining traditional knowledge with science is now widely recognised as a possible way of solving problems that neither science nor traditional knowledge can solve by itself. In this regard, the process described in this paper is in line with the emphasis on "co-production of knowledge", defined as "collaborative process of bringing a plurality of knowledge sources and types together to address a defined problem" (Armitage et al., 2011), which is now recognised as important in the relevant literature (see also Nakashima et al., 2012; Raymond et al., 2010).

Conclusions

Local and indigenous knowledge can play an important role in increasing the resilience of coastal and small island communities to impacts of climate change and climate-related hazards. To fully harness this knowledge, it needs to be integrated with science and technology, through a process during which scientists, practitioners, and communities jointly undertake observation, documentation, analysis and validation of local and indigenous knowledge. In this paper, we have presented a process for integrating local and indigenous knowledge on hydro-meteorological hazards and climate change with science, which we believe is key to enable communities themselves to make optimal decisions on dealing with the impacts of these phenomena. Knowledge integration will also enable practitioners and scientists to implement activities and research to increase resilience of coastal and small island communities, and will also make it possible for decision makers to make policies that support such activities.

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PROJECT INFORMATION

Title:	Capacity Building to Strengthen Resilience of Coastal and Small Island Communities against Impacts of Hydro-Meteorological Hazards and Climate Change
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