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Technical Note:

Impact Assessment of Climate Change and Environmental Degradation on Children in Thailand

Objectives

This technical note aims to offer technical guidance on conducting a climate change impact assessment on children. Full details can be found in Thailand Development Research Institute (TDRI) and UNICEF's 2022 study entitled *Impact Assessment of Climate Change and Environmental Degradation on Children in Thailand.*

The objectives of this technical note are twofold:

- To facilitate the exchange of knowledge and provide step-by-step guidance on how to conduct a climate change impact assessment on children
- To share lessons learned, which might be helpful for future studies

Why Conduct an Impact Assessment?

Climate change risk is not homogenous across places and time. Conducting a climate change and environmental degradation impact assessment enables the identification of the regions in Thailand in which children are exposed to high risk of climate change, and across three time horizons, namely the near future (2016-2035), intermediate future (2045-2065) and far future (2081-2099). Identifying the impacts of climate change on children and the highly vulnerable regions in Thailand can lead to more effective child-sensitive policy recommendations and child-sensitive climate policies.

Methodology and Data

Multiple methodologies and data can be used in conducting a climate change impact assessment on children. The table below contains a summary of methodologies and data used in this study.

Methodologies	Data
1) Desk research	• Studies on the impact of climate change and environmental degradation on children, both in Thailand and in other countries • Policies and plans on climate change, environmental degradation, and children
2) Development of climate risk maps to identify the areas in Thailand where children face high risk of climate change	• Development of climate risk maps require both data on climate drivers and non-climate drivers as follows: • Climate data from the Southeast Asia Climate Downscaling/Coordinating Regional Climate Downscaling Experiment Southeast Asia Project (SEACLID/CORDEX -SEA) Phase II: High-Resolution Analysis of Climate Extremes over Key Areas in Southeast Asia. • Non-climate driver data from the National Statistical Office of Thailand, and the Health Data Center, Ministry of Public Health.

Methodologies	Data
3) Regression analysis to analyze linkages between climate risk and adaptive capacity	• Climate risk indices at provincial level, obtained in the process of risk map development under this project • Child-MPI data from the Multiple Indicator Cluster Survey (MICS) 2015/16
4) Policy gap analysis to understand how impacts and risks of climate change on children are being addressed and the gaps that remain	• Policies and plans related to climate change, environmental degradation, and children in Thailand
5) Stakeholder mapping and multi-stakeholder consultation	• Suggestions and comments provided by stakeholders during consultation workshops

Steps

1) Desk Research: A review of literature on the climate change impacts on children was conducted, focusing on four types of climate hazard, namely high temperature, low temperature, flood, and drought.

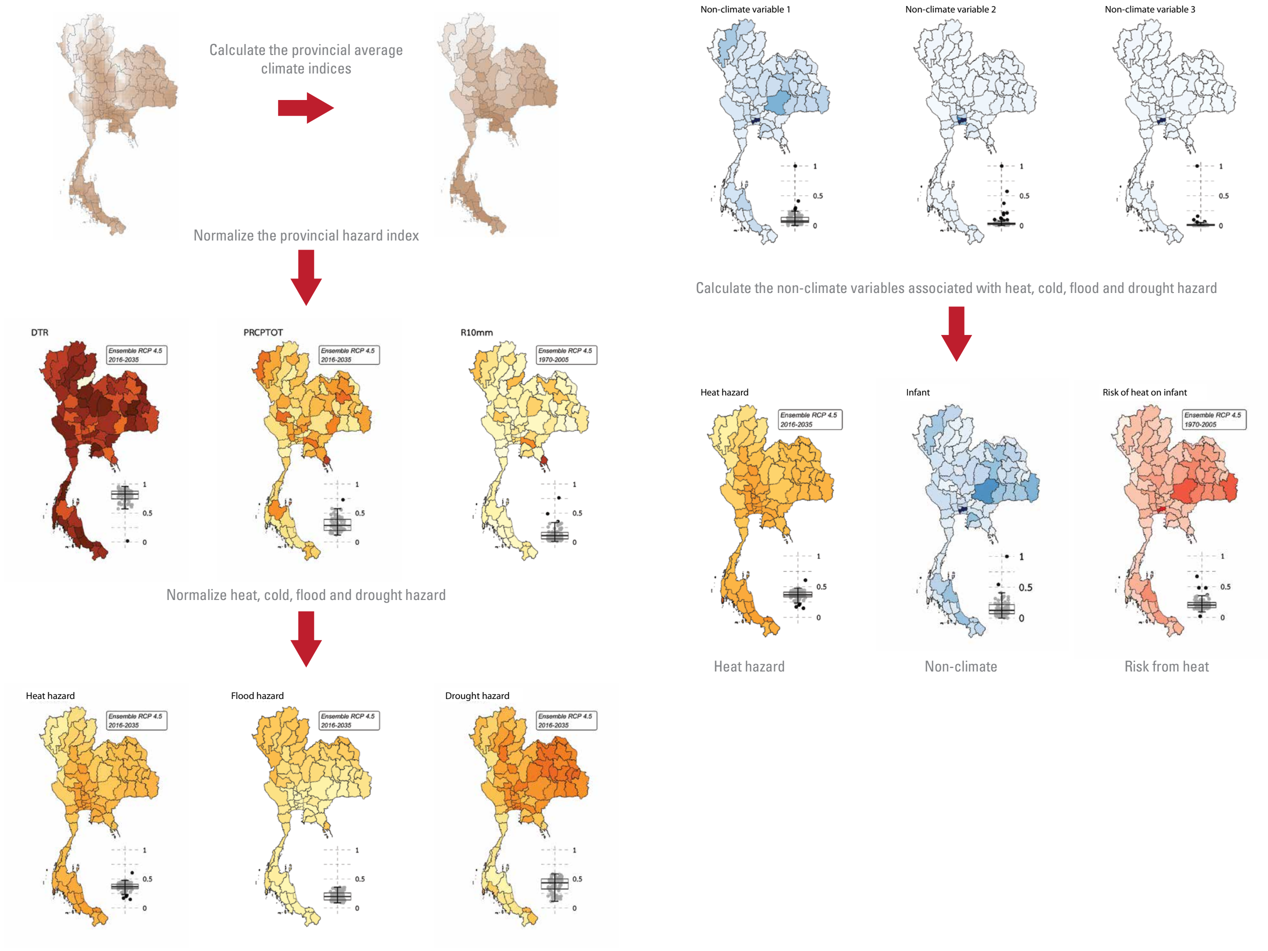
2) Climate Risk Maps: The study's climate risk maps were developed using risk indices, which were calculated from the summation of climate hazard indices and vulnerability indices with equal weight. Those climate hazard indices and vulnerability indices were calculated from both climate drivers and non-climate drivers. The climate drivers were obtained from the three General Circulation Models (GCMs)[1] for two future climate change scenarios under two Representative Concentration Pathways (RCPs) [2]– RCP4.5 and RCP8.5. The three GCMs considered here include EC-Earth, MPI-ESM-MR, and HadGEM2 ES[3]. Figure 1 contains a summary of the steps used in the development of the study's climate risk maps.

1 GCMs are numerical models representing physical processes in the atmosphere, ocean, cryosphere and land surface. GCMs are the most advanced tools currently available for simulating the response of the global climate system to increasing greenhouse gas concentrations (IPCC Data Distribution Centre). This information is available at the following url: https://www.ipcc-data.org/guidelines/pages/gcm_guide.html.

2 RCPs are scenarios that include time series of emissions and concentrations of the full suite of greenhouse gases and aerosols and chemically active gases, as well as land use/land cover (Moss et al., 2008). According to the IPCC, RCPs usually refer to the portion of the concentration pathway extending up to 2100, for which Integrated Assessment Models produced corresponding emission scenarios. Four RCPs produced from the Integrated Assessment Models were selected (RCP2.6, RCP4.5, RCP6.0 and RCP8.5). RCP2.6 represents a stringent mitigation scenario, RCP4.5 and RCP6.0 represent intermediate scenarios, and RCP8.5 represents a scenario with very high GHG emissions.

3 EC-Earth, MPI-ESM-MR, and HadGEM2 ES are the GCMs produced by EC-Earth consortium, Max Planck Institute for Meteorology, Germany, and the Met Office Hadley Centre, UK. The full names of these GCMs are European Consortium Earth System Model, Max Planck Institute Earth System Model, medium resolution, and Hadley Centre Global Environment Model version 2 - Earth System Model. The atmospheric grids under these three GCMs are different, with the latitude and longitude for EC-Earth, MPI-ESM-MR, and HadGEM2 ES being 1.1215 and 1.125; 1.8653 and 1.875; and 1.25 and 1.875, respectively.

Figure 1 Step-by-step process in the development of climate risk maps



Four non-climate variables related to children were used in the development of risk indices, namely: (1) number of children (0-14 years old), (2) number of medical doctors, (3) number and proportion of underweight newborns (<2,500 grams), and (4) number and proportion of underweight children (0-5 years old). The number of children, number and proportion of underweight newborns and number of children (0-14 years old) variables reflect exposure and sensitivity to climate change, while the variable on number of medical doctors reflects adaptive capacity to climate change.

3) Regression Analysis: To investigate the relationship between climate change risk and indicators for child poverty, a regression analysis was conducted using a fractional logistic regression model[4]. The indicators for child poverty (Y) under this study focused only on the living standards dimension of the Child MPI, based on data from the Multiple Indicator Cluster Survey (MICS) 2015/16. The climate change risk index developed under this project was used as a proxy of climate change risk (CR). The following regression model was estimated:

4 A fractional logistic regression model is used when the dependent variable takes a value within a bounded range. As the dependent variable in the regression considered here is the risk index, which takes values within a bounded range of 0-1 (a continuous variable which does not need to be converted to categories), a fractional logistic regression was used.

$$CR_i = \beta_0 + \beta_1 Y_i + \beta_2 C_{1i} + \cdots + \beta_n C_{ni} + \varepsilon_{i,}$$

Where:

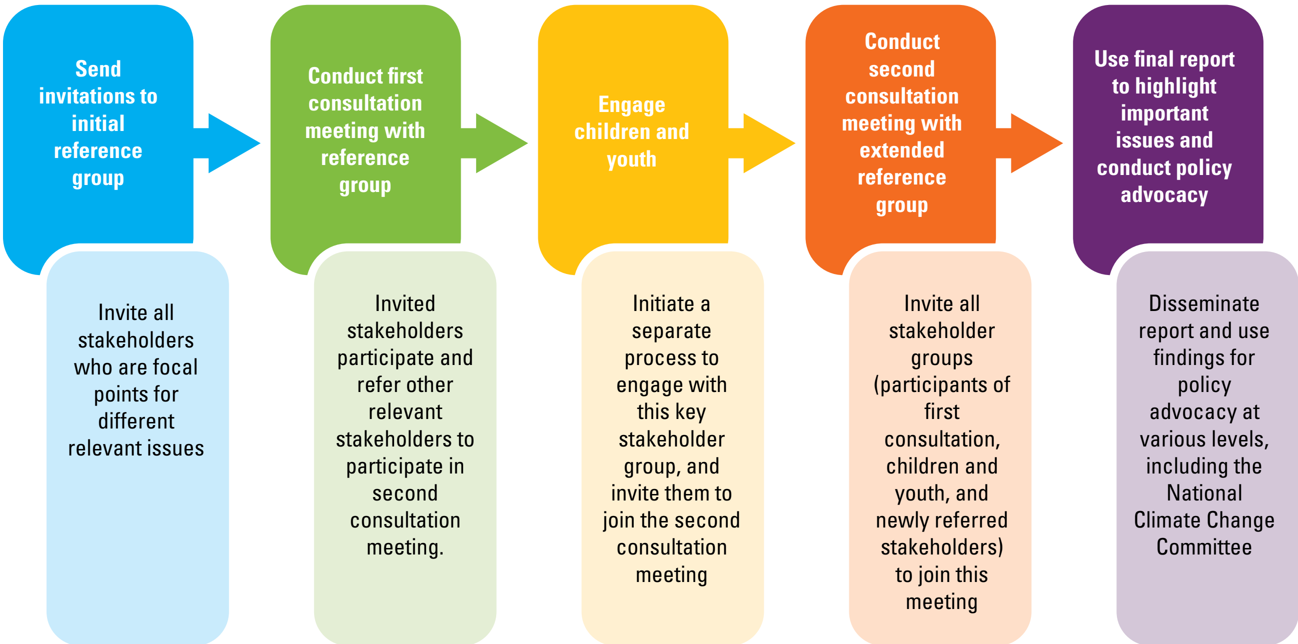
CR_i	=	climate risk index or hazard index (note that hazard index or risk index is the province-level data; thus, they are the same for all respondents in the same province)
Y_i	=	different indicators for child poverty
$C_{1i}, \ldots, C_{ni}$	=	control variables that affect climate risk, such as urbanization, adaptive capacity, etc.

Estimating the above regression model using a fractional logistic regression model enabled investigation of the linkages between selected dimensions of child poverty and climate risk, as well as the adaptive capacity.

4) Policy gap analysis: Relevant policies and plans related to climate change in Thailand, such as the National Strategy, Climate Change Master Plan 2015-2050 and National Adaptation Plan were reviewed to identify existing measures to address impacts of climate change on children and identify policy gaps.

5) Stakeholder mapping and multi-stakeholder consultation: As climate change imposes direct risks which can then have cascading effects on other areas (e.g. a direct health impact can lead to social, economic, ecological and even political impacts), it is important to engage diverse groups of stakeholders who can offer different expertise and interests related to different facets of climate change and children. Multi-disciplinary stakeholders were engaged and consulted throughout the process, including transnational actors, governmental agencies, the private sector, civil society organizations, and youth groups. Figure 2 shows the process for engaging stakeholders in the multi-stakeholder consultation.

Figure 2 Multi-stakeholder consultation process



Constraints and lesson learned

The main constraints and lesson learned from conducting the climate change impact assessment are as follows.

- **Data/Information:** The future climate projections used in this study are based on the dynamical downscaling of three GCMs with the grid resolution of 25 x 25 km2. This data is the most up-to-date and best available data in Thailand. In the future, if finer grid resolution becomes available, such data should be used in the analysis to yield risk maps with finer resolution, which will enable more detailed risk assessment and planning for climate change adaptation. In addition, this data model does not provide adequate output to directly assess the sea level. Additional simulation needs to be carried out to evaluate the sea level rise under future climate change scenarios. The topography achieved from publicly available DEMs (digital evaluation models) are not fine enough to evaluate the impacts of sea level rise. In the future, other dimensions of child poverty should also be analyzed such as learning (education) and health (nutrition) as these dimensions might be related to children's ability to cope with climate risks.
- **Methodology:** Given that children living in different provinces in Thailand are facing multiple types of risk of climate change, i.e., heat, flood, drought or low temperature, with limited resources available to support climate change adaptation, it is essential to prioritize the specific climate change risk or climate hazards facing children living in high-risk provinces. However, the methodology used to develop the risk maps in this study does not have a "sensitivity layer" built into the analytical framework to identify which climate hazard is more of a concern in which area; thus, the aforementioned prioritization was not able to be carried out in this study. Future studies should incorporate a sensitivity layer to the model to provide deeper layers of information. Examples of sensitivity data that would be necessary include the percentage of children in each province sensitive to heat, flooding, drought or low temperature.

Implementing Partners

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