

# Children and Climate Change



## Children's Vulnerability to Climate Change and Disaster Impacts in East Asia and the Pacific

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This paper was written by Jill Lawler who is a consultant working with UNICEF East Asia and Pacific Regional Office. The paper draws heavily from four UNICEF commissioned country studies. As such, it is equally authored by those individuals who produced the country reports. These authors are:

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Cover photos:

*Top left:* Photo by a child in East Nusa Tenggara

*Top right:* Photo by a child in East Java

Both photos taken during a UNICEF-commissioned research and Photovoice exercise exploring children's vulnerability to climate change and disaster, with a specific focus on nutrition and health impacts on children in Indonesia.

*Right:* Photo of a girl from an indigenous community wringing out a hand towel at an outdoor tap, Ban Pho Preschool, Lao Cai Province, Viet Nam.

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# Foreword

Climate change is one of the biggest development challenges of the twenty-first century. Communities across the globe are already experiencing the impacts of more extreme weather events, temperature changes and disease outbreaks.

Though no one will be immune to the effects of climate change, children are particularly vulnerable. The types of climate risks confronting children are diverse, ranging from direct physical impacts, such as cyclones, storm surges and extreme temperatures, to impacts on their education, psychological stress and nutritional challenges. Some of the leading killers of children worldwide are highly sensitive to climate changes. Higher temperatures have been linked to increased rates of malnutrition, cholera, diarrhoeal disease and vector-borne diseases like dengue and malaria. Yet children's underdeveloped immune systems put them at far greater risk of contracting these diseases and succumbing to their complications.

Even moderate climate change impacts could have profound long-term consequences on children's overall development, threatening achievement of the Millennium Development Goals.

UNICEF is committed to ensuring the protection of children and young people in a changing climate and to supporting their participation in decision-making processes that will ultimately impact their future. UNICEF is stepping up efforts to strengthen programming that reduces children's risk to climate change and natural hazards. The organization has also invested resources to help develop the knowledge base on children's vulnerabilities to climate change as well as the role they can take in shaping a more sustainable and climate-resilient future.

In 2011, UNICEF, with support from Reed Elsevier Publishing, commissioned field research in Indonesia, Kiribati, Mongolia, Philippines and Vanuatu to see if there were noticeable patterns and trends of climate change and disaster impacts on children. The studies also included interviews with children and youth to assess their perspectives on climate change.

The regional report *Children's Vulnerability to Climate Change and Disaster Impacts in East Asia and the Pacific* summarizes key findings from the studies as well as brings together published evidence, along with the perspectives of children, on the potential impact of climate change on children over the course of this century.

The regional report and country studies remind us of the connection between climate change and the other challenges confronting children. They also remind us that children's experiences and the risks they face, in terms of effects on their health, education and development, are unique. Findings from the reports will be used to support UNICEF programmes in child health, education, protection and social policy, to help mitigate the potential impacts on children, and also inform our work with governments in developing child-sensitive adaptation policies to better manage climate impacts.

The impacts of climate change on the lives and well-being of children are real and the policies and decisions made today will set the tone for years to come. Now is the time to put in place adaptation strategies and low-carbon development plans that ensure that the risks specific to children are addressed. By doing this, we will go some way in helping to build a climate-resilient world for children.



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Any errors are the responsibility of the author.

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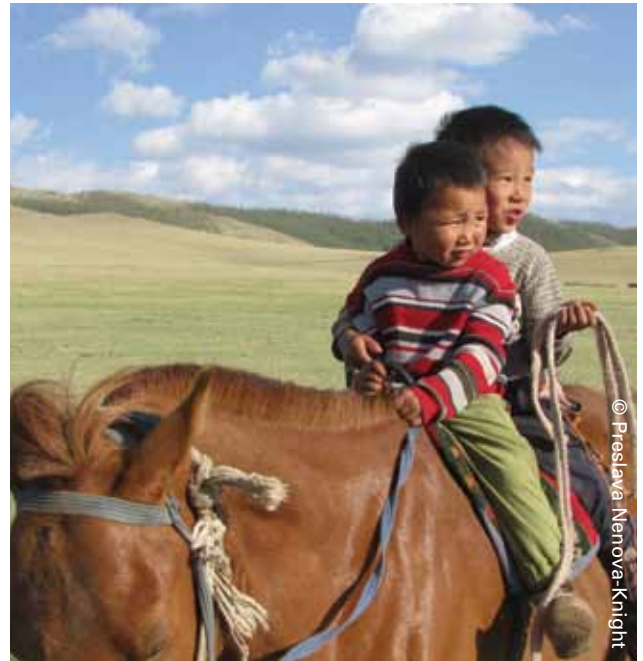
## Acronyms and terms

COP	Conference of Parties
ENSO	El Niño Southern Oscillation
GHG	greenhouse gases
ICT	information and communications technology
IPCC	Intergovernmental Panel on Climate Change
MARCC	Mongolia Assessment Report on Climate Change
MDGs	Millennium Development Goals
NGO	non-government organization
NTT	Nusa Tenggara Timur
UNDP	United Nations Development Programme
UNICEF	United Nations Children's Fund
UNISDR	United Nations International Strategy for Disaster Reduction
WFP	World Food Programme
WHO	World Health Organization



## Executive summary

This report provides an overview of the climate change trends and potential impacts on children in East Asia and the Pacific that appeared in studies covering five countries that were commissioned by the United Nations Children's Fund. The country studies highlight children's specific vulnerability to climate change that needs to be taken into account in policy development. The impacts they will encounter, however, will not be uniform. Children noted a range of experiences already, ranging from livelihood insecurity in Mongolia to threats of sea level rising in the Pacific Islands to massive flooding of their neighbourhoods in the Philippines and crop failures in Indonesia. The scientific research indicates that existing vulnerabilities will likely be exacerbated by continued climate change. Because children have unique perspectives of their environment, they can be important actors in enhancing community capacity to address climate-related risks. Involving children in the design of policy and designing climate change policies with children's rights in mind are essential to creating policies that do not have unintended negative consequences.



# 1. Introduction

Greenhouse gas emissions have committed the world to a range of adverse and potentially catastrophic effects that will impact children.<sup>1</sup> Current and future generations of children face declining water security, rising pressures on food production and increasing disasters and disease risks, with long-term consequences on their development. This is particularly alarming because millions of children in East Asia and the Pacific already experience a range of challenges, from poor access to water and sanitation to malnutrition and disease.<sup>2</sup>

Children are especially sensitive to changes in the climate because they are physiologically and metabolically less able than adults at adapting to heat and other climate-related exposure.<sup>3</sup> Their still-evolving development puts them at higher risk of contracting diseases and succumbing to related complications due to lower functional immunity. Children are also more likely than adults to be killed or injured during disasters.<sup>4</sup>

Studies show that some of the main killers of children are highly sensitive to changes in the climate. For example, temperature increases have been linked to increases in the burden of malnutrition, cholera, diarrhoeal disease and vector-borne diseases like dengue and malaria.<sup>5</sup> Climate change<sup>6</sup> impacts are also projected to increase the numbers of children affected by natural hazards, from an estimated 66.5 million per year in the late 1990s to as many as 175 million per year (globally) in the coming decade.<sup>7</sup>

In 2011, the United Nations Children's Fund (UNICEF) commissioned field research in

Indonesia, Mongolia, Philippines and Kiribati and Vanuatu<sup>8</sup> to quantify and illustrate patterns and trends of climate change and disaster impacts on child survival and development. In addition to an extensive literature review, the studies included interviews with children and youth to assess their perspectives on climate change. In Kiribati and Vanuatu, the study included a modelling exercise to project possible impacts by 2050. The studies differed in detail but produced a similar big picture: Children are already reporting changes to their environments due to changes in the climatic conditions, either on the basis of their own experience or what they have learned about their environments. In Indonesia, children reported crop failures and parents who consequently had left the home to find work elsewhere and an increase in food prices. In Kiribati, children said coastal erosion had worsened. In Mongolia, children noted harsher winters and declining water resources. In the Philippines, children talked of heavier rainy periods and increased flooding. In Vanuatu, children said saltwater intrusion had contaminated drinking water supplies. These experiences and perceptions are affecting their lives and potentially their development.

The country studies also portray children and youth as passionate about what is affecting their worlds and eager to engage on the issue of climate change. When asked what would help children and young people to cope and adjust to climate change, a majority of children in Indonesia, for instance, replied they wanted to do something tangible to help protect their communities.

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<sup>1</sup> The Convention on the Rights of the Child defines children as anyone younger than 18 years. A child's experience and vulnerability, as well as their opportunity to learn and capacity to contribute, will vary based on age and gender. Vulnerabilities of boys and girls, and those of young children and teenagers are not the same. For more information on gender and climate change, see [www.gender-climate.org/index.html](http://www.gender-climate.org/index.html).

<sup>2</sup> UNICEF, 2007a: 6. See also <http://www.aap.org/disasters/pdf/Youngest-Victims-Final.pdf>.

<sup>3</sup> Akachi et al., 2009: 2

<sup>4</sup> UNICEF, 2007: 6.

<sup>5</sup> See Akachi et al., 2009

<sup>6</sup> "Climate change refers to a change in the state of the climate that can be identified (by using statistical tests) by changes in the mean and/or the variability of its properties, and that persists for an extended period, typically decades or longer. Climate change may be due to natural internal processes or external

forcings, or to persistent anthropogenic changes in the composition of the atmosphere or in land use. It can manifest as extreme climatic events or as gradual systemic change leading to a slow deterioration in environmental conditions until customary practices or habitation become non-viable," according to IPCC AR 4, 2007.

<sup>7</sup> Save the Children UK, 2007

<sup>8</sup> Research teams were contracted to undertake original field research in Indonesia, Kiribati, Mongolia, Philippines and Vanuatu, focusing on critical climate-related challenges for each country. The teams followed a common research approach involving a literature review and field-based informant interviews with government officials, international institutions, NGOs, parents and children. Detailed description of the methods and sample questions are available through the full reports: Urbano et al., 2011; Nenova-Knight, 2011; Perez et al., 2011; Burton et al., 2011.

This report provides an overview of the climate change trends and potential impacts on children in East Asia and the Pacific that appeared in the country studies as well as other regional research. Section one introduces the concept of vulnerability and the drivers of vulnerability. Section two explains why children are vulnerable to climate change impacts. Section three explores climate change impacts on children in more detail, framed around a subset of risks that emerged during the country studies. Section four illustrates ways in which children are involved in climate change adaptation. Section five describes barriers to child-centred climate change adaptation. The paper ends with recommendations for strengthening adaptation policies and practices to address children's vulnerabilities and improve children's adaptive capacity<sup>9</sup> to climate-related risks. It also includes suggestions for further child-sensitive research, which is a major gap in the expanding body of knowledge on climate change.

The country studies are based on existing peer-reviewed literature supplemented with key informant interviews, including children's reports of their own experiences. Caution is needed when generalizing findings derived from select focus group interviews to the broader population. Limitations also apply to the derivation of a 'regional perspective' from

these national studies. First, the economies, societies and political systems that comprise the East Asia and the Pacific are not homogenous, making any synthesis a simplification. Second, climate systems rarely align with the territorial boundaries of a nation state or region. Climate change effects, such as monsoon rains or sea level rise, may be experienced by only a small part of a country. But they can have knock-on impacts that reach far and wide, such as crop failures that lead to higher food prices for urban households. For example, crop failures may force parents to move away from the family to find work or to migrate with the family, possibly to already densely populated urban areas, which will have separate types of impact on children's growth and well-being. Third, population group experiences of, and responses to, climate changes and their effects will also vary. As an example, high food prices may be beneficial to farmers without crop failures or agribusinesses in terms of income, but they will be harmful to net food purchasing households who will need to spend a larger proportion of their income buying food.

While some effects of climate change will vary between countries and require national policy responses (which can usefully be compared and contrasted), other effects may be common to several countries and best be dealt with through coordinated regional policy responses.

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<sup>9</sup> Adaptive capacity denotes the ability of a system to adjust, modify or change its characteristics or actions to moderate potential damage, take advantage of opportunities or cope with the consequences of shock or stress.

## 2. Climate change impacts in East Asia and the Pacific

Over the past decade there has been significant convergence of scientific understanding relating to climate change. Based on an analysis of thousands of scientific publications, the *Fourth Assessment Report* by the Intergovernmental Panel on Climate Change (IPCC) determined that global warming is “unequivocal” and that human activities are “very likely” to be the cause of it.<sup>10</sup>

Temperatures have increased an average of 0.74°C within the past century. Global and regional climate model simulations suggest temperature increases in the Asia-Pacific region on the order of 0.5–2°C by 2030 and 1–7°C by 2070.<sup>11</sup> Temperature changes will vary between geographic regions and according to types of terrain. Mountainous regions are expected to experience a higher-than-average increase in temperature. The modelling<sup>12</sup> created by CLIMsystems<sup>13</sup> for the UNICEF study suggests that Kiribati and Vanuatu are likely to experience higher-than-average temperature increases. The modelling outcomes project maximum temperatures to increase by 2.1°C in Kiribati and by 1.9°C in Vanuatu by 2050, relative to the 1961–1990 average.<sup>14</sup>

Globally, the prevailing view in the scientific literature allows a maximum increase of 2°C above pre-industrial levels to avoid catastrophic climate effects on ecosystems and human lives. The best estimate for stabilization, based on IPCC scenarios of probable outcomes, projects temperatures that are 2–2.4°C above pre-industrial levels by 2050. Temperature increases of this magnitude are likely to have profound impacts on other climatic parameters, such as rainfall intensity and distribution, carbon sequestration, frequency and intensity of extreme weather events, soil evaporation and evapotranspiration, humidity and ocean acidity.

The following table summarizes projected impacts for East Asia and the Pacific. These are the climatic impacts; the effect of climate change on societies will depend largely on human development and development practices and overall vulnerability.

Region	Countries	Current and future implications
South-East Asia	Cambodia, Indonesia, Lao PDR, Malaysia, Myanmar, Philippines, Thailand, Timor-Leste, Viet Nam	<ul style="list-style-type: none"><li>• Decrease in the availability of fresh water.</li><li>• Sea level rise, leading to saltwater intrusion and coastal flooding, causing significant losses in the built environment and coastal ecosystems.</li><li>• Increases in morbidity and mortality, resulting from diarrhoea and disease.</li><li>• Reductions in crop yields, ranging from 5% to 30% by 2050, compared with 1990 levels, with risks of hunger.</li></ul>

<sup>10</sup> IPCC, 2007: 30. Atmospheric concentrations of CO<sub>2</sub> – and of greenhouse gases in general – are measured in parts per million, referring to the number of greenhouse gas molecules per million molecules of dry air. Besides carbon dioxide, the major anthropogenic greenhouse gases are ozone, methane, nitrous oxide, halocarbons and other industrial gases (IPCC, 2007). Between 1750 and 2005 the concentration of carbon dioxide rose from 280 to 379 parts per million; of methane, from 715 to 1,774 parts per billion; and of nitrous oxide, from 270 to 319 parts per billion.

<sup>11</sup> *ibid.*

<sup>12</sup> The modelling was based on the IPCC A1FI and A1B scenarios across an ensemble of 21 climate models. The results indicate

that Kiribati and Vanuatu will likely experience increases in average temperature as well as changes to the return rate and magnification of extreme temperatures and rainfall events. Given the uncertainty associated with modelling, it was not possible to identify the geographic and temporal spread of changes to average rainfall. For a more comprehensive overview of the projected scenarios and impacts refer to the technical report (Burton et al., 2011).

<sup>13</sup> CLIMsystems develops software systems for assessing impacts and adaptation to climate variability and change. See <http://www.climsystems.com/> for more information.

<sup>14</sup> Burton et al., 2011



Region	Countries	Current and future implications
South Asia	Bangladesh, India, Maldives, <sup>15</sup> Nepal	<ul style="list-style-type: none"> <li>• Increase in the intensity of heavy rainfall events, decrease in total number of rainy days.</li> <li>• Sea level rise, leading to saltwater intrusion and coastal flooding, causing significant losses in the built environment and coastal ecosystems.</li> <li>• Melt water from Himalayan glaciers and snowfields will increase flood risk during the wet season and strongly reduce dry-season water supplies.</li> <li>• Increased incidence of extreme heat, leading to higher mortality rates.</li> <li>• Changes in intensity of rainfall events combined with increased risk of critical temperatures could reduce crop yields.</li> </ul>
Pacific	Cook Islands, Federated States of Micronesia, Fiji, Kiribati, Marshall Islands, Nauru, Niue, Palau, Papua New Guinea, Samoa, Solomon Islands, Tokelau, Tonga, Tuvalu, Vanuatu	<ul style="list-style-type: none"> <li>• Sea level rise, causing accelerated coastal erosion, saline water intrusion and increased flooding from the sea, with effects on human settlements.</li> <li>• Freshwater resources seriously compromised as a result of predicted 10% reduction in average rainfall by 2050.</li> <li>• Significant reductions in mangrove areas and coral reefs, with knock-on effects on commercial and artisanal fisheries.</li> <li>• Reductions in agricultural production in both coastal and inland areas.</li> </ul>

Source: IPCC, *Fourth Assessment Report*, 2007.

## 2.1 Measuring vulnerability

Vulnerability has been conceptualized in varying ways across different fields of study. In climate change and disaster risk research, it has been related to resilience, exposure, sensitivity, coping capacity, adaptability and risk.<sup>16</sup> The multiple uses of the term may lead to confusion about who is vulnerable to climate change and may also cause a loss of clarity as to the causes and consequences of vulnerability.

In this paper, ‘vulnerability’ refers to the characteristics and circumstances of a person, community, system or asset that make it susceptible to the effects of climate change and other hazards.<sup>17</sup> It is often expressed as a function of physical exposure to hazards,<sup>18</sup>

sensitivity to the stresses they impose and capacity to adapt to various stresses.<sup>19</sup>

Vulnerability at either the individual or community level depends on a range of factors, such as population density, age distribution, economic development, dependence on climate-sensitive sectors, food availability, health status, prevalence of climate-sensitive diseases, local environmental and geographical conditions and quality and availability of social services, including health care. Underlying these components are economic, socio-demographic and legislative processes that collectively or independently include or exclude certain populations from accessing services and realizing their rights

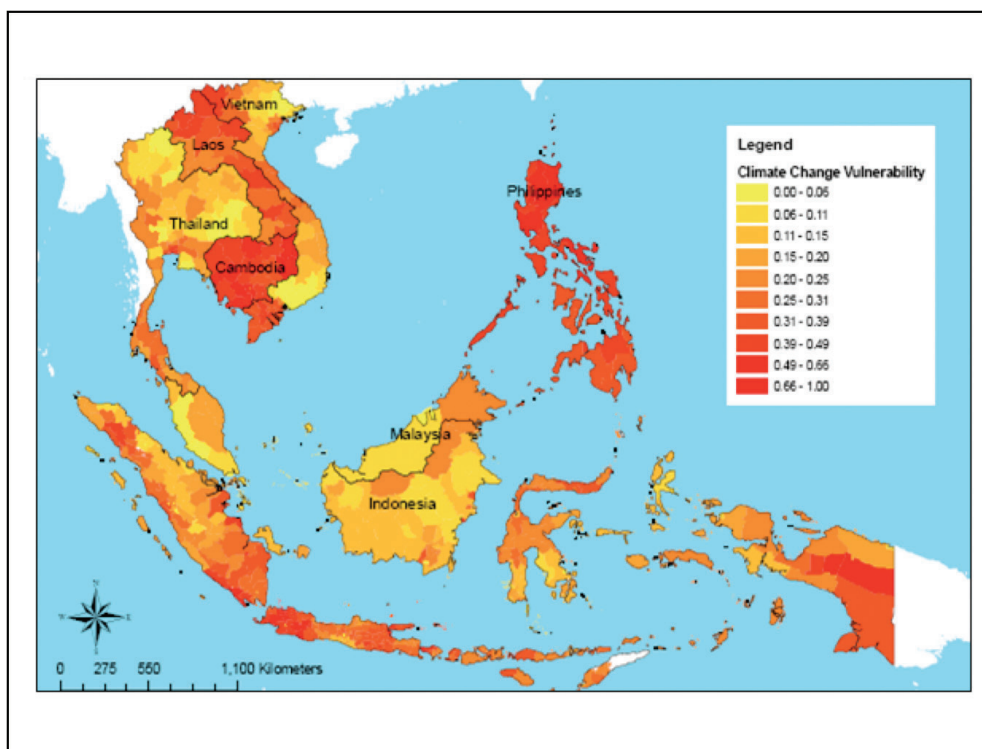
<sup>15</sup> The Maldives, a Small Island Developing State, experiences many of the same challenges as Pacific Island countries.

<sup>16</sup> See Füssel, 2009 for more detailed discussion on the use and evolution of vulnerability narratives in climate science literature.

<sup>17</sup> UNISDR, 2009

<sup>18</sup> UNISDR defines a hazard as “a potentially damaging physical event, phenomenon and/or human activity, which may cause the loss of life or injury, property damage, social and economic disruption or environmental degradation.” (UNISDR, 2009)

**Figure 1: Climate change vulnerabilities based on exposure (multiple hazard risk exposure) and sensitivity (human and ecological and adaptive capacity)**



Source: Yusuf, A. and Francisco, H., *Climate Change and Vulnerability Mapping for Southeast Asia*, IDRC/CRDL, 2009

as citizens.<sup>20</sup> Vulnerability is thus contextual and the vulnerability of a country or a certain population to climate change cannot be measured directly. Nevertheless, attempts have been made to aggregate vulnerability indexes, based on indicators of geographic and other climate change vulnerabilities.

Figure 1 illustrates levels of vulnerability in South-East Asia that are based on a range of climate change indicators, including multiple hazard risk exposure, human and ecological sensitivity and adaptive capacity. Some areas are considered vulnerable not because of their exposure to climate hazards but because they lack the necessary institutions, assets and infrastructure needed to cope. Cambodia is considered highly vulnerable because of its low adaptive capacity rather than because of the expected magnitude of climate change. Viet Nam's eastern coast is high on adaptive capacity, which moderates its otherwise high vulnerability. For Bangkok and Jakarta, their high adaptive capacities are not enough to

moderate extreme vulnerability brought about by their heavy population densities and significant exposure to climate hazards (in particular, sea level rise and floods). These factors, taken together, provide a potentially useful index of relative vulnerability, with components that may also serve as pointers to specific circumstances that make certain groups of people vulnerable or resilient to climate change.<sup>21</sup>

Small Island Developing States, which include the Pacific Island countries and Maldives, are particularly vulnerable to the effects of climate change due to their limited physical size and natural resources, high susceptibility to natural hazards and sensitivity to sea level change. For some of them, vulnerability includes their sovereign survival. The IPCC concluded in 2007 that a sea level rise resulting from a global temperature increase of 4°C would completely submerge low-lying island states such as Kiribati, Maldives and Tuvalu. Most islands of the region also have limited freshwater

<sup>20</sup> Issues range from the role of industrialization and economic growth in concentrating wealth across regions and groups to growth of privatization of basic social services and impacts on costs and quality of services to the poor and to processes of

discrimination and social exclusion based on age, illness, income, identity and ethnicity, among others.

<sup>21</sup> Yusuf, 2009



supplies. Under IPCC scenarios, future water resources are likely to be seriously compromised due to coastal erosion and saltwater intrusion contamination of freshwater supplies.<sup>22</sup>

Poverty and geography are strong determinants of vulnerability in East Asia and the Pacific. Despite significant economic growth, the region is still home to 60 per cent of the world's extreme poor, with children and youth comprising a majority of those living on less than US\$2 a day (at purchasing power parity). Although per capita household expenditure has increased significantly across the region, it has increased at a faster pace for the richest 20 per cent than that of the poorest 20 per cent.<sup>23</sup> A study of household survey data in East Asia and the Pacific showed that children in the poorest income quintile are more likely to be excluded from essential services, such as health care, water, sanitation and social protection, than those in the higher quintiles.<sup>24</sup> In addition to these hardships, poverty deprives families of the resources and services needed to withstand climate-related shocks.

Geography can also hinder access to services. Rural areas remain poorly developed in terms of basic infrastructure. Road networks, medical facilities and other infrastructure are typically concentrated in cities. A majority of the rural poor are dependent on agriculture and natural resources for their livelihoods and are particularly vulnerable to shocks, such as crop and livestock loss.

Children in poor urban areas face different challenges. The urban poor often live in informal squatter settlements located on land where they typically lack adequate sewage and drainage systems, access to health facilities

and sanitation services, diverse asset bases and other resources to reduce their risk.<sup>25</sup> The urban poor may experience climate change through increased hazards, such as flooding and disease, and through rising food prices.

Climate change is a more long-term phenomenon, based on statistical changes in average weather over a period of time (often 20–30 years). Although children are understandably unable to experience climate change per se because of their young lives, it is nonetheless useful to note their ability to compare present events with past experiences and to describe the range of impacts that changes in weather have on them and their families. There are differences between the perceptions of children in rural and in urban areas in this regard that are also useful to consider.

A survey for the UNICEF study in Indonesia, for example, demonstrated children's perceptions of how they believe they are affected by changes in their environment, based on where they live. When asked how changes in weather had impacted their lives, one fifth of the rural children surveyed reported having to quit school due to a lack of money because of crop failure associated with flooding or drought. Only 1 per cent of urban children reported this impact. More children in urban areas reported damage to their home or school from weather-related events. Both urban and rural children reported increases in food prices that they said were related to crop damage, indicating children's awareness of household economics and market prices.

These examples are indications of the impact that changes in weather will continue to have on children's lives.

<sup>22</sup> IPCC, 2007

<sup>23</sup> Ortiz et al., 2011

<sup>24</sup> Patel et al., 2010

<sup>25</sup> UNISDR, 2009

### 3. Evidence of climate change impacts on children in East Asia and the Pacific

The environment is a crucial determinant of child survival and health. Children are especially susceptible to air and water quality, temperature, humidity and vector-borne infections due to their less-developed physiology and immune system.<sup>26</sup> Epidemiological studies on climate and disease transmissions show that many of the main killers of children are highly sensitive to climate variability.<sup>27</sup> Changes in temperature or precipitation can cause changes in the seasonality of some allergenic species, changes in the distribution of some disease vectors and changes in the seasonal distribution of malaria, dengue, tick-borne diseases, cholera and other diarrhoeal diseases. Extreme weather events and changes in maximum temperatures (heat waves) can increase the incidence of mortality and morbidity.<sup>28</sup>

The types of climate risks confronting children are diverse, ranging from direct physical impacts, such as cyclones, storm surges and extreme temperatures, to impacts on their education, psychological stress and nutritional challenges. The following section explores climate change trends in the region and potential impacts on children in more detail.

#### 3.1 Mortality and injury from extreme weather events

The Asia-Pacific region is the most disaster-prone area in the world. Globally, the majority of lives lost to disasters<sup>29</sup> are concentrated here. Over the period 1975–2008, Asia accounted for 88 per cent of people affected by disasters worldwide, 61 per cent of total fatalities and 47 per cent of total economic damage.<sup>30</sup>

The IPCC projects an increase in the frequency and intensity of hydrometeorological events, such as cyclones, floods and storm surges, as

warmer temperatures lead to higher rates of evaporation and consequently higher concentrations of water vapour in the atmosphere. Evidence suggests this is already occurring in some countries. In Mongolia, for instance, the frequency of droughts, thunderstorms, flash floods and hail events have increased by 20 per cent over the past two decades, causing economic damage and loss of life. The number of category 4 and 5 storms in the South-West Pacific in the period 1990–2004 doubled from what was recorded during 1975–1989.<sup>31</sup> Box 1 singles out some of the evidence from the climate modelling in Kiribati and Vanuatu; the findings indicate that extreme heat and rainfall events will occur more often and at higher intensities as a result of climate change.

Extreme weather events impact children's health and development through loss of life or injury or by aggravating diseases related to malnutrition, poor water and sanitation. Infants and young children's chances of surviving beyond age 5 greatly decrease if their mother dies, in part because they are less likely to receive adequate nutrition and health care.<sup>32</sup>

The impact of extreme weather events is not just physical but also social and psychological. Psychological stress during disasters has been documented among children in Mongolia. Children interviewed during the country study in Mongolia said they had to engage in hazardous tasks, such as livestock herding during snow blizzards and dust storms. A UN study revealed that 47 per cent of children in areas affected by the 2010 dzud<sup>33</sup> showed signs of psychological stress<sup>34</sup> – characterized by expressions of disappointment, loss of self-confidence, nervousness and insomnia.<sup>35</sup>

<sup>26</sup> Akachi et al., 2009

<sup>27</sup> See Kumaresan et al., 2010 and Ebi, 2009

<sup>28</sup> McMichael et al., 2003

<sup>29</sup> According to the United Nations International Strategy for Disaster Reduction (UNISDR), a disaster is serious disruption of the functioning of a community or a society causing widespread human, material, economic or environmental losses which exceed the ability of the affected community or society to cope using its own resources. A disaster is a function of the risk process. It results from the combination of hazards, conditions of vulnerability and insufficient capacity or measures to reduce the potential negative consequences of risk.

<sup>30</sup> Asian Disaster Reduction Centre, 2009

<sup>31</sup> Bender et al., 2010: 455

<sup>32</sup> Strong, 1992

<sup>33</sup> The standard definition of a dzud treats it as a climatic condition in which an unusually harsh winter follows a severe summer drought; however, Mongolians use the word to refer to mass mortality of livestock resulting from a sequence of or single occurrence of weather and environmental extremes (from Nenova-Knight, 2011).

<sup>34</sup> UN Mongolia Country Team, 2010

<sup>35</sup> UNICEF, 2007b

### Box 1: Modeling extreme weather events in Kiribati and Vanuatu

Climate modelling conducted as part of the Pacific research study analysed climate change effects of extreme events. The findings indicate that extreme heat events will occur more often and at higher temperatures as a result of climate change. For Tarawa, the capital of Kiribati, the historic highest extreme of 39.3°C has a return period (or period of time between occurrences of an event of a certain magnitude or intensity, such as a record flood) of 46 years. By 2050, under the A1FI high-impact scenario, the highest extreme may increase to between 41.2°C and 41.8°C (with a 50-year return period). The return period for 39.3°C may decrease to 1 in 20 years. For Vanuatu, the return period for the current extreme temperature may decline, from every 39 years to every 2 years.

The historical heaviest rainfall of 716 millimetres in three days occurs every 168 years for Vanuatu. By 2050 (under the A1FI high-impact scenario) this event could increase to between 820 millimetres and 980 millimetres. The return rate may fall to every 72 years. In Tarawa, the return period for the three-day extreme may shift from 300 years to 1 in 43 years (see Burton et al., 2011 for other findings).

## 3.2 Risk of disease and death from thermal stress

Climate change is expected to increase the frequency and intensity of extreme heat in both days and nights. Data from 70 monitoring sites distributed across Mongolia show an 8–18 day increase in the length of annual heat waves (or days experiencing temperatures above 25°C).<sup>36</sup> Trends in extreme temperature across the South Pacific for the period 1961–2003 also show increases in the annual number of hot days and warm nights and decreases in the annual number of cool days and cold nights.<sup>37</sup> Studies have shown an association between the number of hot days and children's hospital admissions, mostly for fever from heat stress.<sup>38</sup>

## 3.3 Increased risk of water scarcity

Climate change will alter precipitation, evaporation, runoff water and soil moisture, threatening the water security of many populations. Regional data show an alarming trend. In Indonesia, studies indicate a decline in stream flow over the past two decades for some of the largest watersheds.<sup>39</sup> Mongolia has experienced a 19 per cent decline in surface water since the 1970s (see box 2).<sup>40</sup>

### Box 2: Children's role in water fetching in Mongolia

Mongolia is especially vulnerable to water scarcity. About 35 per cent of Mongolian households living in gers (traditional mobile dwelling) acquire drinking water from open water sources, such as springs, rivers, streams and lakes (Census, 2010). The 2009 *Assessment Report on Climate Change* (MARCC) discloses that 852 of Mongolia's 5,128 rivers and streams, 2,277 of 9,306 springs and 1,181 of 3,747 lakes and ponds had dried up over the past decade (Dagvadorj, 2009: 61). Recent studies suggest that variations in temperature and precipitation will negatively affect aquifer recharge and water levels, leading to water shortages (Batimaa et al., 2011).

In most families, the responsibility for fetching water rests with children. In Mongolia, more than a third of children spend three to four hours a day collecting water, braving frozen rivers and wells in winter and hauling containers long distances (Nenova-Knight, 2011).

Variations in rainfall and snow melt is likely to affect surface-water resources and groundwater recharge, cause flooding, soil erosion and landslides, and affect people's access to safe water sources when access to freshwater sources is already strained. Already, average per capita freshwater availability in the Asia-Pacific region is the second lowest in the world. Per capita water availability in Indonesia is only 372 cubic metres per year, with Java the most water scarce of all provinces.<sup>41</sup> (Per capita allocation of 1,700 cubic meters per year is considered the benchmark for water scarcity.) In Mongolia,

<sup>36</sup> Batima, 2005: 16

<sup>37</sup> IPCC, 2007

<sup>38</sup> See Lam, 2007

<sup>39</sup> Urbano et al., 2011

<sup>40</sup> Dagvadorj et al., 2009: 15

<sup>41</sup> See CIA, 'The World Factbook'

water consumption of the population living in the traditional ger<sup>42</sup> districts of large cities, town centres and big settlements is equal to 8–10 litres per person per day, which is four to five times lower than the accepted sanitary norms.<sup>43</sup> The Pacific Islands are particularly vulnerable to water scarcity. Most islands have limited water supplies, and slight variations in the distribution and frequency of rainfall could lead to drought conditions.

### 3.4 Transmission of waterborne and food-borne diseases

Climate variables may have an impact on the replication rate of bacterial and protozoan pathogens that cause diarrhoea.<sup>44</sup> A study from Japan found that the weekly number of infectious gastroenteritis cases increased by 8 per cent for every 1°C increase in the average temperature.<sup>45</sup> A study of the relationship between climate variability and the incidence of diarrhoea in the Pacific Islands found a positive association between annual average temperature and the rate of diarrhoea reports and a negative association between water availability and diarrhoea rates. Floods have a particularly large effect on the incidence of waterborne diseases.<sup>46</sup> In September 2008, for example, more than 200,000 people in northern Thailand were diagnosed with waterborne diseases after 19 days of heavy flooding.<sup>47</sup> In Manila, a large outbreak of leptospirosis<sup>48</sup> was reported after tropical storms and severe flooding in October 2009.<sup>49</sup>

An increase in the prevalence of environmental pathogens can have severe implications for children, especially when already vulnerable to disease. In Mongolia, although 14 per cent of deaths of children younger than 5 years are already caused by diarrhoeal disease, the highest rates of incidence of dysentery and salmonella in recent years occurred between 2001 and 2003, coinciding with a severe drought in which springs and small rivers dried

up throughout the country.<sup>50</sup> Acute water shortages from droughts and contamination of freshwater supplies from flooding may increase the number of people using untreated water for drinking or crop irrigation, increasing the risk of infectious waterborne diseases, such as diarrhoea, hepatitis A and cholera.

### 3.5 Changes in incidence and distribution of vector-borne diseases

Studies of the effects of temperature on malaria and dengue incidence have found that increased temperatures shorten the viral incubation period and the breeding cycle in mosquitoes and increase the frequency of mosquito feeding, allowing for more efficient transmission of the parasites from mosquitoes to humans.<sup>51</sup> In modelling the effects of weather and climate change on malaria transmission, Parham (2010) identified an optimum temperature of around 32–33°C at which endemic transmission and the rate of malaria spread in disease-free regions increased.<sup>52</sup> The location of vector outbreaks may change as temperature increases. Changes in rainfall patterns may also affect the transmission of some vectors. The IPCC reported very high confidence that the geographical range for malaria will contract in some place while in other locations it will expand. The transmission season may also change. For example, a study in Ecuador<sup>53</sup> of five species of the Anopheles mosquito (transmitters of malaria) show higher maximum elevation levels (2,100–2,400 metres) for four Anopheles species that had been previously contained to coastal lowland regions (less than 500 metres).<sup>54</sup> Similarly, studies in India have recorded that the distribution of the Aedes aegypti mosquito (carrier for dengue, yellow fever and Chikungunya) has moved from a normal height of 500 metres above sea level to altitudes as high as 2,200 metres, such as in Darjeeling, India.<sup>55</sup>

<sup>42</sup> Traditional mobile dwelling, typically made of a wooden frame and felt insulation with a canvas cover.

<sup>43</sup> Batimaa et al., 2011

<sup>44</sup> Zhang et al., 2007 and Hashizume et al., 2008

<sup>45</sup> Onozuka et al., 2010

<sup>46</sup> Singh et al., 2001

<sup>47</sup> IRIN, 2008

<sup>48</sup> A bacterial infection spread through animal-human contact.

<sup>49</sup> See <http://www.irinnews.org/report.aspx?ReportId=86779>

<sup>50</sup> Nenova-Knight, 2011

<sup>51</sup> Gething et al., 2011 and Parham et al., 2010

<sup>52</sup> Parham et al., 2010

<sup>53</sup> The study collected larvae over three years (2008–2010) throughout nearly all regions of Ecuador. Larvae were identified using morphological key and gene sequencing. Spatial statistics were also used to identify density clusters of each species of Anopheles mosquito; see Pinault et al., 2011: 1.

<sup>54</sup> Pinault et al., 2011: 1

<sup>55</sup> Narain, 2008

Development practices and disease eradication programmes will considerably influence the incidence and transmission of malaria and other vector-borne diseases. Indeed, malaria incidence has contracted in many parts of the world as a result of successful disease control programmes.<sup>56</sup> To maintain this success, governments will need to consider new areas of transmission in addition to maintaining disease prevention programmes in traditionally endemic areas. This is especially important because malaria still claims the lives of one million people a year, most of them children, and causes 350 million to 500 million illnesses annually.<sup>57</sup> It also contributes to anaemia in children – a major cause of poor growth and development – and in pregnant women, contributing to maternal deaths, low birth weights and neonatal deaths.

### 3.6 Migration due to extreme weather events, declining livelihoods

Field consultations in Indonesia produced possible links between climate change and human migration patterns. Consultations in East Nusa Tenggara province (Nusa Tenggara Timur, or NTT) indicate that weather-induced crop failure is a factor in the decision among farmers and mothers to move for non-agricultural work to the provincial capital of Kupang or even beyond NTT as well as to non-agricultural work within the province.<sup>58</sup>

The driving factors behind migration are multiple and complex, and climate change, to date, is typically not the sole reason influencing people's decision to migrate. Nonetheless, for all countries, a large part of the migration experience remains temporary and seasonal as people move in response to agricultural and weather cycles.<sup>59</sup> It is a reasonable expectation that seasonal migration could be extended, with the potential for longer periods of out-migration, especially for seasonal migrants, if changing weather conditions make agriculture less viable as a source of income.

Studies also suggest that livelihood diversification through migration can be an important adaptation strategy in reducing household vulnerability, if done well.<sup>60</sup> Variables that are likely to influence the effect of migration on children include whether they migrate with parents, whether the mother, father or both parents migrate and whether the migration is circular (seasonal rural-urban migration).<sup>61</sup> Duration of parental absence, the socio-economic status of the household, the effect of migration on the household income and the caring capacity (including feeding knowledge and practices) of guardians are also important. If not managed well, displacement and forced or voluntary migration can lead to a host of problems for children, including loss of social networks and cultural identity, and disruptions in health care and school attendance. Children who migrate from rural to urban areas may encounter difficulties in continuing their education and may be forced to work to help their family recover the costs of moving. Recently migrated families may not be able to afford school or civil registration fees. Schools that are overcrowded may refuse taking in migrant children due to lack of capacity.<sup>62</sup> Children who are new to a school may also experience discrimination.<sup>63</sup> In Mongolia, migrant children are four times more likely to drop out of school than non-migrant children.<sup>64</sup>

### 3.7 Relocation caused by sea level rise

The IPCC *Fourth Assessment Report* projected a rise in global sea levels of between 18 and 59 centimetres by 2100. More recent studies indicate an average global sea level rise between 75 and 190 centimetres by 2100.<sup>65</sup> Sea level rise will have a disproportionate impact on the lives of people living in coastal areas due to flooding, coastal erosion, storm surges, saltwater intrusion and other coastal hazards.

In Indonesia, those at risk include some 42 million people living in areas less than 10 metres above current mean sea level. A 1-metre rise in sea levels is estimated to

<sup>56</sup> Gething et al, 2010: 342

<sup>57</sup> See [www.unicef.org](http://www.unicef.org).

<sup>58</sup> Urbano et al., 2011

<sup>59</sup> Other factors driving households to urban areas include the need for cash income to purchase essential commodities, access to health care and education for children, access to water, sanitation and food and livelihood security and access to transport and markets.

<sup>60</sup> See Soumyadeep et al., 2011 and Urbano et al., 2011

<sup>61</sup> Urbano et al., 2011

<sup>62</sup> UN DZUD Appeal, 2010

<sup>63</sup> Batbaatar, 2005

<sup>64</sup> Nenova-Knight, 2011

<sup>65</sup> Vermeer and Rahmstorf, 2009

<sup>66</sup> Urbano et al., 2011



inundate approximately 400 square kilometres of land in Indonesia, much of it arable and/or densely populated.<sup>66</sup>

Sea levels are currently increasing at a rate of 3.9 millimetres per year for Kiribati (1992–2010) and 5.6 millimetres per year for Vanuatu (1993–2009).<sup>67</sup> Sea level rise will likely require some households to relocate (see box 3 for a child's perspective on sea level rise). Internal resettlement of coastal populations has already occurred in Kiribati, Tuvalu and Vanuatu. Research on Kiribati and Vanuatu indicates that the incremental process of sea level rise will first affect those who do not have sufficient capacity (or space) to avoid the risk. In Betio, Kiribati's 'urban atoll', the density of the population is likely to inhibit options for moving from the coastal foreshore.<sup>68</sup> Some communities have already had to relocate as a result of coastal erosion over the past few decades.<sup>69</sup> In Kiribati, the majority of children's homes, health facilities, schools, churches and recreation areas are located within a few hundred metres of the coast. For Vanuatu, sea level rise already presents a direct threat to those in low-lying coastal areas.

**Box 3: Impact of sea level rise in East Asia and the Pacific**

*"There is no way we can live because land of ours that we are going to build our gardens, it's gone....land is washed away by waves and we don't have enough space for everyone to live". Child in Kiribati, from Burton et al., 2011*

The consequences of rising sea levels are already felt by the region's children, especially in the Pacific. Rising sea levels forced approximately 2,600 people from the Carteret Islands to relocate to Bougainville, also in Papua New Guinea, in 2006, while an entire village in the Torres Islands, in Torba province (north Vanuatu), had to relocate due to increased coastal erosion (due to a combination of seismic land movement and sea level rise).<sup>70</sup>

Some countries are also exploring the possibility of buying land in other countries as a long-term adaptation strategy. Approximately 3,000 people

from Tuvalu already have migrated to Auckland, New Zealand, many of whom were prompted to move in part by changes in their environment.<sup>71</sup> For Vanuatu and Kiribati, international relocation may be an unavoidable solution to the adverse impacts of climate change.

While offering a long-term solution to at-risk populations, international relocation raises a host of issues for children, from loss of cultural identity to ensuring legal entitlements, protection and access to public services in the receiving State. Policy measures will be needed to ensure that households receive adequate economic, social and psychological support and that all rights under the Convention on the Rights of the Child are upheld. It is especially important that relocation policies do not lead to unintended impacts. The 'safer islands' approach under consideration in the Pacific prioritizes specific population centres in terms of investment in infrastructure and services.<sup>72</sup> Though potentially a positive adaptive solution for families at risk, children from areas that are not prioritized for the installation of resilient infrastructure may be required to travel or temporarily relocate from their homes for education or health services, which may have implications in terms of child protection as well as social cohesion. It may also affect the quality of education if a large number of children relocate to areas in which the school system is already heavily populated. Governments will need to ensure adequate protection and support of children and their families that are forced to temporarily or permanently relocate in order to access services.

### 3.8 Disruptions in school attendance

Children may be forced to miss or drop out of school as a result of destruction of schools or related infrastructure or to help their families recover from extreme events.<sup>73</sup> Interviews conducted during the UNICEF 2011 research in Kiribati and Vanuatu revealed that children were often kept out of school after extreme events to help their family and community clean up debris. Negative impacts of climate change on livelihoods would make it more likely that parents remove their children from

<sup>67</sup> AusAID, 2007

<sup>68</sup> Burton et al., 2011

<sup>69</sup> Reed, 2011

<sup>70</sup> Perry, 2006

<sup>71</sup> Warner, 2009

<sup>72</sup> Burton et al., 2011

<sup>73</sup> Baez et al., 2010

school. A review conducted by the World Bank on the impact of disasters on human capital shows that household income typically falls after a disaster, especially for already poor households; the effects of reduced household expenditure included a decline in investments in children's education.<sup>74</sup> A study on school enrolment in rural areas of India found that a 10 per cent decline in agricultural income due to heavy rainfall led to an average decline in school attendance of five days.<sup>75</sup> A sustained drought in 2006 in Gode, Ethiopia, contributed to high rates of student absenteeism and drop-outs; girls were often the first to be removed from school. In the Gode zone, 8 of 31 schools were forced to close due to high drop-out rates.<sup>76</sup> The 2011 UNICEF research in Indonesia, Mongolia and the Pacific provide anecdotal evidence of this. When asked about experiences in the previous year due to weather events, children interviewed in Indonesia reported that they had to quit school due to a lack of money, which they associated with crop failure. This was the case far more often in rural than in urban communities.<sup>77</sup>

### 3.9 Heightened risk of food insecurity and child malnutrition<sup>78</sup>

Undernutrition, which includes stunting, poor foetal development and micronutrient deficiencies, is already the underlying cause of 3.5 million child deaths and 35 per cent of the disease burden in children younger than 5 years of age globally.<sup>79</sup> Child undernutrition is associated with many factors, including household income, maternal health and education, vaccinations and medical care at birth, disease and feeding and hygiene practices at home. Children who are undernourished are more susceptible to a range of risks related to weather and climate, including pneumonia, diarrhoeal disease and infections.<sup>80</sup>

Climate change may also affect nutrition through reduced food security (box 4). Agriculture provides more than 50 per cent of the

livelihood base in the Asia-Pacific region and a significant portion of gross domestic product for most countries. Agriculture is vulnerable to changes in temperature, precipitation and the salinity of water. High temperatures reduce crop yields while also encouraging weed and pest proliferation; changes in precipitation increase the likelihood of crop failures and production declines.<sup>81</sup> Although some regions may experience an increase in crop productivity as a result of more favourable growing conditions, the overall impacts of climate change on agriculture are expected to be negative, threatening global food security.<sup>82</sup>

Although climate modelling of agriculture is in its infancy, early research suggests that some of the region's largest food-producing countries are projected to experience a decline in crop productivity as a result of climate change.<sup>83</sup> For example, a study in Indonesia found that a one-month delay in rainfall translated to an 11 per cent decline in the yield of wet season rice in East Java and Bali (an area that, together with Central and West Java, provides approximately 55 per cent of the national rice yield).<sup>84</sup>

Climate change modelling<sup>85</sup> conducted by the International Food Policy Research Institute shows an increase in real agricultural prices (under current emission trends) as demand outstrips supply due to the negative productivity effects of climate change.<sup>86</sup> The study used a global agricultural supply-and-demand projection model (IMPACT, 2009) linked to a biophysical crop simulation model (Decision Support System for Agrotechnology Transfer, or DSSAT) to project the impact of climate change on five crops. The model simulated growth in crop production, determined by crop and input prices, rates of productivity growth and area expansion, investment in irrigation and water availability.<sup>87</sup> Three combinations of income and population growth were used: a baseline scenario, a pessimistic scenario and an optimistic scenario.<sup>88</sup> These scenarios were tested against five climate

<sup>74</sup> Baez et al., 2010: 8

<sup>75</sup> *ibid.*: 12

<sup>76</sup> See [http://www.unicef.org/infobycountry/ethiopia\\_34733.html](http://www.unicef.org/infobycountry/ethiopia_34733.html) for more information.

<sup>77</sup> Urbano et al., 2011

<sup>78</sup> The term 'malnutrition' encompasses under- and overnutrition, the latter not being addressed here. Acute malnutrition or 'wasting' means low weight for height, and chronic malnutrition is indicated by 'stunting' or low height for age. Undernutrition also includes poor foetal growth and micronutrient deficiencies, the so-called 'hidden hunger', which results from an insufficient intake or failure to absorb vitamins and minerals because of diarrhoea. Undernutrition diminishes immunity to disease, which also decreases nutritional status (from Urbano, 2011).

<sup>79</sup> Black et al., 2008

<sup>80</sup> Mitrshahi et al., 2007

<sup>81</sup> Nelson et al., 2010: vii

<sup>82</sup> *ibid.*: vii

<sup>83</sup> ADB, 2009: 5-6

<sup>84</sup> Urbano et al., 2011

<sup>85</sup> The report used two climate models, the National Center for Atmospheric Research and the Commonwealth Scientific and Industrial Research Organization models, based on the IPCC A25 scenario to simulate future climate impact; see Nelson et al., 2010: vii-viii for more details.

<sup>86</sup> Nelson, G. et al., 2010 : 21

<sup>87</sup> Nelson, G. et al., 2010



#### Box 4: Viewing climate change through a child's eyes



*"Because of the high rainfall the fertility for the corn is not good, and it means that the plants get unhealthy to the point where they die. If the corn dies, it also means that the country people will have a difficult economic situation."* Quote and photo by a child in East Java during the Photovoice exercise



*"One shoot of corn is standing shriveled in a dry field. There is no water source that can help it to grow normally. This means the harvest will not be what the farmer hopes. So farmers' work becomes futile."* Quote and photo by a child in NTT during the Photovoice exercise

The UNICEF-commissioned research team explored children's vulnerability to climate change and disaster impacts in Indonesia, with a specific focus on nutrition and health impacts of children in East Java and East Nusa Tenggara (NTT). The study incorporated a survey component designed for children and youth. The survey found that rural children commonly reported negative experiences associated with not having enough water, including harvest failure and drought. Children in urban areas reported negative experiences with flooding of their house or street. This is not to suggest that rural areas have experienced less water and urban areas have had more. Rather, it illustrates how experiences will differ across groups of children. Urban children are likely to have access to municipal water sources, so drought conditions may not be as noticeable to them. Poor drainage in a city centre, however, may make flooding a more visible issue. Children in rural areas may be more reliant on wells and hand pumps for water and will therefore be more affected by drought conditions. Significant in these responses is the indication of food and water security stresses. Almost a quarter of the rural children surveyed responded that they had to drop out of school due to not having enough money due to crop failure. Almost one third of rural children had parents move for work because of food shortage or harvest failure due to adverse weather. Families interviewed reported reduced meal intakes and an increase in the agricultural burden on women (see Urbano et al., 2011 for other findings and results of the Photovoice exercise in which children were given cameras to respond to a question or theme through photographic imagery (and then describe the significance of the images).

scenarios, ranging from slightly to substantially wetter and hotter on average than the current climate as well as a scenario depicting perfect climate mitigation that halted greenhouse gas emissions (and today's climate exists into the future).<sup>89</sup> Climate change effects were assessed using two indicators: per capita calorie consumption and child malnutrition. Under these three scenarios, food prices increased between 31.2 per cent for rice under the optimistic scenario to 100.7 per cent for maize under the baseline scenario. Even under a perfect climate mitigation scenario, prices increased by 18.4 per cent for rice under the optimistic scenario

and 34.1 per cent for maize in the pessimistic scenario.<sup>90</sup> In terms of calorie availability, the number of malnourished children in developing countries falls by more than 45 per cent between 2010 and 2050, but by only 2 per cent under the pessimistic scenario. For middle-income countries, the number of malnourished children declines by 50 per cent, but by only 10 per cent in the pessimistic scenario. For low-income countries, rates decline by 37 per cent under the optimistic scenario but increase by 18 per cent under the pessimistic scenario.<sup>91</sup>

<sup>88</sup> The report defines a baseline scenario as being 'middle of the road'; a pessimistic scenario is likely to result in more negative outcomes for human well-being; and an optimistic scenario results in more positive outcomes; see Nelson, G. et al., 2010: xvii.

<sup>89</sup> *ibid.*: xvii

<sup>90</sup> Nelson, G. et al, 2010: xviii

<sup>91</sup> *ibid.*: xviii; see the report for more detailed explanation of the findings.

This suggests that many of the region's families who are poor are particularly vulnerable to price increases. The poor already spend a disproportionate amount of household income on food. An increase in the price of staple foods is the equivalent of a decrease in real income for poor households, which reduces the amount of disposable income available for purchasing food items or health care or for investing in education.

The magnitude of climate change impacts on food security will ultimately depend on the extent to which the global community: supports beneficial trade policies that promote trade between net consumers and net producers of food; implements sustainable development and land use practices; strengthens investments in agricultural productivity, especially in crop varieties and irrigation practices; and reduces global greenhouse gasses. Implementing proactive measures will determine whether,

by 2050, children experience the optimistic or pessimistic scenario.

### 3.10 Livelihoods

Climate change affects the livelihoods of people who are poor through repeated floods, droughts and other disasters, although urban and rural areas are affected differently. While the rural poor often build up productive assets, such as livestock, as a form of self-insurance during times of shocks, the urban poor are more limited in their asset creation and their access to insurance (see box 5). For families just barely able to meet their basic needs, any additional income stress from delayed harvests or increased costs for food could drive families to adopt adverse coping strategies, such as withdrawing children from school or selling off assets that ultimately will exacerbate their underlying vulnerability.

#### Box 5: Compounded effects of drought and extreme winters in Mongolia

Mongolia is highly dependent on pastoralism and thus the environment for sustaining livelihoods. The pastoral livestock sector engages more than half of the population and provides food (meat and milk) and fibre to the majority of the population. Agriculture and animal husbandry, and the grasslands and water resources on which they depend, are particularly vulnerable to droughts and dzud events. Approximately 70 per cent of the total land in Mongolia is classified as desertified, with losses of soils and soil fertility due to erosion (Dagvadorj et al., 2009: 64). Areas with unfavourable grazing conditions are expected to increase to 65–70 per cent by 2050 and to 70–90 per cent by 2080, due to climate change (Dagvadorj et al., 2009: 205). Some plant species are growing one to two months later as a result of declining precipitation, while others are growing with fewer leaves or at a reduced size. High-nutrient plants have declined by 1.5–2.3 times since 1940 (Boldgiv, 2009: 28).

With poorer grazing conditions, the live weight of animals is expected to decrease significantly, especially in the forest-steppe and steppe regions. Data already show a decline in average weight of sheep, goat and cattle, by 4, 2 and 13 kilograms, respectively, from 1980–2001 (Dagvadorj et al., 2009: 202). Low weight affects other development processes, such as fertility and birth, productivity and resilience to cope with extreme winter weather. Animal mortality is expected to increase to 12 per cent by 2020 and to 18–20 per cent by 2050 (Dagvadorj et al., 2009: 72).

Livestock loss can have devastating effects. Livestock and livestock productivity is the livelihood base for nearly half of Mongolia's population. Rural populations are almost entirely dependent on livestock for nutrition as well as for trade and income. Loss of livestock means less income, less food and less protection for these populations.

The 2010 dzud provides a telling example: A study by UNDP following the 2010 dzud found that of 32,500 small subsistence-level herders (owning fewer than 250 animals) in the 14 worst-affected aimags, 17 per cent reported experiencing a shortage of food for daily consumption due to a lack of cash to buy food, resulting in hunger; 83 per cent reported a lack of cash to engage in any new business for income generation; and 61 per cent reported having a bank loan requiring repayment in the near future (UN Dzud Appeal, 2010). The large number of livestock deaths (8.5 million) prevented families from selling milk, meat and cashmere fur for income. Families reported using cash for children's school supplies on food for the household. The implication is that even a small risk of increased droughts and effects to livestock as a result of climate change and the knock-on effects related to poor nutrition and disruptions in education could lead to development setbacks for children and their families (see Nenova-Knight, 2011 for other findings.)

## 4. Engaging children in climate change adaptation

Climate change presents a challenge to children but also offers opportunities for interventions that the international community has not yet recognized. Recent climate change studies have noted the “dominance of vulnerability narratives” and the pessimistic tone of consultations with children about climate change.<sup>92</sup> Although analysis of risk and differential adaptive capacities among children is needed, an exclusive focus on vulnerability overlooks existing examples of children contributing to climate change adaptation<sup>93</sup> as well as broader development processes.<sup>94</sup>

Research and case studies show that children and youth can be strong advocates, helping their families, schools and communities adapt to climate change.<sup>95</sup> A study by Plan International suggests that children are often more knowledgeable about climate change impacts than adults, based on information learned at school or from accessing environmental resources through other media and communication sources.<sup>96</sup>

With appropriate support provided by adults, children can make positive contributions as analysers of risk and risk-reduction activities, as designers and implementers of climate change and disaster risk reduction interventions, as communicators of risks and risk-management options and as change agents promoting action for community-based resilience and sustainable development, as elaborated below.

### 4.1 Positive roles for children in climate change adaptation

#### 4.1.1 Risk analysers

Children can help communities identify risk based on their understanding of their environment. In all the UNICEF country

studies, children showed a high level of awareness of climate change impacts. In Indonesia, for example, children associated drought periods with increases in food prices. Poster presentations by children in Kiribati and Vanuatu depicted impacts of sea level rise and water scarcity. Children in Chingeltei, in peri-urban Ulaanbaatar, Mongolia, produced detailed maps of hazardous areas and areas threatened by climate change in their community (figure 2). Children also identified play areas that were at risk from landslides and ger homes that they thought were susceptible to flooding.<sup>97</sup>

Child-led hazard and vulnerability mappings have been used effectively in the region to teach children about climate change adaptation and disaster risk reduction and to facilitate their participation in local planning. In Sri Lanka, for example, children participated in mapping hazard risks in and around their schools.<sup>98</sup> Areas identified as risk areas were marked on a paper and hung in an area visible to other students. Activities were conducted to inform other students of these risk areas and to prepare evacuation routes. Hazard mappings have also been linked to local government planning processes.<sup>99</sup> In the Philippines, schoolchildren skilled in disaster risk mapping and vulnerability assessments used their knowledge to successfully persuade school officials and community planners to relocate their school, previously situated in a high-risk landslide zone, to a safer area.<sup>100</sup> These examples demonstrate children’s ability to conceptualize their environments and the risks to their safety; their perspectives can add value to overall risk analysis and planning.

#### 4.1.2 Designers and implementers

Children have distinct perceptions of what is needed for climate change adaptation and disaster risk reduction. In one workshop during

<sup>92</sup> Urbano et al., 2011

<sup>93</sup> ‘Adaptation’ refers to initiatives and measures to reduce the vulnerability of natural and human systems against actual or expected climate change effects. Adaptation can be anticipatory and reactive, private and public, and autonomous and planned (see IPCC AR4, 2007 for more information).

<sup>94</sup> Tanner T., 2009

<sup>95</sup> See Back et al, 2009; Tanner et al., 2009; Pollack, 2010; Gautam et al., 2008.

<sup>96</sup> Plan-UK, 2002

<sup>97</sup> Nenova-Knight, 2011

<sup>98</sup> Sibghatullah et al., 2006: 14. Child-led mappings have also been conducted in India, Thailand and Viet Nam, among others. See [www.childreninachangingclimate.org](http://www.childreninachangingclimate.org) and [www.savethechildren.org](http://www.savethechildren.org) for more examples of child-led disaster risk mapping.

<sup>99</sup> See [www.childreninachangingclimate.org](http://www.childreninachangingclimate.org) for more examples.

<sup>100</sup> Back et al, 2009, p. 30

the UNICEF research, children in Kiribati identified sea level rise as a concern. As a solution, they suggested planting more trees to protect the coastline and building rock walls against water intrusion. Recognizing that local activities to stop sea level rise are not available, children are thinking about these changes, suggesting ways their community can adapt and offering to help. The children also noted that development practices can exacerbate climate impacts: that removing sand (a common practice in some islands) to sell for construction purposes results in greater coastal erosion.<sup>101</sup> In Vanuatu, schools participate in environmental programmes such as Reef Check, in which students visit coral reefs and learn about marine ecosystems and how to protect them.

#### 4.1.3 Communicators

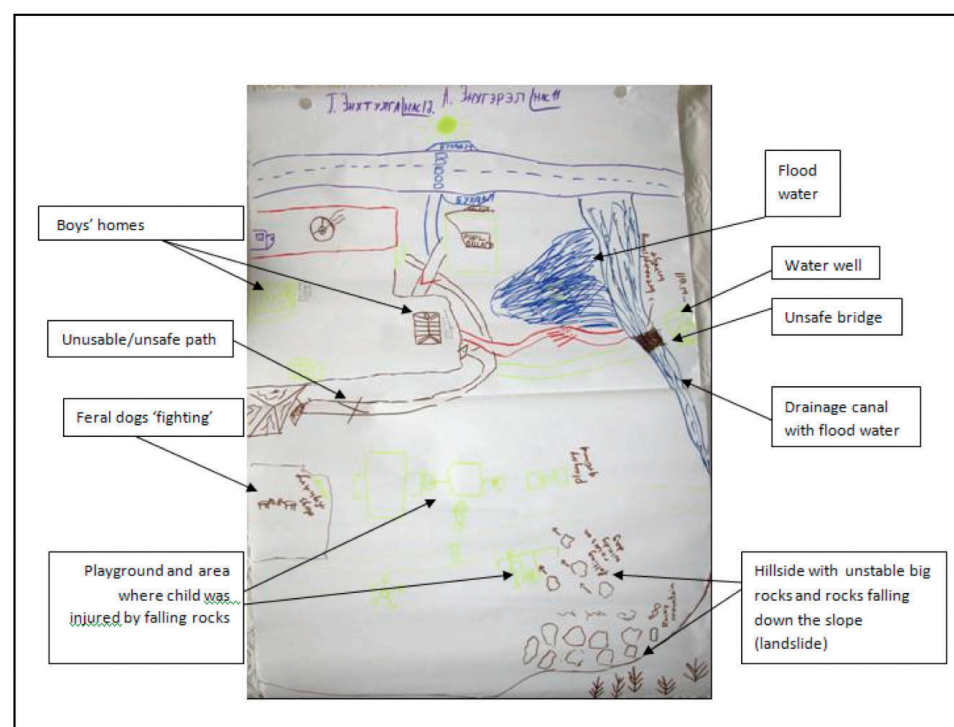
Children have the right to speak for themselves and are often effective when expressing their opinions. In the Philippines, children's groups

have used participatory video as an advocacy tool to lobby local officials on the ways that some development practices (tree cutting and mining) have increased the risk of flooding.<sup>102</sup> In Rembang, Indonesia, children adapted traditional Qasidah music (used often for religious activities) to raise public awareness on disaster risk reduction and environmental issues.<sup>103</sup> In Thailand, a youth network was instrumental in increasing flood preparedness in their community; children also were trained on how to use a rain gauge to monitor water levels and how to detect other signs of flooding.<sup>104</sup>

#### 4.1.4 Change agents

Children have the capacity and interest to contribute to adaptation solutions and decision-making. The UNICEF studies found that children and youth want to engage. When asked what would help children and young people to cope with and adjust to climate change, a majority of children in Indonesia

**Figure 2: Map of hazards drawn by two boys (11 and 12 years old) of their Chingeltei neighbourhood**



Source: Nenova-Knight 2011; photo copyright Preslava Nenova-Knight

<sup>101</sup> Burton et al., 2011

<sup>102</sup> Back et al, 2009: 32

<sup>103</sup> Plan International, 2010: 28

<sup>104</sup> Chainmontree, 2010: 21



replied that they wanted to do something tangible about climate change for their communities and that they wanted to be involved in planning for a future with climate change.<sup>105</sup> There are many examples of children acting as change agents, mobilizing their communities around climate change solutions. In the Solomon Islands, young people have been trained as peer educators in schools and communities and now track seasonal changes, communicate risks and, in times of natural disasters, work to protect their communities. In Viet Nam, 126 children developed and presented a declaration on climate change to government leaders as input for the UN Climate Change Conference (COP15).<sup>106</sup>

More than 600 children across 21 countries provided input towards the development of a Children's Charter for Disaster Risk Reduction in 2011,<sup>107</sup> which calls for stronger commitment from government, development agencies and donor partners to protect children and to use their knowledge and various capacities to engage in disaster risk reduction and climate change adaptation.

The Charter outlines five priority areas:

1. schools must be safe and education must not be interrupted;

2. child protection must be a priority before, during and after a disaster;
3. children have the right to participate and to access the information they need;
4. community infrastructure must be safe and relief and reconstruction interventions must help reduce future risk; and
5. disaster risk reduction response must reach the most vulnerable people.

These examples represent opportunities to support children and young people's shared learning and to promote their participation in policy-making processes and community adaptation events.

#### **4.1.5 Promoters of sustainable development**

Climate change is not only an environmental issue – it is very much a development issue. Climate change is an additional risk factor to what in many instances are structural development issues that are chronic in nature. Investments in sustainable development strategies will help prevent or diminish the causes of climate change and mitigate its adverse effects. Children can contribute to development strategies that ultimately increase the capacity of communities to adapt to a range of climate impacts.

<sup>105</sup> See Urbano et al., 2011 for more findings.

<sup>106</sup> Lawler et al., 2009: 28

<sup>107</sup> See [www.childreninachangingclimate.org](http://www.childreninachangingclimate.org) for a copy of the Charter.

## 5. Barriers to child-friendly adaptation

Although limited in scope, the findings from the UNICEF studies signal opportunities to learn from children about their interactions with the environment and about their practical capabilities and needs, which should be factored into adaptation plans. Yet, while more governments are acknowledging the specific vulnerabilities and capacities of children, few are incorporating children's issues in the necessary policy frameworks. Analysis of the institutional structures in the five countries covered by the studies uncovered a complex array of agencies and overlapping mandates but little focus on children. Where children are mentioned, it is usually in the context of their vulnerability to climate change impacts. For example, a content review of the national adaptation plans of action and the national communications specific to the United Nations Framework Convention on Climate Change in the Pacific region revealed that most acknowledge children's vulnerability (especially regarding health), but only Kiribati and the Solomon Islands provided specific examples of how children can be involved in the adaptation process.<sup>108</sup>

Part of the difficulty in getting children included in climate change adaptation policies is the overall slow progress towards funding and implementing climate change initiatives. Lack of public support for a post-Kyoto Protocol climate change regime remains an impediment for marshalling resources for climate-related initiatives. Despite pledges by developed countries for increased financing, current levels are a fraction of what is needed, and a number of national adaptation action

plans remain underfunded. Governments have been slow to develop robust regulatory, technological and financial systems to move policies and initiatives forward.

Political will to support climate change initiatives at the global and national levels is influenced, to some degree, by the level of data available on climate science and impacts on development. Yet, variations in capturing and reporting social, economic and health statistics, meteorology changes and disaster incidence limit comparability across time scales and across countries. Reporting on subnational data is especially poor. Climate science is also evolving and is largely dependent on development processes – results will ultimately differ depending on which greenhouse gas emission scenario plays out. Governments are often reluctant to put in place expensive measures based on predictions that are couched in uncertainty.

Many countries also lack institutional arrangements to formulate policies and coordinate various needs and budget allocations around climate change and disaster risk reduction. In Indonesia, for example, government functions are divided between sector-based agencies, each with different mandates and responsibilities. Formulating policy rarely involves other sectors, leading to contradictory regulations. Social sectors, such as health, education and social welfare, are typically overlooked when considering funding for climate adaptation projects. This has important implications in terms of planning and executing climate-related initiatives.

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<sup>108</sup> See Burton et al., 2011

## 6. Findings and recommendations

This report provides a brief overview of the potential climate change impacts on children, with particular focus on East Asia and the Pacific. The threat that climate change presents is not only one of greater exposure to hazardous events, such as flooding and cyclones, but also in changes in the range and intensity of existing health disorders and diseases. Climate change impacts may disrupt education and protection networks and provoke more families to relocate in search of better livelihood opportunities. The UNICEF country studies indicate that children of poor households or from families deprived of basic social services due to their geographic location are disproportionately vulnerable because they already lack access to resources and opportunities needed to cope with climate impacts.

Children's first-hand accounts suggest that not all populations will be affected the same way. Reports from children in Indonesia, for instance, indicate that children in rural areas will probably experience some of the highest risks due to reduced food security and impact on overall livelihoods. When discussing impacts of weather events, rural children also reported that one or more family members have migrated for work. Children in Kiribati and Vanuatu expressed concerns about the threat of rising sea levels and the possibility of losing their homes and having to relocate. In Mongolia, children reported losing livestock to drought and harsh winters.

The studies also show that capacity to adapt to climate change is continuously evolving. Children can and do fill an important role in reducing a community's overall risk of, and vulnerability to, climate change. The studies identify a number of activities through which governments and development partners can engage to enhance people's capacity to adapt to climate change.

### 6.1 Preparing for risk

Climate change will exacerbate existing risks while creating new risks of disease outbreaks or sea level rise. Considering the challenges in

developing comprehensive vulnerability and risk assessments, it is important that policies and programmes are risk-informed and relevant. There are many examples of how this can be done, balancing the need for completeness in terms of data with the goal of providing a useful starting point for policy discussion and action. For example, countries can develop a composite map of risks to children, based on hazard data, climate change science and socio-economic factors, to inform planning and programming processes. Participatory risk assessments can help strengthen local planning processes and promote regular interaction between locally elected leaders, NGOs and community members. These can be a useful entry point for child-friendly community-based disaster risk plans and for longer-term climate change adaptation.

### 6.2 Enhancing the knowledge base with surveillance strengthening

Better data generation, reporting and coordination between relevant agencies (such as health, meteorology, hydrology and disaster response) are needed to determine the identity and location of the most vulnerable populations and the factors that could help build their resilience. Governments could work with academic institutions, the private sector and UN agencies to create a system that integrates child-specific data (such as Multiple Indicator Cluster Survey data and Health and Nutrition Management Information System data) with climate change statistics to improve data documentation and flag emerging trends in children's health that require further investigation. Incorporating climate vulnerability indicators into census surveys or Multiple Indicator Cluster Surveys could also help to monitor and capture subnational variations in child development. Specific questions could be included on population movements and on absent family members and their locations to capture migration trends.<sup>109</sup>

Sentinel surveillance of child health and nutrition indicators in climate-vulnerable areas

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<sup>109</sup> Urbano et al., 2011



could help generate real-time information on climate change impacts and trends and serve as an early warning system on food security issues, disease outbreaks and children's overall health. Some governments are already piloting such systems. In Indonesia, the National Institute of Health Research and Development, within the Ministry of Health, launched a three-year pilot project with the World Health Organization and the Center for Disease Control and Environmental Health to develop a sentinel surveillance system that analyses health, weather and environmental data in six districts (in six provinces).<sup>110</sup> A critical niche for UN agencies is to help governments access international experience, expertise and lessons learned on climate change adaptation and disaster risk reduction.

### 6.3 Mainstreaming children's issues into policy documents relating to climate change

The threat that climate change presents is not only one of greater exposure to hazardous events but also of changes in the incidence, range, intensity and seasonality of existing health disorders and diseases. Even how governments respond to climate change threats can exacerbate children's overall risk, for example, by initiating relocation strategies without considering child protection issues. Policies that fail to distinguish children from adults can result in additional harm to children. A coordinated multisectoral effort is needed to address the range of impacts on children and their families.

A variety of ministries will need to be involved to ensure that children's needs and priorities are addressed: the environmental ministry for identifying environmental vulnerabilities; the meteorology department for tracking weather vicissitudes; the education ministry for ensuring quality education and safe school environments and promoting feeding programmes; the health ministry for strengthening surveillance and early warning systems as well as the health care system in vulnerable areas; the finance ministry for ensuring adequate social expenditures and allocating climate change-specific budgeting; the social welfare ministry for ensuring

protective environments and targeting protection and social services support, particularly to vulnerable groups; and the planning and interior ministries for strengthening coordination across agencies involved in disaster management and development planning. An effective coordinating mechanism is also needed.

Some countries have created sector-based working groups that encompass line ministries, civil society, the private sector and donors to coordinate priorities around climate change and disaster risk reduction. For example, Indonesia created a National Council on Climate Change in 2008 to develop climate change policies and coordinate climate change activities across relevant ministries. Similarly, in 2010, Thailand created a Climate Change Coordinating Unit under the Office of the National Environment Board. Mongolia has established an inter-disciplinary and cross-sectoral national Climate Committee, led by the Minister for Nature, Environment and Tourism, to coordinate and guide climate change activities and policy measures. Such groups offer entry points for making sure that child-centred data relating to climate change is adequately integrated within poverty reduction and sustainable development strategies and health planning and that children's needs and rights are mainstreamed into project designs.

Several governments and international financial institutions have earmarked funds for climate change mitigation and adaptation activities. For example, Indonesia has developed a Climate Change Trust Fund that serves as a financing mechanism for implementing national climate change policies and programmes. Other funds include the Copenhagen Green Climate Fund, the World Bank Climate Investment Funds (including the Clean Technology Fund and Strategic Climate Fund), the Global Environment Facility's Least Developed Countries Fund and Special Climate Change Fund, and the Adaptation Fund.<sup>111</sup> It is important that governments uphold their commitments under the Convention on the Rights of the Child by increasing investments that improve children's adaptive capacities and by safeguarding that related investments and activities take children's concerns into account.

<sup>110</sup> *ibid.*

<sup>111</sup> See [http://www.climatefund.info/climate\\_fund\\_info](http://www.climatefund.info/climate_fund_info) for more information on climate change-related funding mechanisms.

It is important that as governments prioritize adaptation assistance, traditional funding support for development issues, and especially funding for health and education, is maintained.

#### **6.4 Strengthening health systems and scaling up health and nutrition interventions**

Climate change will probably alter the spatial distribution of vectors and potential diseases, pushing them into currently non-endemic areas. Additional investments will be needed to strengthen and improve health systems, water and sanitation services and related health infrastructure in those areas. Advances in mobile phone technology for disease surveillance, emergency services, diagnostic tests and transportation systems (bicycle ambulances) make such scaling up more feasible. Other interventions can include livelihood diversification assistance, vocational skills training and awareness raising on proper nutrition for growing children and pregnant women.

#### **6.5 Expanding social protection**

Addressing children's vulnerability to climate change will require a combination of policy measures, some sector-specific, others cross-cutting. Social protection, which refers to programmes that reduce economic and social vulnerability of families through cash transfer, social insurance and skills training programmes, can help build resilience to climate change impacts. This type of investment in productive livelihood assets strengthens people's, and thus communities', capacity to manage risk.

Governments will need to assess current social protection systems against future climate risks because already strained systems may not be able to cope with even a minimum level of protection against increased risks, which could exacerbate issues of vulnerability and social exclusion. Countries could explore integrated social protection systems that offer a suite of community-based options to address poverty

and livelihood insecurity as a result of disasters and climate change (such as microinsurance for farmers and fishermen and targeted benefits packages based on food prices).

#### **6.6 Promoting environmental education and life skills**

Climate change presents an opportunity for children to learn about their environment and community and their role as global citizens. Many children are already aware of climate change through the media and both formal and informal education activities. An array of child-sensitive climate change education and disaster risk reduction resources are being developed that support children – as both active learners and teachers. Such initiatives include school and community projects to build knowledge, skills, values and attitudes; organizing school-wide projects to decrease a school's carbon footprint (using earth science and mathematics) and providing community outreach and resilience-building programmes and activities, such as swimming classes.

Many governments have mainstreamed climate change adaptation and disaster risk reduction into the education system. The Ministry of Education in Maldives, for example, recently revised its environmental education curricula for primary schools and incorporated climate change issues into textbooks and teachers' guides for grades 3–5. The Philippines Department of Education is mainstreaming climate change education into its public school curriculum. The Government of Thailand has a national policy on mainstreaming disaster risk reduction into the primary and lower secondary school curricula. Schools in India have introduced environmental awareness into their syllabus.<sup>112</sup>

All schools should work to raise students' 'environmental intelligence'. Technical and vocational education and training as well as non-formal education need to also adapt to the requirements of low-carbon economies (such as jobs in green technologies).

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<sup>112</sup> UNICEF is developing a resource kit on integrating climate change issues and disaster risk reduction responses into education curricula.

## **6.7 Ensuring genuine participation of children in climate change adaptation efforts**

Climate change is an intergenerational problem – it requires an ‘inter-generational agent’ to adapt and manage it. Children and youth represent a tremendous resource of skill and creativity that has yet been tapped. As the UNICEF country studies illustrate, children and youth want to be engaged. This is underscored by the emergence of child and youth advocacy groups and social networking media sites around issues of climate. Governments, the United Nations and development partners should support the vocal participation of children and young people in policy decisions through investments in national youth policies, children’s parliaments and youth advisory councils and innovations in ICT and mobile technology to foster a sense of social activism on climate change.

## **6.8 Scaling up proven interventions**

Many of the above solutions have been shown by pilot programmes in one or more countries, to be effective strategies that reduce the vulnerability of children to the effects of climate change. Sleeping under insecticide-treated nets protects children from vector-borne diseases at low cost and could easily be extended to cover all endemic areas. Diarrhoea and cholera are curable with antibiotics and oral rehydration therapy, treatments that are easily administered even in the most remote areas. Abolishing school fees, providing cash transfers to poor families and introducing water, sanitation and hygiene programmes in schools are all proven interventions that boost school enrolment and attendance. In all these cases, and many of the others described above, low cost feasible strategies already exist and have been tested in the field, in pilot communities, districts or provinces. Achieving full national coverage with these basic social goods for children is not just good climate change protection – it is desirable in its own right. The seemingly inexorable approach of climate change and more frequent extreme events makes the essential provision of these goods equally inescapable.

## 7. Conclusions

This report presents an analysis of the climate change trends and potential impacts on children in East Asia and the Pacific, drawing on findings from the UNICEF-commissioned country studies, children's own perspectives on climate change and other research. The findings pointedly reiterate that children are vulnerable to the adverse impacts of climate change and are already reporting ramifications in their lives and livelihoods. The findings also point out how children regard addressing climate change with enthusiasm and are, in many ways, already working with their families and communities to prepare for and adapt to climate change effects. The evidence demonstrates the importance of understanding children's perception of the risks they face in broader climate change planning. Ultimately, developing children's various capabilities will determine their resilience to climate change.

Vulnerability is not a static process: it is driven by a range of social, economic and political variables. Reducing children's vulnerability to climate change means implementing specific child-friendly adaptation policies and programmes, but it also requires strengthening broader socio-economic development, addressing social and gender inequalities and improving political, legal and institutional governance as well as public services. This further requires strong coordination and, above all, political will. Low-cost interventions should be scaled up where appropriate and new interventions considered in light of the changing risk profiles – giving priority to areas where vulnerability is already high and where climate change impacts are likely to overwhelm existing capacity.

Greater attention should be given to understanding the characteristics of vulnerability, adaptive capacity and resilience of communities through better subnational data collection and sharing. Research is also needed on the effect of adaptation programmes and policies on households and communities, including the role of social protection and other support to strengthen community resilience and ability to cope with climate-related shocks. Further analysis is needed on the relationship between climate change and migration patterns as well as on climate change impacts on child nutrition.

The impacts of climate change have great potential to adversely affect the lives and well-being of children. Policies and decisions made today will set the course for years to come. Children's experiences, and the risks they face in terms of health impacts or of schooling are unique compared with those of adults. Specific child-friendly policies are important for protecting populations as a whole from the impacts of climate change. It is in this context that countries must consider their obligations to mitigate climate risks and uphold children's fundamental rights to live in a safe and decent environment, as codified in the United Nations Convention on the Rights of the Child. The perspectives of children and youth should be integral to this process, focusing not only on the differential impacts that climate change is having on them and the additional economic burden it levies on future generations but also the contribution children can make in managing the changes and the threats. Having developed environmental and community awareness as children, they will have gained the necessary building blocks to help protect future societies as adults.

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