

Preface

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1. Climate Change as Certainty

Recent measurements show that the earth's average surface temperature is rising at an accelerating rate. If this rate continues, the resulting change in daily weather patterns will most certainly have a major impact on everything from water resources and disaster preparedness to natural ecosystems and food production.

Both natural and human systems can tolerate a certain amount of change. Terrestrial and marine communities of plants and animals can, to a certain extent, adjust to rising temperatures and consequential changes in the weather environment. And if the change is significant, they can adapt by changing themselves. Human societies can also adjust, by turning on the air conditioning during a heat wave, or by fortifying protective infrastructure in the case of disasters caused by windstorms and floods. Such modifications to natural and human systems made in response to current or projected climate changes and their impacts, with the intention of minimizing adverse impacts or capitalizing on emerging opportunities, are what we call climate change adaptation.

Regardless of the causes of our changing climate, there are limits to our adaptive capacity, which means that we must work to eventually stabilize it. If climate change is a natural one, biological and human communities have no choice but to surrender and do everything in their power to adapt. However, if the current climate change is caused by anthropogenic factors, we can survive by controlling those factors and stabilizing climate within the range of our ability to adapt.

The Fifth Assessment Report (AR5) of the Intergovernmental Panel on Climate Change (IPCC), published in 2013, states that present climate change is "extremely likely" due to anthropogenic increase in greenhouse gas (GHG) concentrations. This means that mitigation of climate change through anthropogenic control is possible. If we can adequately mitigate climate change by reducing GHG emissions, natural and human communities will be able to survive on less adaptive effort.

The global mission of stabilizing climate by reducing GHG emissions is being driven by the United Nations Framework Convention on Climate Change (UNFCCC). The prospect of stabilizing climate looks bleak within the current agreement, set by the Kyoto Protocol, wherein only some industrialized nations have committed to reducing their GHG emissions. For this reason, the UNFCCC is advancing negotiations to create by 2015 an international framework in which all parties will participate in reducing emissions starting in 2020.

The current consensus is that by 2050, total global emissions of carbon dioxide need to be reduced to half their current level (30 billion tons per year) in order to stabilize climate and limit global temperature rise to 2 degrees Celsius above pre-industrial levels, the level targeted by the UNFCCC, G8, and others in the international community. To do that, the world's nations need to reduce by 2030 at least 8 billion tons *on top of* the amounts they have committed to reducing under the 2010 Copenhagen Accord.

But international negotiations on GHG emissions reduction are moving far too slowly. Many are coming to the realization that the 2-degree target can't be met at the current rate. An increasing number of experts, anticipating a potential rise in average surface temperatures of 3 or 4 degrees Celsius by the end of the century, are advocating the need to promote adaptation.

2. Toward an Integrated Policy of Mitigation and Adaptation

As action on climate change mitigation falls behind amidst reports of deepening climate change and associated damages, adaptation is climbing on the climate policy agenda. Faced with the inevitability of climate change, communities the world over are taking steps to prepare. As a result, climate policy is moving toward making maximum mitigation efforts in tandem, or synergistically, with preparation for worst-case scenarios.

While the need to consider adaptation when assessing the impacts of climate change was indicated as far back as the 1990s, when climate change was beginning to draw public attention, policy research on adaptation and mitigation were carried out separately, with the majority of research focused on predicting the size of impacts and the level of mitigation that would be possible. Starting in the 2000s, however, when awareness of the difficulty of implementing mitigation began spreading and various phenomena attributable to climate change began to be observed around the world, it became clear that waiting for mitigation measures to stabilize climate proved too risky: adaptation was unavoidable.

While the impacts stemming from climate change are manifold, in the near term we can expect temperature and rainfall patterns to fluctuate to greater extremes, heat waves, rainstorms, droughts and other extreme weather events to happen more frequently, and weather disasters to grow in intensity. Over the long term, sea levels will rise—continuously and inexorably. To respond to this, the adaptation perspective must be incorporated into existing plans regarding land use, disaster preparedness, and infrastructural investment (i.e., mainstreaming of climate change policy). Doing so will make nations more resilient to disasters resulting from natural hazards.

Adaptation is increasingly becoming the focus of research and institutional programs, and is beginning to garner attention in international negotiations. It has also become clear that mitigation policies that address energy supply alone are inadequate, and that they must also include within their scope land use and urban infrastructure development. We have entered an age when climate policy must integrate mitigation with adaptation.

3. Practical Challenges to Adaptation

Specific measures for implementing adaptation exist as an extension of efforts already being made in various sectors and fields. For example, as temperature and rainfall patterns change, more dams will be needed to store water for emergencies and natural hazards such as droughts and floods. To maintain crop yields amidst a changing climate, farmers will have to shift planting seasons, or plant different varieties of crops. There is very little that humans can do to counteract the widespread ecological change and species loss that will take place on a global scale. We can only leave it up to

nature and see if ecosystems move toward the poles or evolve new forms of life.

Adaptation measures must be constructed in consideration of the following characteristics of climate change problems.

I. Irreversibility

Impacts, once set in motion, will have an inertia all their own. Even if climate is restored, the changes will not reverse. There is also no guarantee that climate can be restored. Precautionary measures that preempt changes are essential.

II. Prolonged impacts

The impacts of warming will transpire on a time scale of hundreds of years. For example, the Antarctic and Greenland ice sheets will not melt immediately as temperatures rise but gradually, following the general temperature trend, causing sea levels to rise over centuries. In contrast, extreme weather events, characterized by severe fluctuations in temperature, rainfall, and the like, will emerge rather quickly.

III. Uncertainty

Climate modeling research has advanced to the point where scientists have not only obtained consistent findings on regional and spatial climate change patterns, but can also, using advanced computing capabilities paired with downscaling methods, calculate climate changes with a high degree of resolution.

However, while it is safe to say that the major trends of climate change are already understood, we are still unable to adequately predict where, when, what, and the degree to which changes will occur. Moreover, projections of global average temperature rise vary greatly depending on the model researchers use, to say nothing of the fact that the rate of increase also depends on how much GHG emissions are reduced going forward. Consequently, it is still difficult to develop adequate adaptation measures for a given region based on the results of only a single model.

Adaptation strategies need to take these uncertainties into account and be considered from a broad, flexible perspective.

IV. Site-specificity and variability

While the impacts of climate change are global, the nature of climate (weather) changes and of the human and natural communities that experience those changes vary greatly from one region to another. Water shortage will be a serious problem for agricultural communities, heat stroke for urban, storm surges caused by rising seas for coastal, and ocean acidification for marine. Since each locale faces different circumstances and hence a different set of associated problems, general knowledge of adaption is insufficient for facing the task at hand.

What is needed is a bottom-up process of formulating a site-specific adaptation strategy, one that consolidates local knowledge, is linked to local circumstances, and is driven by local stakeholders themselves, such as residents and administrative entities. Internationally, we are already seeing governments and non-governmental groups alike starting to consider their options for adaption. The Asia-Pacific Adaptation Network, for example, under the auspices of the United Nations Environment Programme, operates as a network for sharing adaptation knowledge within the region.

V. Mainstreaming

Mainstreaming is the integration of adaptation considerations into important decision-making processes already in place. Despite adaptation being largely an extension of existing actions being taken in various fields, the current reality is that there are few examples of this being done. Rather than developing new measures, therefore, the most effective approach is to incorporate the adaptation perspective into existing policies on national land-use, urban planning, agricultural development, human health, and other fields with the intent of building more resilient nations.

4. Background to this Publication

Responding to the globally escalating need for an adaptation response to climate change, in 2011 the Sampo Japan Nipponkoa Environment Foundation launched the Environmental Issue Research Group, a group of experts devoted to investigating potential adaptation strategies for Japan and to sharing its findings with the public.

For a three-year period, group members and guest speakers discussed a variety of topics around the theme "Climate Change: Adapting to Natural Disaster Risk" including international trends, scientific research, theory, and initiatives by Japanese government and municipalities, businesses, and overseas stakeholders. As an interim report, the group held an open symposium in November 2012 in an effort to widely disseminate its findings.

Now, with a meeting of the IPCC's Working Group II scheduled to be held in March 2014 in Yokohama, Japan, to finalize its contribution to the Fifth Assessment Report, an assessment of the latest scientific understanding of the impacts of climate change and options for adaptation, the group has decided to compile and publish its findings. We hope this book will support vigorous adaptation efforts in various sectors and fields in Japan and abroad.