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Mr. Chairman, thank you and the Subcommittee for giving me the opportunity to speak to you today. My name is Steve Zebiak, and I am Director-General of the International Research Institute for Climate and Society (IRI), at Columbia University. My remarks concern international climate research, and are relevant to the proposed FY12 NOAA budget.

Last fall, Medhin Reda, who farms about 1 acre of land in Adi Ha, Ethiopia, was able to afford crop insurance for the first time. She bought "index insurance", an innovation created by the IRI in partnership with Oxfam, Swiss Re, and local banks in Ethiopia. What makes it affordable to small farmers is that it is indexed to climate conditions verifiable by rain gauges and satellite remote sensing. Farmers everywhere are subject to the vagaries of climate variations; with this innovation, the poor can obtain some of the protection previously available only in rich countries. Insurance is a form of adaptation to climate, which is the business of the IRI. Our immediate concern is with natural variations such as those associated with El Niño and La Niña, but our products apply to all climate variations, whatever their cause.

Savvy American farmers think about global markets and global competitors. They tell us that they are keenly interested in climate impacts on their competitors around the world and on export markets. The worldwide rise in food prices, fed in good measure by climate calamities like last summer's Russian heat wave, have potent implications for our own security interests. Over 15 years, the IRI has built a unique capability to address the need for climate information of both average American citizens and those engaged with our national security. Our work is about understanding tomorrow's environment and creating strategies to deal with it.

The IRI helps developing countries understand and adapt to the climate variations that can imperil people by flooding, by contaminating water supply, by increasing vector-borne diseases such as malaria as well as other climate related diseases such as meningitis. The IRI is the main part of NOAA's international climate program and the only federal program in the climate area doing this kind of work and providing information of this kind. We are proud of our humanitarian contribution, but also proud of the value of what we do for policy makers at all levels.

Mr. Chairman, we are concerned that the FY12 NOAA budget proposes to cut support for this valuable international climate activity by two-thirds, thus jeopardizing its future. We believe that it is in the US national interest to continue the existing international climate activity, and urge the Committee to restore funding for it to current levels.

Thank you, and I'll be glad to take questions.

Fifteen Years of Foundational experiences in international climate services

Below are four examples of IRI collaborations that allowed climate information and climate risk management innovations to be developed and tested in specific geographic and problem settings. They also demonstrate a key strength of the IRI: the expertise and ability to identify and bring together stakeholders who are relevant to the problem at hand. These four experiences have helped shape IRI's commitment and contribution to the establishment of effective climate services.

Agricultural Management in Southeast South America

For the last twelve years, the IRI has collaborated with the National Agricultural Research Institutes, or INIAs, of countries throughout Latin America. A key objective of this collaboration has been to establish Information and Decision Support Systems (IDSS) for the agricultural sector. These innovative systems offer an excellent opportunity to provide climate services to the agricultural community. They bring together relevant, state-of-the-art climate information--such as climate monitoring, weather forecasts, seasonal climate forecasts and plausible future climate scenarios--with other information, such as vegetation monitoring tools, databases of natural resources and crop simulation models. Agricultural agencies can then utilize these innovative platforms to create easily understandable and *usable* information, maps and products for both public- and private-sector purposes. Decision makers have used IDSSs to develop early warning systems and monitoring products for droughts, floods, frosts, crop disease outbreaks. Insurance providers look to IDSSs to help assess the risks associated with different production systems and with different agronomic management practices. Agencies can also use IDSSs to define the feasibility of producing different crops or using different technologies in various regions.

IRI created the first IDSS in collaboration with Uruguay's INIA. In 1999-2000, Uruguay suffered one of the worse droughts in its history. During the drought, the country's Ministry of Agriculture and the National Emergency System used the information and products created by the IDSS to successfully plan and prioritize aid responses to affected regions of the country.

The successes of the IDSS approach in Uruguay created demands from other countries in the region to establish similar systems. Efforts are currently ongoing in Paraguay, Chile and southern Brazil, and are likely to expand to several other countries. Work is underway now using the IDSS approach and tools with the INIAs of countries in the Southern Cone (Argentina, Bolivia, Brazil, Chile, Paraguay and Uruguay) to assess the vulnerabilities associated with the expansion of the agricultural frontier in the context of near-term climate change.

Water resource management in the Philippines

The Angat reservoir in the Philippines provides 97% of the water supply for metro Manila, home to 11 million people. Water from Angat also irrigates 30,000 hectares of rice fields in Bulacan Province, supplies 250 megawatts of hydropower for the island of Luzon, and the dam offers flood protection for tens of thousands of people living in downstream communities. The region is strongly affected by climate variability, particularly related to the El-Niño Southern Oscillation (ENSO) cycle. During drier-than-normal years, there is not enough water in the reservoir for all uses, and in wetter-than-normal years, the Angat dam operators need to carefully manage reservoir levels to avoid serious floods.

The IRI, along with the National Water Resources Board (NWRB) of the Philippines, the national meteorological service (PAGASA) and other stakeholders, developed practical *climate-smart* strategies for allocating Angat's water across all the competing uses, especially during years that see extremely low or high rainfall.

This work addressed three principal elements, each critical to developing a climate risk management strategy for Angat, and each requiring a deep and ongoing commitment on the ground, over a number of years. The first was understanding the institutional and decision-making landscape surrounding the reservoir and its management. For example, the IRI partnered with the University of the Philippines, Los Baños to conduct an analysis, based on extensive stakeholder dialogues, of the policies, regulations and processes of Angat water allocation. This led to a nuanced understanding of the specific needs and constraints of decision-makers, which has been a critical guide to climate research and tool development.

The second was to put focus on climate research and capacity building. The IRI collaborated with PAGASA to more reliably predict the start of the summer monsoon, to identify the seasonal reversal of ENSO rainfall signals, and to produce more skillful forecasts of Angat inflow. IRI staff trained PAGASA counterparts on how to use IRI's *Climate Predictability Tool* to produce downscaled climate information, and on state-of-the-art techniques for regional climate modeling.

The third element was to develop specific risk management tools and strategies. With the NWRB, the IRI created a reservoir model that integrates seasonal climate forecasts within the current reservoir decision process. The tool is user-friendly and allows NWRB staff to visualize the probabilities associated with specific scenarios of future water availability. In doing so, it helps stakeholders better assess possible outcomes from decisions the make on allocations, given climate conditions in a particular year.

Malaria in Ethiopia

Ethiopia's population of 80 million people makes it the second most populous country in Africa. Given Ethiopia's prevailing poor economic conditions, its complex topography and its highly variable climate, the population remains vulnerable to all too-frequent and often prolonged droughts, food insecurity and epidemics of climate sensitive diseases such as malaria. The *Roll Back Malaria Partnership,* which started in 1998, generated significant interest in developing early warning systems to improve prevention and control of this deadly, but preventable, disease. For their part, the IRI, the World Health Organization and other partners have helped frame, develop and test integrated early warning, surveillance and response systems for epidemic malaria, known as *MEWS*. These systems are supported by climate monitoring and prediction information. Initial work in Botswana provided clear evidence of a relationship between rainfall and malaria, and demonstrated the ability to estimate seasonal risks at least a season in advance using operational seasonal forecasts. The subsequent establishment of an epidemic early warning system has been influential in creating strong demand from other countries in Africa and in other regions.

In 2008, Google.org began to support IRI in new efforts to help develop early warning systems for climate-sensitive diseases in Ethiopia. Climate services will have little value unless potential user communities are capable of accessing and utilizing existing climate information, and are able to request products that better suit their needs. In this spirit, the IRI helped to establish a multi-agency

Climate and Health Working Group (CHWG) chaired by Ethiopia's Federal Ministry of Health and co-chaired by the National Meteorological Services. The working group aims to foster stronger collaboration between the climate and health community so that climate information is used effectively for protecting the Ethiopian people from climate-related health problems such as malaria, meningitis and others. The development of the Ethiopian CHWG has already been influential in encouraging other African countries to follow suit and, to date, CHWGs have been established in Kenya and Madagascar, two other countries where epidemic malaria threatens large, vulnerable populations.

Global Disaster Risk Management and the Red Cross

Climate services offer a range of benefits to the humanitarian community. While three-day weather forecasts are generally good only for last-minute life-saving decisions, medium-term and seasonal forecasts can be used to guide contingency planning, logistical preparations, and resource management decisions. At longer timescales, information about climate change over the next decade or longer can help disaster managers evaluate how decisions and investments taken today will stand up to future extremes.

The International Federation of Red Cross and Red Crescent Societies (IFRC) Operations Support unit in Geneva is responsible for coordinating preparations and response to disasters around the world. It also coordinates appeals for funding and resources to manage disasters. Its role is especially vital in countries that have little or minimal capacity for disaster preparedness. And yet, despite its invaluable function to the global community, the IFRC did not have a way to quickly understand where in the world a weather or climate-related disaster might take place in the next week, or to know where droughts were likely to happen in the coming three months. The IRI designed a dynamic map-based tool to meet this need. The tool has been incorporated into day-to-day operations in Geneva, and now, any user there can quickly access timely, reliable information on areas that are potentially vulnerable to weather and climate extremes in the coming days, weeks and months. As a complement to the map tool, the IRI also runs an email-based "helpdesk" that provides IFRC staff scientific expertise on demand, answering questions regarding climate forecasts and evolving extreme weather conditions, for example. The IFRC has used these IRI products as part of its preparations and response to recent disasters in Senegal and Mozambique.

The IRI has also worked closely with national and zonal Red Cross offices across Latin America, Asia and Africa. Thanks to the training and collaborations fostered by IRI with the African Center for Meteorological Applications for Development (ACMAD), the West and Central Africa Zonal Office issued the *first ever appeal for resources based on a seasonal forecast* before the rainy season of 2008.

Support of U.S. Climate Activities

The IRI supports our nation's climate enterprise in a multitude of ways. The institution's seasonal forecast products feed into the consolidated seasonal forecast produced every month by the Climate Prediction Center (CPC) for the entire United States. The CPC also uses IRI's multiple model El-Nino sea-surface temperature forecast product in its development of seasonal forecasts for the U.S., and to forecast future sea-surface temperatures in the central and eastern equatorial Pacific Ocean. As witnessed during the recent *Climate Prediction and Application Science Workshop* in Des Moines, Iowa, this product is extremely valuable to and popular with many diverse user communities, including NOAA climate scientists and scientists involved in applying climate information to agricultural planning and other sectoral problems.

The next generation of seasonal forecasting systems will benefit greatly from climate-model correction and weighting strategies being developed through collaborations between IRI and CPC scientists. They are also working on cutting-edge drought monitoring and diagnostic tools for North America in partnership with the Earth System Research Laboratory (ESRL).

The IRI collaborates with NOAA to understand the processes that cause decade-to-decade variability in climate, and to assess if there is predictive skill on this timescale. IRI scientists contribute to this national effort as members of the US CLIVAR Working Group on Decadal Predictability, as well as through targeted research projects.

The outstanding contributions of research and leadership that IRI climate scientists make to their field is perhaps most clearly evident by their invited participation to key research groups. Affiliations and titles include:

a. Chair of the U.S. Climate Variability and Predictability Research Program (US CLIVAR).
b. Co-chair of the US CLIVAR Working Group on Decadal Predictability.
c. Member of the National Academy of Sciences, Climate Research Committee.
d. Member of the International CLIVAR Working Group on Seasonal to Interannual Prediction.
e. Membership on the International CLIVAR Variability of the American Monsoon Systems.
f. Member of the Scientific Steering Group of International CLIVAR.
g. Member of NOAA Climate Observing System Council