APEC Climate Symposium 2016

Smart Climate Information and Accountable Action:

Achieving Sustainable Food Security in a Changing World

Piura, Peru
September 16-18, 2016

APEC Asia-Pacific Economic Cooperation · APEC PERU 2016 · APCC · Senamhi · PERÚ Ministerio del Ambiente

APEC Climate Symposium 2016

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Achieving Sustainable Food Security in a Changing World

Contents

Welcome Message

On behalf of the organizers, the APEC Climate Center is delighted to welcome you to Piura, Peru for the APEC Climate Symposium (APCS) 2016. The APEC Climate Center has developed this event to advance climate science to better strengthen food security in the face of large scale environmental change.

Climate change is already affecting food security and the most vulnerable livelihoods in the Asia-Pacific, highlighting its importance for sustainable development and economic growth. With such a diverse group of participants bringing together experiences from both emerging and advanced economies, this event provides a unique opportunity to link advances in science with lessons learned from across the globe to promote regional food security.

We are excited to have such a phenomenal group of experts ready to share their knowledge and such an interested group of participants to enhance discussions. It is our hope that participants will return to their home economies enriched by the information and case studies shared over the next days and can apply their learning towards reducing the vulnerability of their agriculture and fisheries towards both short- and long-term climactic events.

APCS 2016 would not have been possible without the strong support of our valuable partners. I would like to offer our sincere gratitude to all the members of the Organizing Committee and our co-hosts at the Peruvian Ministry of Foreign Affairs and the National Meteorology and Hydrology Service of Peru, as well as to all the speakers and participants.

I hope that you enjoy the symposium.

Thank you.

Dr. Hong-Sang Jung

Executive Director, APEC Climate Center

Organizers

APEC Climate Center (APCC)

The Asia-Pacific Economic Cooperation (APEC) Climate Center is a leading climate information service provider in the Asia-Pacific region. We provide climate forecasts and information services, and, using these results to conduct research and implement development activities. Additionally, we organize capacity building initiatives in the Asia-Pacific region such as trainings and APCS. APCC was established in 2005 with the endorsement and warm welcome of the APEC senior officials and leaders. APCC hosts the annual APEC Climate Symposium, which provides a forum for various scientists, academics, policy-makers and other stakeholders to share the latest science innovations in climate prediction and explore climate information applications.

In addition to organizing events, APCC provides operational services such as monthly seasonal outlooks and climate monitoring and prediction products, as well as conducting climate change R&D and developing supporting online tools and data services. At APCC, we strive to strengthen scientific and technical cooperation across the APEC region in order to help economies and societies deal effectively with the consequences of current and future climate-related hazards through the provision of climate information, research, and technical support.

National Meteorology and Hydrology Service of Peru (SENAMHI)

The National Meteorology and Hydrology Service of Peru (SENAMHI) aims at generating and providing meteorological, hydrological and climate knowledge and information in a reliable, timely and accessible manner for the benefit of the Peruvian society.

With the ongoing intention of disseminating reliable and quality information SENAMHI operates, controls, organizes and maintains the National Network of more than 900 meteorological and hydrological stations according to the technical standards established by the World Meteorological Organization (WMO).

Currently, thanks to the development of a modern public policy for disaster risk management, Peru has been improving its mechanisms of formulation and implementation of actions aimed at preventing risk in priority areas through increased synergies between different public entities that take part in the National System for Disaster Risk Management.

The orientation of management by results and products with a final destination is the framework in which SENAMHI´s new institutional paradigm is developed, linked to the development of products and provision of services based on user's needs.

Overview and Session Information

Since 2005, the APEC Climate Center (APCC) has hosted the APEC Climate Symposium (APCS) in partnership with the APEC Host Economy. Each year, APCC selects a priority topic with important linkages to climate science. Despite recent advances in climate science and related applications, there are often large gaps in its use in the implementation or management of relevant issues, particularly in developing economies. By bringing together climate scientists and policy makers, APCS aims to bridge these gaps through discussion of cutting edge science, sharing of best practices, and the advancement of policy. This year food security, as a priority topic for Peru, was selected due to the important relationship between climate science and agriculture and fisheries.

As industries are highly dependent on climate variability, agriculture and fisheries around the world face significant threat from the impacts of climate change. Studies by academics and international organizations such as the Asian Development Bank (ADB) predict that these impacts will be increasingly disruptive to food supplies and, without sufficient preparation, may destabilize industries and potentially trigger decreased food availability. While the importance of agriculture and global environmental change is widely recognized, there are significant gaps in the policies and technical capacity of many APEC economies to build cross-industry climate resilience. With the advancement of climate prediction technology, enhanced comprehension of market response to climatic events, and improved monitoring systems, we are now capable of seriously addressing these risks. The APEC Climate Symposium 2016 will explore how changing climate affects agricultural production and investigate how climate technology can be employed in finding climate-smart agriculture and fishery solutions.

2016 APCS will feature sessions on current challenges for food security, applications of climate science for short- and long-term planning, long-term solutions for threatened fisheries, and current application challenges to linking climate information with target sectors. It will also feature a final panel discussion to wrap-up the symposium and articulate policy recommendations to APEC economies.

Session Descriptions

Opening

Current Challenges for Food Security (keynote presentation)

Climate change is already affecting food security and the most vulnerable livelihoods. Overcoming climate change is the key to food security and sustainable development. Climate change directly impacts food security as well as the underlying natural resources base, especially in fragile ecosystems, that is agriculture and fishing industry. We need to take definite action to minimize the threat of climate change to food security. Through the first session, the keynote presenters will give an overview of current challenges that the stakeholders in agriculture and fishery practitioners are facing.

Session I

Utilizing Climate Science in Agriculture: Impacts of Extreme Weather Events and Seasonal Phenomena on Agriculture

Increased climate variability and extreme weather events due to climate change have important effects on the agricultural systems of the Asia-Pacific region, with small communities of developing economies being most vulnerable to these changes. Seasonal climatic phenomena like the El Niño–Southern Oscillation have significant impacts on regional food security, particularly through extreme weather events such as droughts and floods. While there are still great challenges to solve, recent improvements in climate monitoring and observation systems increases the ability for agricultural decision-makers to respond intelligently to and manage extreme weather and climatic events. Thus, promoting climate science based agricultural policies on extreme weather events and adopting innovative technologies of climate-smart agriculture are essential next steps required for achieving sustainable agriculture and food production in the region. This session will therefore focus on the role that climate science can play in defining short-term to seasonal agricultural decisions.

Session II

Employing Climate Science for Long-Term Agricultural Planning

Food security issues in emerging economies in the APEC region will be exacerbated by theimpacts of climate change. These effects go beyond extreme weather events discussed in Session 1 and may include significant shifts in meteorological patterns, resulting in other large-scale changes in agricultural sectors. While this is recognized as integral information for sustainable agriculture and food security, there are still significant gaps in translating climate information from scenarios into long-term agricultural policy development, particularly on a local scale. Many economies lack the awareness or capacity to reap the benefits from advances in climate modelling and downscaling.

Exploring the challenges and opportunities in long-term agricultural planning will help bridge this gap, thus facilitating the use of climate information by policy-makers. This session will therefore compliment Session 1 by examining the practical application of climate science for long-term agricultural planning, with the intention of bridging gaps between science and policy.

Session III

Long-term solutions for fisheries vulnerable to climate change

Rising ocean temperature and acidity rapidly alters aquatic ecosystems. These threaten marine organisms and fisheries by affecting fish habitats, production and distribution. Fishing industries of APEC economies, especially developing counties, are at risk and proper decision on policy should be made immediately for continuous economic growth. In this session, current issues of fisheries in the present days and future by climate change will be introduced and long-term solutions to maintain healthy ocean ecosystems and hence to mitigate food security will be discussed.

Panel Discussion

Each year, APCS hosts a panel discussion between leading scientists and experienced practitioners to explore additional perspectives on the symposium's key topics. The panel often highlights the importance of proactively addressing climate change in a way that is relevant to the heterogeneous mix of participants, addressing questions with important implications for government, society, and academia. Recognizing the need for complex and interdisciplinary approaches to climate issues, the panel is composed of an equally diverse range of experts. The interplay between panelists, who draw upon a veritable wealth of knowledge, provides an important opportunity for participants to gain an understanding of the diverse perspectives present in the field of food security.

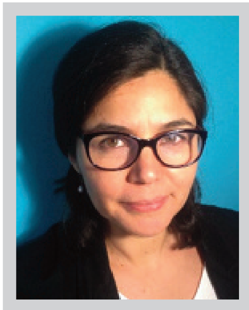
This year's panel will explore how science and technology can be employed to strengthen regional food security and provide insight into developing relevant scientific and socioeconomic policy. Other aspects of agriculture and fisheries will be discussed, with possible topics including how to build more robust, informed food supply chains and how to equip decision-makers with the climate science needed for long-term planning.

Speakers

Dr. Ana María Loboguerrero

CGIAR Research Program for Climate Change, Agriculture and Food Security

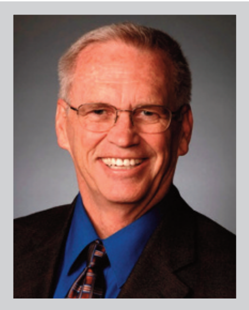
Dr. Ana María Loboguerrero is the leader of the Latin American program of the CGIAR Research Program for Climate Change, Agriculture and Food Security (CCAFS). In this position, she plays a major role in partnership development aimed to build impact pathways so that knowledge in climate change leads to implementation. Dr. Loboguerrero has 7 years' experience of working on climate change challenges. Previously, she worked at the Sustainable Environmental Development Deputy Directorate of the National Planning Department of Colombia as coordinator of climate change. While at the deputy directorate, Dr. Loboguerrero led the formulation of the Colombian Climate Change Policy, the National Adaptation Plan, the National Development Plan and the research agenda on climate change as well as coordinated technical support for the Colombian Low Carbon Growth Strategy. Dr. Loboguerrero has also worked as an external expert panel member of the evaluation of FAO work in climate change mitigation and adaptation.



Ms. Laura Meza

Food and Agriculture Organization of the United Nations

Ms. Laura Meza is an agronomist, with Master in Environmental Science (MSc - State University of New York) and International Relations (MA - Syracuse University). She has more than 15 years of professional experience as a researcher and expert in natural resource management and the environment. She has advised environmental management agencies such as the International Union for Conservation of Nature (IUCN), Conservation International (CI), and the Inter-American Development Bank (IDB) based on Washington D.C. and the United Nations Economic Commission for Latin America and the Caribbean (ECLAC). Since 2008 Ms. Meza has given support to the Office for Latin America and the Caribbean Organization United Nations Food and Agriculture Organization (FAO) on issues related to adaptation systems of production and design support agricultural policies around change climate. She has supported various processes of confrontation of climate change Colombia, Bolivia, Uruguay, Peru, Chile, Costa Rica, Panama, Nicaragua, among others.



Prof. Elwynn Taylor

Iowa State University

Prof. Sterling Elwynn Taylor, born 12 March 1942, grew up in Logan, Utah, graduated from South Cache High School in Hyrum, Utah, received a B.S. degree from Utah State University, Logan, Utah, and a Ph.D. from Washington University, St. Louis, Missouri.

In 1979 he accepted an appointment as the nation's first USDA Extension Climatologist. He led the effort that in 1981 established the first known automated reporting weather observation network for agriculture and received the "Raymond and Mary Baker Agronomic Excellence" award. In 2000 the Iowa Board of Regents "Award for Faculty Excellence" recognized his contribution to the goals and purposes of the State of Iowa university system. Dr. Taylor is well known internationally for his delivery of educational programs to aid in the management of risk associated with weather in agricultural production and associated economic market responses. He was a 2003 recipient of the Iowa Farm Bureau Distinguished Service to Agriculture award. He was the 2014 recipient of the national Hertz: Service to Agriculture Award from the American Association of Farm Managers and Rural Appraisers organization.

Dr. Ken Takahashi

Geophysical Institute of Peru (IGP)

Dr. Ken Takahashi is a Peruvian scientist and with a degree in physics from the Catholic University of Peru. He obtained a Ph.D. in atmospheric sciences from the University of Washington in Seattle, specializing in large-scale ocean-atmosphere interactions. After this, he was a postdoctoral researcher at Princeton University and the NOAA Geophysical Fluid Dynamics Laboratory working on large-scale climate change physics.

He returned to Peru in 2009, and is currently a research scientist and director of Atmosphere and Hydrosphere Sciences at the Geophysical Institute of Peru. His research focuses primarily on the mechanisms of El Niño-Southern Oscillation, with emphasis in its prediction, and was the scientific coordinator of the ENFEN Committee, which is the multi-institutional Peruvian government entity that issues the official ENSO outlooks, during the recent 2015-2016 El Niño. He is also a member of the CLIVAR Pacific Region Panel and of the Scientific Committee of the Tropical Pacific Observing System 2020 (TPOS 2020) project, as well as co-chair of the TPOS 2020 Eastern Pacific Task Team.

Speakers

Dr. Govindarajalu Srinivasan

Regional Integrated Multi-hazard Early warning System (RIMES)

As Chief Scientist for Climate Applications, Dr. Govindarajalu Srinivasan's work focuses on climate analysis to understand risks to societal systems, and development of decision support tools. He leads investigations on climate variability, trends, and change; and identifies risks posed to societal systems. He provides expert assistance to National Meteorological and Hydrological Services to deliver user-demanded climate data, products, and tools. He facilitates capacity building of users for application of climate information in planning and decision-making processes. Dr. Srinivasan has worked as a Consultant, Climate Adaptation and Prediction branch, World Meteorological Organization (WMO); Program Manager, Climate Change, Ministry of Earth Sciences &; Scientist, Dept. of Science & Technology (DST), Govt of India; Director, Climate Unit, India Meteorological Department; and the Asian Disaster Preparedness Center prior to his engagement with RIMES. He has more than 25 years experience in research and operational aspects of climate information, applications and services. He has represented India at UNFCCC and IPCC meetings and been involved in policy issues of climate change. He has served on the editorial board of the international journals - Agricultural and Forest Meteorology & Climate Research. He has also been a contributing author and expert reviewer for the IPCC AR4 and earlier reports. Dr. Srinivasan holds a Doctoral Degree in Atmospheric Sciences from Indian Institute of Technology, Delhi and carried out postdoctoral work at the Climate Research Unit (CRU), University of East Anglia, U.K., and the School of Environmental Sciences, Rutgers State University of New Jersey, USA.

Dr. Julian Ramirez-Villegas

International Center for Tropical Agriculture (CIAT)

Dr. Julian Ramirez-Villegas is a climate impacts scientist at the International Center for Tropical Agriculture (CIAT) in Colombia, and a research fellow at the University of Leeds in the UK. Julian is an agricultural engineer by training, with a PhD in environmental science. He has worked on a variety of projects ranging from the conservation of crop wild relatives to the projection of climate change impacts and adaptation and climate-smart agriculture, using a range of modelling tools. During his career, Julian has published more than 40 peer-reviewed papers related to crop-climate modelling, climate change impacts, adaptation, conservation of biodiversity and plant genetic resources. Julian's current research focuses on agricultural adaptation to climate change using crop and climate models, on quantifying crop-climate modelling uncertainties, and on developing an evidence base for climate-smart agriculture.

Dr. Alexander Ruane

NASA Goddard Institute for Space Studies
(Climate Impacts Group)

Dr. Alex C. Ruane is a Research Physical Scientist at the NASA Goddard Institute for Space Studies (GISS) in New York City. He earned a B.S. in Atmospheric Science from Cornell University and a Ph.D. in Climate Science at the Scripps Institution of Oceanography at the University of California, San Diego, before pursuing postdoctoral work at GISS. Dr. Ruane is a civil servant in the GISS Climate Impacts Group with a mandate to demonstrate the practical use of climate observations and climate change information, often through innovative, multi-disciplinary, multi-scale, and multi-method approaches.

Dr. Ruane's research involves the tailoring of climate scenarios for application to a wide variety of climate impacts assessments, facilitating the identification and prioritization of adaptation options for climate variability and change. He is the Science Coordinator and head of the Climate Team for the Agricultural Model Intercomparison and Improvement Project (AgMIP), an international effort involving more than 850 experts in the agricultural modeling community to link climate, crop, livestock, economics, nutrition, and food security models for consistent assessment and intercomparison of climate impacts on the agricultural sector. Dr. Ruane is active in several panels of panels of the US Global Change Research Program (USGCRP). He also founded and co-Chairs the Vulnerability, Impacts, Adaptation, and Climate Services (VIACS) Advisory Board for the sixth Phase of the Coupled Model Intercomparison Project (CMIP6), which forms a bridge between the climate modeling community and the diverse communities undertaking climate applications. Dr. Ruane has also published extensively on the representation of hydroclimate in models, and has collaborated on urban impacts assessments for New York City and the Northeast Urban Corridor.

Dr. Kwanghyung Kim

APEC Climate Center

Dr. Kwanghyung Kim joined APCC in February 2013 as a Research Fellow. Before coming to APCC, he worked as a researcher at the Samsung Advanced Institute of Technology and Samsung Techwin, where he developed molecular diagnostic assays that simultaneously detect and quantify human infectious microorganisms. He received his Ph.D. in Biological Sciences from Virginia Tech, USA, followed by a year of postdoctoral work at the Virginia Bioinformatics Institute. His Ph.D. and postdoctoral research focused on understanding a specific pathosystem in the interaction between plant or human hosts and microbial pathogens at a molecular and genomic level and dealt with the Alternaria disease of major crop plants, the human Aspergillosis disease, and allergy/asthma caused by air-born fungi. At APCC, his research goal is to systematically estimate plant and/or human infectious diseases under the ongoing effects of climate change through the sophisticated integration of pathological and ecological (biotic) information, as well as abiotic data. To accomplish his goal, he will first focus on the generation of individual pathosystem information in response to different climate change-related stressors at the genomic and physiological levels, which will later be followed by the utilization of microclimate pathosystem information, such as modules for inclusion in larger modeling systems.

Dr. Roberto Quiroz

International Potato Center (CIP)

Dr. Roberto Quiroz has been working for the International Potato Center (CIP) since February 1996. He led the creation of the Production Systems and Environment research group and has pioneered research on climate-agriculture interactions at the Center. Roberto was one of the founders of the Consortium for the Sustainable Development of the Andes (CONDESAN) and he led the Global Mountain Program: a CGIAR initiative created to promote sustainable agriculture in mountain areas. Roberto has served in many capacities including project leader and division leader. He currently leads the Crop Systems Intensification and Climate Change Disciplinary Center of Excellence. Roberto has MS and PhD degrees from North Carolina State University in nutrition and biochemistry and over 30 years of field experience putting science at the service of people. He has experience conducting and leading basic and translational research – to understand the interaction between climate and agriculture and how farmers can cope and adapt to extreme events – in the Americas, Asia and Africa. He also took a four-month sabbatical to work with the radar group of the Jet Propulsion Laboratory of the US National Air and Space Administration (JPL-NASA).Roberto has published extensively in scientific journals and has been a speaker at many international events. Throughout his career, he has also dedicated time to teach and mentor young scientists, which he hopes to do for the rest of his life.

Dr. Toshichika Iizumi

National Agriculture and Food Research Organization (NARO), Japan

Dr. Toshichika Iizumi is Senior Researcher at the Institute for Agro-Environmental Sciences, a center for research on agricultural impact of climate change and adaptation in the NARO. His global crop study aims to understand how changes in management and climate have contributed to crop production in the historical past and its application to depict food production pathways in coming decades under changing climate. Using global crop models, climate change projections, seasonal climate forecasts, statistical downscaling and data assimilation techniques, his research ultimately aims to aid in transforming crop production systems into more climate-smart ones. He was Associate Editor of Journal of Agricultural Meteorology, and is Editor of Climate Research. He won The Young Scientists' Prize of the Commendation for Science and Technology by the Minister of Education, Culture, Sports, Science and Technology of Japan in 2015.

Prof. Mark Howden

Australian National University

Prof. Mark Howden is Director of the Climate Change Institute at the Australian National University. His work has focussed on climate impacts and adaptation for systems we value: agriculture and food security, the natural resource base, ecosystems and biodiversity, energy, water and urban systems. He helped develop the national and international greenhouse gas inventories and has assessed sustainable ways to reduce emissions. Mark has partnered with many industry, community and policy groups via both research and science-policy roles and has over 400 publications. He has been a major contributor to the IPCC since 1991 now being a Vice Chair of IPCC Working Group 2.

Dr. Ho-Young Kwon

International Food Policy Research Institute

Dr. Ho-Young Kwon, a Research Fellow of the Environment and Production Technology Division, received his Masters in Environmental Management from Duke University at Durham, NC and PhD in Environmental Sciences from University of Illinois at Urbana-Champaign, IL. Prior to joining IFPRI in March 2013, he worked as a Postdoctoral Associate at University of Florida and University of Illinois on developing process-based modeling frameworks that link to policy and econometric models. His research has focused on incorporation of up-to-date findings about soil-plant-nutrient interactions into process-based modeling frameworks where global statistics databases and remote sensing data/analyses coupled with models are designed to investigate sustainable management strategies and current environmental issues. He has been involved in several projects, including Economics of Land Degradation initiative (ZEF), Low Emission Development Strategies (USAID), and Soil Carbon Emission Associated with Land Use Conversion for Cellulosic Ethanol Production (USDOE).

Speakers

Dr. Maximo Torero

International Food Policy Research Institute

Dr. Maximo Torero is the Division Director of the Markets, Trade, and Institutions Division at the International Food Policy Research Institute, leader of the Global Research Program on Institutions and Infrastructure for Market Development and Director for Latin America. He has fifteen years of experience in applied research and in operational activities. In this capacity as director and research program leader, he directs the activities of an IFPRI unit that conducts research, with special emphasis on M&E of infrastructure and rural development interventions in urban and peri-urban areas through the use of randomized experimental design. Prior to that, he was a senior researcher and member of the executive committee at Group of Analysis for Development (GRADE). He received his Ph.D. from the University of California at Los Angeles Department of Economics, is a professor on leave at the Universidad del Pacífico, was postdoctoral fellow at the UCLA Institute for Social Science Research (ISSR), and an Alexander von Humboldt Fellow at University of Bonn, Germany. Dr. Torero's major research work lies mostly in analyzing poverty, inequality, importance of geography and assets (private or public) in explaining poverty, and in policies oriented towards poverty alleviation based on the role played by infrastructure, institutions, and on how technological breakthroughs (or discontinuities) can improve the welfare of households. His experience extends to projects in Latin America, Sub Saharan Africa (east and West), and Asia. Dr. Torero had a unique expertise on impact evaluation on projects linked to water and sanitation, electricity, ICTs, roads, and in social and institutional aspects on the delivery of public services. He has won twice the World Award for Outstanding Research on Development given by the Global Development Network (GDN).

Dr. Willingthon Pavan

University of Passo Fundo, Brazil

Dr. Willingthon Pavan is a full professor at Graduate Program in Applied Computing of University of Passo Fundo, Brazil. Is a computer science scientist with experience in academia and development of tools for the agricultural area. Expertise in the development of disease simulation models, systems for aid in taking decisions, and software development for small equipments. Is graduated in Computer Science by University of Passo Fundo (1994), master in Computer Science by Federal University of Rio Grande do Sul (2000), Ph.D. in Agronomy (Phytopathology) by University of Passo Fundo (2007), and postdoctorate by University of Florida (2008-2009). Has experience in Computer Science and Agronomy, focusing on Analytical Models and Simulation, acting on the following subjects: mathematical models, simulation, and programming languages.

Dr. David Ellis

International Potato Center (CIP)

Dr. David Ellis, Leader of the Program for the Conservation of Biodiversity for the Future of the International Potato Center (CIP) has been involved in the preservation of plant genetic resources for decades, with experience in academia, private industry and the public sector. Dave is currently charged with overseeing the maintenance of the global in-trust collections of potato, sweetpotato and Andean root and tuber crops in the CIP Genebank, in Lima, Peru.

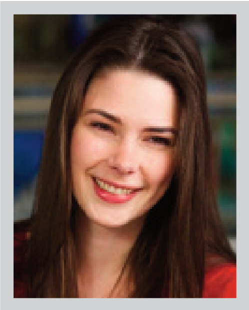
With a PhD in Botany from the University of Montana, USA, Dave's research interests have spanned plant development, medicinal compounds in plants (taxol), plant molecular biology (modification of plant cell walls, control of plant reproduction, genomics), plant and insect ecology, cryobiology and conservation of plant genetic resources and diversity. His expertise in heading programs for the conservation of plant and microbial genetic resources and running genebanks brought him to CIP in 2012.

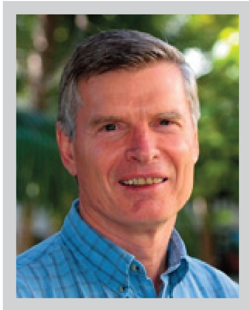
Dave has collaborated with the International Maize and Wheat Improvement Center (CIMMYT) in the collection of teosinte (the immediate ancestor to maize) in Mexico, worked with native American tribes in the U.S. to preserve their plant genetic resources (principally Fraxinus (ash) seed), and is currently working with indigenous communities in the Potato Park (Parque de la Papa), in the Peruvian Andes. Dave has been a member of the Advisory Board for the Desert Legume Program, an associate editor of In Vitro Cellular & Developmental Biology – Plant, board member of the Society for In Vitro Biology, and a fellow of the Society for In Vitro Biology. He is currently a member of the scientific advisory committees for Asociación ANDES and SeedSavers. He has published extensively in peer review journals, book chapters and conference proceedings.

Eng. Grinia J. Avalos Roldán

National Meteorology and Hydrology Service of Peru (SENAMHI)

Meteorologist engineer graduated from the Universidad Nacional Agraria La Molina with a Master Degree in Applied Meteorology (completed studies) -UNALM. Specialized studies in numerical modeling at the University of Maryland - USA (2000-2001); training in physical parametrizations and in settings of the Eta - CPTEC-Brazil model (2004); Diploma course on Administration and Management for Engineers organized by the Universidad Nacional de San Marcos (2007); Diploma course on Risk Management to face Climate Change, organized by the Ricardo Palma University (2008); Training in the implementation of a high-resolution model for generating climate change scenarios in the Andean region in the Meteorological Research Institute - MRI of Japan (2007 and 2008); Formulation and coordination of climate component of the PRAA Project (Adaptation to the accelerated glacier retreat in the Andean tropical glacier Project) with the financial support from the World Bank and the coordination of the CAN (2007-2008; 2009-2011). She has participated as a speaker in various scientific meetings in public and private institutions. Since 1998, she worked for SENAMHI as professional of the General Directorate of Meteorology. In 2012, Eng. Roldán was promoted to the position of Director of Applied Meteorology and between 2013 and 2016 I have been in charge of the Directorate of Climatology. As of May 26, 2016 she is working as Deputy Director of Climate Prediction of the Directorate of Meteorology and Atmospheric and Environmental Assessment office of SENAMHI. Eng. Roldán is SENAMHI's technical representative with the ENFEN (National Study of the El Niño Phenomenon) and is currently technical coordinator of the Climandes Project one of the projects prioritized by WMO for the implementation of the Global Framework for Climate Services. She is a member of the Global Task Team for Seasonal Climate Update of the Commission for Climatology of the World Meteorological Organization.





Ms. Lauren Weatherdon

Marine Programme, UNEP World Conservation Monitoring Centre

Ms. Lauren Weatherdon is a Programme Officer in the Marine Programme at the UNEP World Conservation Monitoring Centre (UNEP-WCMC), which is a collaboration between the not-for-profit organisation, WCMC, and the United Nations Environment Programme to deliver specialist biodiversity expertise. As part of her role, she streamlines marine and coastal data to support decision-making and efforts to track progress towards global conservation targets. Her areas of expertise include fisheries management, spatial ecology (species and habitat distribution mapping and modelling), and climate change (impacts and adaptation). Previously, she collaborated with scientists under the "Oceans 2015 Initiative" to produce a review of the scientific literature published subsequent to the IPCC's Fifth Assessment Report, identifying points of agreement and departure regarding the impacts of climate change on coastal sectors through changes in the marine environment. She has also led research on the impacts of climate change on fisheries catch potential for coastal indigenous communities of British Columbia, Canada.

Dr. Johann Bell

Conservation International

Dr. Johann Bell has worked extensively on fisheries and aquaculture in developing countries in Asia-Pacific with WorldFish and the Pacific Community. In recent years, he has focused on the strategic planning needed to maintain the important role that fish plays in the food security of Pacific Island countries in the face of rapid population growth and climate change.

While Dr. Bell was employed at the Pacific Community, he led a major assessment of the vulnerability of fisheries and aquaculture in the tropical Pacific to climate change and was a contributing author to Chapter 30 (The Ocean) of the Intergovernmental Panel on Climate Change Fifth Assessment Report. More recently, Johann has advised the Consultative Group on International Agricultural Research's cooperative research program on 'Climate Change, Agriculture and Food Security' about building climate-resilient food systems for Pacific Islands.

Dr. Bell currently works as a consultant for Conservation International's 'Tuna Initiative' and has contributed to the development of policies to diversify the use of tuna to improve food security and public health in Pacific Island countries. Johann is also a Visiting Professorial Fellow at the Australian National Centre for Ocean Resources and Security, University of Wollongong (http://ancors.uow.edu.au/fellows/UOW189534.html), the Chair the Recreational Fishing Advisory Council for the State of NSW in Australia, and a member of the International Advisory Committee for the United Nation University's Institute of Water, Environment and Health.

Dr. Elvira Poloczanska

Alfred Wegener Institute
(Biosciences | Integrative Ecophysiology)

Prof. Elvira Poloczanska has over 15 years experience in climate change research with a background in marine ecology and fisheries modelling. Her work includes syntheses and modelling of responses of marine biodiversity to climate change at local, regional and global scales. Her research also focuses on understanding adaptation options to climate change for marine management and fisheries. Elvira was a senior scientist with CSIRO Oceans and Atmosphere, Australia, for 11 years and has recently moved to the Alfred Wegener Institute, Germany, as Director of Science in the Technical Support Unit of Working Group II of the Intergovernmental Panel on climate Change.

Dr. Dimitri Gutierrez Aguilar

Ocean Institute of Peru (IMARPE)

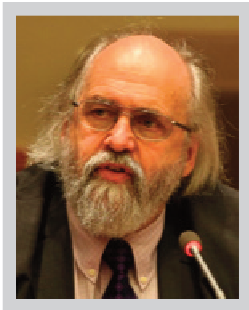
Dr. Dimitri Gutiérrez, a Peruvian biological oceanographer, is the Director of Research in Oceanography and Climate Change of the Peruvian Marine Research Institute (IMARPE) since 2012. His research has been focused on paleoceanography of the Peruvian upwelling ecosystem, recent trends and global warming impacts on the upwelling ecosystem, oxygen minimum zone and benthic communities. He is author or co-author of over 60 publications in scientific journals and books. He is currently involved in adaptation projects for the impact of climate change on Peruvian fisheries and marine coastal ecosystems.

Speakers

Dr. Ussif Rashid Sumaila

University of British Columbia

Dr. Sumaila is Professor at the Institute for the Oceans & Fisheries and the Liu Institute for Global Issues, and Director of the Fisheries Economics Research Unit (FERU) at the University of British Columbia. He specializes in bioeconomics, marine ecosystem valuation and the analysis of global issues such as fisheries subsidies, IUU (illegal, unreported and unregulated) fishing, and the economics of high and deep seas fisheries. Dr. Sumaila has experience working in fisheries and natural resource projects in Canada and the North Atlantic region, Norway, Namibia and the Southern African region, Ghana and the West African region, and Hong Kong and the South China Sea. He has authored over 180 journal articles; including in Science and Nature. Sumaila is the winner of the 2013 American Fisheries Society Excellence in Public Outreach, the Stanford Leopold Leadership Fellowship and the Pew Marine Fellowship. He has given talks at the UN Rio+20, the WTO, the White House, the Canadian Parliament and the British House of Lords. His research has generated a great deal of interest, and has been cited by, among others, The Economist, The Boston Globe, International Herald Tribune, the Globe and Mail, the Wall Street Journal and Vancouver Sun.



Dr. Jake Rice

Department of Fisheries and Oceans Canada

Dr. Jake Rice retired in 2015 after 9 years as Chief Scientist for the Department of Fisheries and Oceans, Canada. He previously served as Director of Peer Review and Science Advice (1996-2006) and held senior DFO Science positions in Pacific (1990-1996) and Newfoundland Regions (1982-1990). He received a BSc. from Cornell University (1970 - Conservation) and a Ph. D. from University of Toronto (1974 - Ornithology). He has more than 300 publications in the scientific and technical literature, primarily on the ecosystem approach to integrated marine resource management and the science-policy interface in natural resource management and conservation. In 2014 a book Governance of Marine Fisheries and Biodiversity Conservation, co-edited with Serge Garcia and Tony Charles, was published by Wiley.

He co-chairs the Regional Assessment for "the Americas" for the Intergovernmental Panel on Biodiversity and Ecosystem Services, was a member of the Group of Experts for the UN Regular Process for Global Marine Assessments overseeing the First World Ocean Assessment, and was a Lead Author for the chapter on Drivers, Trends and Mitigation, for the IPCC 5th Assessment Report. He has been active as an expert or delegate to an alphabet soup of UN meetings and agencies (FAO, CBD, GEF, UNEP, UNESCO-IOC, ICP, BBNJ etc), and served as the Canadian member of the ICES Advisory Committee on Fisheries Management, and later the Advisory Committee on Ecosystems from 1996-2008.

Program

Friday September 16, 2016		APEC Climate Symposium 2016
08:00-09:00	Registration	
09:00-10:00	Opening Ceremony	MC: Ms. Sangwon Moon Head of External Affairs Department, APEC Climate Center
09:00-09:10	Opening Remarks	Dr. Hong-Sang Jung Executive Director, APEC Climate Center
09:10-09:20	Opening Remarks	Eng. Amelia Ysabel Díaz Pablo Executive President, National Meteorology and Hydrology Service of Peru (SENAMHI)
09:20-09:30	Congratulatory Address	Mr. Keun Ho Jang Ambassador of the Republic of Korea to Peru
09:30-09:40	Welcome Remarks	Mr. Marcos Gabriel Alegre Chang Vice Minister, Environmental Management Division, Ministry of Environment of Peru
09:40-10:00	Commemorative Plaque Presentation and Photo Session	
10:00-10:20	Coffee Break	
10:20-12:00	Keynote Session Keynote Presentations	Chair: Dr. Jin Ho Yoo Rapporteur: Ms. Christianne Aikins
10:20-11:00	Reducing risks to food security from climate change	Dr. Ana María Loboguerrero Rodriguez CGIAR Research Program for Climate Change, Agriculture and Food Security
11:00-11:40	Climate change and food security: policy recommendations	Ms. Laura Meza Food and Agriculture Organization of the United Nations – Regional Office for Latin America and the Caribbean
11:40-12:00	Wrap-up and Discussion	
12:00-13:00	Luncheon	
13:00-18:00	Session I Utilizing Climate Science in Agriculture: Impacts of Extreme Weather and Climate Events on Agriculture	Chair: Dr. Alexander C. Ruane Rapporteur: Julian Ramirez-Villegas
13:00-13:30	Subtle climate shift, major agricultural impact	Prof. Elwynn Taylor Iowa State University
13:30-14:00	Prediction of El Niño/La Niña, their diversity and climate impacts in Peru	Dr. Ken Takahashi Geophysical Institute of Peru (IGP)
14:00-14:30	Operationalizing the use of weather and climate information for agriculture in Asia	Dr. Govindarajalu Srinivasan Regional Integrated Multi-Hazard Early Warning System (RIMES)
14:30-15:00	Using crop-climate modelling for adapting cropping systems to climate variability	Dr. Julian Ramirez-Villegas International Center for Tropical Agriculture (CIAT)
15:00-15:30	Coffee Break	
15:30-16:00	Climate application for agriculture and food security	Dr. Alexander C. Ruane Climate Impacts Group, NASA GISS
16:00-16:30	Improving agricultural resilience to climate variability through ensuring data availability and enhancing agro-meteorological services	Dr. Kwanghyung Kim APEC Climate Center
16:30-17:00	Assessing the impact of climate change on potato cultivation in its center of origin	Dr. Roberto Quiroz International Potato Center (CIP)
17:00-18:00	Wrap-up and Discussion	
18:30-20:00	Welcome Cocktail Reception hosted by SENAMHI	

Program

Saturday September 17, 2016		APEC Climate Symposium 2016
09:00-14:50	**Session II** **Employing Climate Science for Long-Term Agricultural Planning**	**Chair: Dr. Maximo Torero** **Rapporteur: Ho Young Kwon**
09:00-09:30	Growth and variability of crop production under climate change and socioeconomic pathways	**Dr. Toshichika Iizumi** National Agriculture and Food Research Organization(NARO), Japan
09:30-10:00	Seasonal climate forecasts as a pathway for climate change adaptation: a review	**Dr. Mark Howden** Australian National University
10:00-10:30	Global adoption of climate-smart agriculture: ex-ante economic impact assessment	**Dr. Ho-Young Kwon** International Food Policy Research Institute
10:30-10:50	**Coffee Break**	
10:50-11:20	Scenarios on climate change impacts for developing APEC economies and how to increase resilience and benefit from opportunities	**Dr. Maximo Torero** International Food Policy Research Institute
11:20-11:50	Climate information tools for decision making	**Dr. Willingthon Pavan** University of Passo Fundo, Brazil
11:50-12:50	**Luncheon**	
12:50-13:20	Is agrobiodiversity a key to sustainable crop production in a changing environment?	**Dr. David Ellis** International Potato Center (CIP)
13:20-13:50	Implementing climate information services for decision-making in Peru	**Eng. Grinia J. Avalos Roldán** National Meteorology and Hydrology Service of Peru (SENAMHI)
13:50-14:50	**Wrap-up and Discussion**	
14:50-15:00	**Break**	
15:00-19:00	**Session III** **Long-term Solutions for Threatened Fisheries Caused by Climate Change**	**Chair: Dr. Johann Bell** **Rapporteur: Ms. Lauren Weatherdon**
15:00-15:30	Where are the fish? Reducing climate impacts on coastal communities and marine industry	**Ms. Lauren V. Weatherdon** UNEP World Conservation Monitoring Centre
15:30-16:00	The effects of climate change on the contributions of fisheries and aquaculture to food security	**Dr. Johann Bell** Conservation International
16:00-16:30	Current and future situation of Australian fisheries to climate change	**Prof. Elvira Poloczanska** Alfred Wegener Institute (Biosciences | Integrative Ecophysiology)
16:30-16:50	**Coffee Break**	
16:50-17:20	Productivity and sustainable management of the humboldt current large marine ecosystem	**Dr. Dimitri Gutiérrez** Ocean Institute of Peru (IMARPE)
17:20-17:50	Climate change effects on the economics and management of world fisheries	**Dr. Rashid Sumaila** University of British Columbia
17:50-18:20	Climate change, food security, and the ocean: is there a path forward?	**Dr. Jake Rice** Department of Fisheries and Oceans Canada
18:20-19:20	**Wrap-up and Discussion**	

Program

Sunday September 18, 2016		APEC Climate Symposium 2016
09:00-12:00	**Session IV** Wrap-up and Panel Discussion	**Chair: Dr. Mark Howden** **Rapporteur: Ms. Christianne Aikins**
09:00-09:30	Session I Wrap-up	**Dr. Alexander C. Ruane** Climate Impacts Group, NASA GISS
09:30-10:00	Session II Wrap-up	**Dr. Maximo Torero** International Food Policy Research Institute
10:00-10:30	Session III Wrap-up	**Dr. Johann Bell** Conservation International
10:30-10:45	**Coffee Break**	
10:45-11:40	**Panel Discussion**	**Dr. Mark Howden** Australian National University **Dr. Heekyung Park** Korea Advanced Institute of Science and Technology **Prof. Elwynn Taylor** Iowa State University **Dr. Maximo Torero** International Food Policy Research Center **Dr. Dimitri Gutiérrez** Ocean Institute of Peru (IMARPE) **Dr. Waldo Lavado** National Meteorology and Hydrology Service of Peru (SENAMHI)
11:40-12:00	**Closing**	
12:00-13:00	**Luncheon**	

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Session I

Utilizing Climate Science in Agriculture: Impacts of Extreme Weather and Climate events on Agriculture

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SUBTLE CLIMATE SHIFT, MAJOR AGRICULTURAL IMPACT
Prof. Elwynn Taylor
Iowa State University

PREDICTION OF EL NINO/LA NINA, THEIR DIVERSITY AND CLIMATE IMPACTS IN PERU
Dr. Ken Takahashi
Geophysical Institute of Peru (IGP)

OPERATIONALIZING THE USE OF WEATHER AND CLIMATE INFORMATION FOR AGRICULTURE IN ASIA
Dr. Govindarajalu Srinivasan
Regional Integrated Multi-hazard Early warning System (RIMES)

USING CROP-CLIMATE MODELLING FOR ADAPTING CROP-PING SYSTEMS TO CLIMATE VARIABILITY
Dr. Julian Ramirez-Villegas
International Center for Tropical Agriculture (CIAT)

CLIMATE APPLICATION FOR AGRICULTURE AND FOOD SECURITY
Dr. Alexander Ruane
NASA Goddard Institute for Space Studies (Climate Impacts Group)

IMPROVING AGRICULTURAL RESILIENCE TO CLIMATE VARIABILITY AND ENHANCING AGRO-METEOROLOGICAL SERVICIES
Dr. Kwanghyung Kim
APEC Climate Center (APCC)

ASSESSING THE IMPACT OF CLIMATE CHANGE ON POTATO CULTIVATION IN ITS CENTER OF ORIGIN
Dr. Roberto Quiroz
International Potato Center (CIP)

APEC Climate Symposium 2016

Smart Climate Information and Accountable Action:

Achieving Sustainable Food Security in a Changing World

SUBTLE CLIMATE SHIFT, MAJOR AGRICULTURAL IMPACT

Prof. Elwynn Taylor

Iowa State University

Epoch storms, drought, and flood make headline news. Diminished diurnal temperature range is hardly noticed and accompanying annual reduction of crop yield, hardly dramatic in any given year, quietly impacts the world. The changing occurrence of tropical storms may be cyclic or associated with a changing atmospheric climate. The impact of great storms is sudden and often disastrous. The impact of an overnight temperature shift of one degree Celsius may go unnoticed as the cause of a long-term drop in food production. The impact on economies and on the welfare of millions of people may greatly exceed the total impact of the changing nature of major storms.

PREDICTION OF EL NIÑO/LA NIÑA, THEIR DIVERSITY AND CLIMATE IMPACTS IN PERU

Dr. Ken Takahashi

Geophysical Institute of Peru (IGP)

El Niño was originally identified as anomalous warming along the Peruvian coast that was later found to be associated with a large-scale ocean-atmosphere phenomenon in the tropical Pacific, the El Niño-Southern Oscillation (ENSO). Advances in understanding the basic physical mechanisms and numerical modeling of ENSO have increased our capacity to predict the main associated climate variations. However, El Niño and La Niña events are diverse and the climate impacts in Peru depend on the details of these, as well as on the role of other climate phenomena. Specifically, ENSO diversity can be quantified to first approximation by the longitudinal distribution of the equatorial sea surface temperature anomalies, e.g. classifying the events into Central Pacific (CP) and Eastern Pacific (EP) types, depending on where the anomalies are largest. The climate impacts of the EP El Niño events on Peru are better known, associated with coastal warming, increased sea level, intense rainfall on the arid coastal lowlands in austral summer/fall, and alteration of the marine environment that can affect its ecosystems. On the other hand, the CP El Niño has an opposing effect on rainfall, tending to reduce it in the Andes, including the middle and upper parts of the coastal river basins, and in the Amazon region. Additionally, the extreme EP El Niño events of 1982-83 and 1997-98 produced disproportionally large coastal impacts in Peru, costing up to 7% an 4.5% of the GDP, respectively, and our research suggests that the physics of these extreme events are different from the others, associated primarily with processes in the eastern Pacific. Predicting the extreme El Niño with several months in advance is a key need for decision makers, but state-of-the-art forecast models are still deficient for simulating the mean climate, particularly in the eastern Pacific (e.g. the double ITCZ syndrome), as well as ENSO diversity.

The ENFEN Committee* is the multi-institutional entity that issues the official El Niño and La Niña outlooks in Peru. Since 2012, due to the different impacts of ENSO types, the Committee explicitly distinguishes between the "coastal (EP) El Niño/La Niña" and the "central Pacific El Niño/La Niña", among which the latter is the exclusive focus of many of the international agencies world-wide due to its teleconnections (including to Peru). The Committee issues medium-range forecasts (up to 3 months) by the monitoring and modeling of equatorial ocean Kelvin waves. At longer leads, the Committee combines the analysis of basin-wide ocean-atmosphere conditions, with theoretical understanding of the dynamics of the system, as well as global climate model predictions and knowledge of their deficiencies, to produce the outlooks. Since 2015, the Committee produces probabilistic predictions of the strength of both the coastal and central Pacific El Niño and La Niña events for the austral summer due to their potential impact on rainfall. These proved to be very useful for high-level decision making in the Peruvian government, allowing for the optimization of allocation of resources during the 2015-2016 El Niño. However, the predictions had substantial uncertainties and their reduction will require substantial improvements in observations, modeling and scientific understanding in the eastern Pacific.

** Comité Multisectorial encargado del Estudio Nacional del Fenómeno El Niño*

OPERATIONALIZING THE USE OF WEATHER AND CLIMATE INFORMATION FOR AGRICULTURE IN ASIA

Dr. Govindarajalu Srinivasan
Regional Integrated Multi-hazard Early warning System (RIMES)

Significant progress has been made during the last few decades in the area of weather and climate modelling making available predictions on a wide range of lead times. Such predictions provide sufficient advance information to adjust critical agricultural decisions, with significant potential to contribute to the efficiency of agricultural management, and to food security. Operationalizing systematic use of such information requires a well-coordinated end-to-end institutional system that begins with monitoring of weather and climate events and ends with a community level response. The main challenge of such a system would also be the customization of information to climate sensitive points of decision-making. This needs to be evolved iteratively through an interactive process of stakeholder engagement.

The need of systematic integration of weather and climate information and its particular relevance in the present times shall be highlighted in the presentation. Examples from projects being implemented in Myanmar and Tamil Nadu, India will be used to elaborate the process of operationalization. Besides close linkages between key institutions, operationalizing the use of weather and climate information requires availability of data and adequate understanding of climate sensitive aspects of the sector. The talk would bring such challenges that have to be overcome to scale up climate services for agriculture and food security.

USING CROP-CLIMATE MODELLING FOR ADAPTING CROPPING SYSTEMS TO CLIMATE VARIABILITY

Julian Ramirez-Villegas[1, 2, 3]; Diego Agudelo[1], Camilo Barrios[1]; Sylvain Delerce[1]; Hugo Dorado[1]; Diana Giraldo1; Andy Jarvis[1, 2]; Daniel Jimenez[1]; Lizeth Llanos[1]; Diego Obando[1]; Victor H. Patiño[1]; Steven D. Prager[1]; Camila Rebolledo[1]; Jeferson Rodriguez[1]; Jeimar Tapasco[1]

[1] *International Center for Tropical Agriculture (CIAT), Cali, Colombia*
[2] *CGIAR Research Program on Climate Change, Agriculture and Food Security (CCAFS), c/o CIAT, Cali, Colombia*
[3] *School of Earth and Environment, University of Leeds, Leeds, UK*

Agriculture is one of the most vulnerable sectors to climatic variations; interannual climate variability explains roughly one third of the global spatio-temporal variation in the yields of maize, rice, soybeans and wheat. This is because climatic conditions affect the planning of agricultural activities in the field and the performance of crops in the field, hence conditioning the outcomes of all agricultural activities. Moreover, as the climate system responds to anthropogenic forcing, it has been projected that climate variability, including the frequency and intensity of seasonal extremes, will likely increase during the 21st century. This is true even for ambitious mitigation targets such as those of the Paris Agreement. Understanding climate variability and its impacts on farming as well as adequately responding to it are thus critical needs in agriculture. Here, we summarize results of ongoing initiatives on climate variability adaptation for Colombian agriculture that span a range of inter-related disciplines including seasonal yield forecasting, big-data-driven site-specific agriculture, and technology (varietal) testing, and involve a total of 13 different national partners across 19 out of the 32 departments of Colombia. While work focused on five crops (rice, maize, beans, bananas, cassava) across the country, we concentrate on rice systems as one of the key success stories. Findings suggest that, on average, between 28–61 % of the variability in rice crop yields at the field-scale can be explained by climate conditions alone, with drivers of climate variability often changing per site and variety. In most rice growing areas, it was possible to identify a single critical climatic limiting factor and identify what type of site-specific management would lead to increased yields. Site-specific management recommendations were then discussed and validated with local agronomists, and later provided to farmers, leading to enhanced crop system performance. Seasonal yield forecasts, varietal testing in the field, and the creation of agro-climatic roundtables, then helped to influence next season's farm-level decisions on what and when to plant across the country. While continuous testing of recommendations and evaluation of adoption levels at the sector level is further needed to appropriately assess the impact of these activities, sector-specific benefits have been substantial, with crop losses during the 2015-2016 ENSO event being avoided, yield gaps being closed and available agricultural technologies better understood and targeted.

CLIMATE APPLICATION FOR AGRICULTURE AND FOOD SECURITY

Dr. Alexander Ruane
NASA Goddard Institute for Space Studies (Climate Impacts Group)

Farmers and the broader agricultural sector have managed climate impacts for thousands of years, seeking to take advantage of fair weather years while minimizing the losses from floods, droughts, heat waves, and frosts. Today there are tremendous new technologies for sophisticated agricultural management as well as new information products that place cutting-edge science at our fingertips. These allow for new levels of risk management with a goal of sustainable, resilient, and productive food systems.

This presentation will describe climate applications for agriculture and food security stemming from farmer surveys, field experiments, and agricultural models that show us how our farm systems respond to shifts in weather and climate. Critical agricultural impacts may take place in just minutes (for example, from a particularly severe frost), over the course of a day (a strong downpour), a sequence of days (a heatwave), or extended over weeks and even years (a persistent drought). To understand these impacts on a farm we approach the problem in a risk management framework -- focusing on the probability of occurrence for a given extreme event, the exposure of the farm to the extreme conditions, and the vulnerability of the system once exposed. Once we have characterized the occurrence, vulnerability, and exposure we are able to identify opportunities for adaptation as a reduction in any of these elements benefits the stability of the entire system.

The occurrence of extreme events may be predictable either on an individual basis or through our understanding of the overall statistics of weather (which we call "climate"). We are thus able to design farming systems that anticipate extreme events, but we have to be aware that human influences are changing the Earth's climate and thus shifting the characteristics of extreme events in a given region. This may change the frequency, intensity, duration, and geographic extent of events when they occur, although climate models can help us understand the types of shifts that are occurring, but also demonstrate that society's actions on greenhouse gas mitigation can reduce the occurrence of detrimental extremes.

The extent to which farms are exposed to these extremes may be dramatically altered, for example through the construction of levees to reduce flood inundation. With forecasted warnings (of hail or heat waves, for example), livestock and sensitive crops may be placed in protected areas. Scientists have linked disease and pest outbreaks to excess moisture on plant leaves, providing opportunities to recognize and even reduce exposure to dangerous conditions before disaster strikes.

Even accepting that extreme events will affect a farm system, there is an opportunity to reduce the impact by enhancing resilience. Irrigation, shading, and flood-resistant seed cultivars are all examples of adaptation investments that allow productive agriculture to persist even in the face of extreme conditions. With accurate forecasts and agricultural models we can stress test our agricultural systems in order to identify and reduce vulnerabilities.

Recent efforts by the Agricultural Model Intercomparison and Improvement Project (AgMIP) demonstrate novel applications of climate information for agricultural planning and investment. These recognize the interconnected nature of the agricultural system, with local impacts affecting international markets and distant trading flows incentivizing local planting decisions. AgMIP models illustrate the challenges facing agriculture, allowing resilience planning even as precise prediction of extremes remains difficult. Climate applications are currently focusing on the reverberating effects of climate shocks through socioeconomic and biophysical systems, helping to recognize unintended consequences and feedback loops as decision-makers respond to the prospect of production shortfalls. Finally, we will discuss AgMIP assessments' use of cutting-edge climate products for historical data, real-time monitoring, seasonal prediction, and long-term climate projections; each with their own uncertainties.

IMPROVING AGRICULTURAL RESILIENCE TO CLIMATE VARIABILITY AND ENHANCING AGRO-METEOROLOGICAL SERVICES

Dr. Kwanghyung Kim
APEC Climate Center

Agricultural resilience requires understanding the impacts of climate variability and the dynamics of farmer adaptation. Weather and climate forecasting allows for the prediction of yields considering potential risks of crop damage and thus enables the exploration of adaptation strategies, but the challenge lies in translating low-to-moderate skill climate information into useful information for farmers. Complex climate-crop interactions are made relevant to the layperson through building easy-to-use tool kits, but these tools are only useful to end users if a decision support environment (building relationships and trust among stakeholders, continued/iterative communication in co-generating products) is created instead of only decision support systems. In fact, anyone who works in climate would recognize the disbelief encountered when talking about climate prediction to a group of people who are experiencing a deviation in weather from what was predicted. Similarly, any agricultural information translated from the climate prediction has no choice but to inherit the distrust within the stakeholder groups. Therefore there need to develop ways to effectively communicate the long-term, variable nature of such climate prediction and its agricultural information by-product. We will highlight these issues by telling the story of the long term use of climate smart agriculture. Here, climate smart agriculture refers to the smart use of climate information for agricultural decision making, which results in maximizing the positive and minimizing the negative influence of climate. Several case studies will be shared, emphasizing on how improved data availability by a stakeholder-participatory approach led to enhanced agro-met services and eventually improved agricultural resilience to climate variability in the communities.

ASSESSING THE IMPACT OF CLIMATE CHANGE ON POTATO CULTIVATION IN ITS CENTER OF ORIGIN

Dr. Roberto Quiroz
International Potato Center (CIP)

Andean farmers cope with the constant presence of extreme climatic events by diversifying their crops, managing spatial variability, stagger planting and the use of biodiversity. With the current warming trend and less reliability of rains, food security is at stake. A series of studies have been conducted by CIP and partners to develop the capacity to model how changes in key climatic variables might affect the most important staple, the potato. Crop growth and pest models were constructed and validated to assess the impact of dramatic changes in temperature, rainfall and CO2 might have on the phenology of pests, the need for chemical control and the likely effect on the yield of local and introduced varieties. The warming trend will increase the proliferation of e.g. potato tuber moth, late blight and potato yellow vein virus. It will also decrease tuber yield (4 % per oC on average) with more dramatic reductions in native when compared to introduced and hybrid varieties. Reduction or increment in rainfall (-/+ 30 % of actual) produced changes in the order of - 4.9 or +2.5 %, respectively; but in the best of the cases yields were way below their potential under irrigated conditions. The fertilization effect due to higher CO2 concentration was estimated as 10 % per 100 ppm incremented. Tolerant varieties and appropriate soil, crop, and water management are needed to guarantee food security.

Session II

Employing Climate Science for Long-Term Agricultural Planning

APEC Climate Symposium 2016

Smart Climate Information and Accountable Action:

Achieving Sustainable Food Security in a Changing World

GROWTH AND VARIABILITY OF CROP PRODUCTION UNDER CLIMATE AND SOCIOECONOMIC PATHWAYS

Dr. Toshichika Iizumi
National Agriculture and Food Research Organization (NARO), Japan

Future projections of climate change impacts are a scientific basis in planning national adaptation and agricultural development programs in coming years. In addition to them, it has become increasing important to understand the climate change impacts on agriculture in the historical past. Studies detecting change in growth and yield across crops and regions of the world and attributing them to historical change in climate and agricultural technology offer further information for national governments and international development organizations about adaptation and development priorities.

Here, I present two recent research outcomes. The first one is the global analysis detecting yield variability change and attributing it to recent climate change. This research shows that year-to-year variations in yields of maize, soybean, rice and wheat in 1981–2010 significantly decreased in 19%–33% of the global harvested area with varying extent of area by crop. However, in 9%–22% of harvested area, significant increase in yield variability was detected. Major crop-producing regions with increased yield variability include maize and soybean in Argentina and Northeast China, rice in Indonesia and Southern China, and wheat in Australia, France and Ukraine. Examples of relatively food-insecure regions with increased yield variability are maize in Kenya and Tanzania and rice in Bangladesh and Myanmar. On a global scale, over 21% of the yield variability change could be explained by the change in climate variability. More specifically, the change in variability of high temperature extremes was more important than other abiotic stresses, such as low temperature extremes and soil water deficit. These findings show that while a decrease in yield variability is the main trend worldwide across crops, yields in some regions of the world have become more unstable, suggesting the need for long-term global yield monitoring so that policy makers can take measures when necessary.

The second one is the modeling study which presents the national and global yield growth patterns in coming decades under developmental pathways. In this study, I proposed country annual per capita gross domestic product-based parameterizations for the nitrogen application rate and crop tolerance to stresses. Using a global crop model combined with the parameterizations, I present global 140-year (1961–2100) yield growth simulations for the crops under shared socioeconomic pathways (SSPs) and no climate change. The model reproduces the major characteristics of reported global and country yield growth patterns over the 1961–2013 period. Under the most rapid developmental pathway SSP5, the simulated global yields for 2091–2100, relative to 2001–2010, are the highest (1.21–1.82 times as high, with variations across the crops), followed by SSP1 (1.14–1.56 times as high), SSP2 (1.12–1.49 times as high), SSP4 (1.08–1.38 times as high) and SSP3 (1.08–1.36 times as high). Future country yield growth varies substantially by income level as well as by crop and by SSP. These yield pathways offer a new baseline for addressing the questions related to adaptation costs and agricultural development under changing climate.

SEASONAL CLIMATE FORECASTS AS A PATHWAY FOR CLIMATE CHANGE ADAPTATION: A REVIEW

Mark Howden[1], Lauren Rickards[2], Steven Crimp[3]

[1] Australian National University [2] RMIT University [3] Commonwealth Scientific and Industrial Research organisation

Seasonal climate forecasts (SCF) hold out the promise for improved decision-making by reducing the 'haze of uncertainty' that clouds the future. As a risk management tool, SCF's provide a valuable but partial 'telescope' to the near future. Twenty-five years ago, the proposition was generated that seasonal climate forecasts could also be a stimulus for and eventual route to improving decision makers' acceptance of, knowledge of, and adaptation to, longer-term climate change. This proposition remains enticing but the evidence supporting it remains somewhat elusive. In this paper we critically evaluate the proposition, exploring both the potential advantages and disadvantages of the use of seasonal climate forecasts for climate change adaptation. We specifically discuss how seasonal climate forecasts can be seen as uncertain, insufficient, distracting, misleading, unnecessary and divisive as well as potentially beneficial. Hence, their effective use as an adaptation tool requires recognition of the risks they pose as well as expose. In particular, over-reliance on SCFs, poor contextualisation of the SCF knowledge products and understanding of the pathways to action, as well as limited integration with more systemic adaptation perspectives poses the risk of maladaptation. We identify several research opportunities, particularly the extent to which SCFs act as an effective boundary object within agricultural and food security adaptation efforts. Understanding the ways in which SCFs may inadvertently and implicitly undermine the steps needed to adapt to climate change in the longer term is needed in order to ensure their potential considerable benefits come to fruition. As climate change progresses, the types of adaptations needed are likely to be increasingly intensive, intentional, large-scale, complex and risky. How to use SCFs in a strategic rather than uncritical manner will be key to this progression. We use this review to contribute to the development of some general principles about what constitutes 'good' climate change adaptation practice and policy.

GLOBAL ADOPTION OF CLIMATE-SMART AGRICULTURE: EX-ANTE ECONOMIC IMPACT ASSESSMENT

Alex De Pinto, Nicola Cenacchi, Jawoo Koo, Ho-Young Kwon, Shahnila Islam
International Food Policy Research Institute

Long-term, spatio-temporally disaggregated climate change scenario data are one of the key input to IFPRI's International Model for Policy Analysis of Agricultural Commodities and Trade (IMPACT) model. The IMPACT modeling framework includes three modeling components: 1) a global partial equilibrium, multi-market food supply and demand projection model, 2) a suite of global water models (i.e., hydrology, water basin management, and water stress), and 3) the DSSAT cropping system model that estimates crop yield responses under varying management systems and environmental conditions. This presentation will present the overall architecture of the IMPACT modeling framework, describe what types of model drivers, scenarios, and climate change scenarios are incorporated, and discuss preliminary results from an ex-ante climate-smart agriculture (CSA) impact assessment study, in which co-authors investigated the biophysical and socio-economic implications of global-scale adoption of CSA technologies and practices.

SCENARIOS ON CLIMATE CHANGE IMPACTS FOR DEVELOPING APEC ECONOMIES AND HOW TO INCREASE RESILIENCE AND BENEFIT FROM OPPORTUNITIES

Dr. Maximo Torero

International Food Policy Research Institute

There is moderate consensus that temperate regions will have increased variability in temperature and rainfall, although there is no consensus on tropical regions (IPCC AR4) but clearly increased mean temperature increases risk. We combine climate models, agronomic model and economic models to simulate the impact over the economic systems of APEC Economies. We assess the effects over yields, agricultural value added, real income per capita, and on household consumption as a result of the changes in relative prices by 2050. Our results show heterogeneous effects across APEC economies. As expected we identify important increases in prices especially of sugar, cotton, vegetables, fruits, rice and other grains. The productivity losses for some farmers are in average more than compensated by the price increase but the production pattern will also be shifted significantly, the average sectoral production change is between 4 to 10%. Finally, consumption per capita of fruits and vegetables decrease across most APEC economies, with the biggest negative effects on upper and middle income economies followed by lower income economies. The exception are economies in South America and Oceania.

Despite we know the big picture in climate smart policies to cope with the risks being observed in our simulations (i.e. accelerate investments in agricultural R&D for productivity growth and climate resilience; Increase investment in rural infrastructure; regulatory reform in seed and input markets; improve extension services; and reform economic policies: open trade; land and water rights; reduction of energy, water, and fertilizer subsidies; value carbon) analysis is needed to close knowledge or information gaps regarding the degree of "climate smartness" of policies (CSA) , investments and technologies. Market signals cannot provide the necessary guidance because impacts are not easily observable and prices are missing on resilience and GHG emissions. So these need to be discovered through analysis.

In addition, climate smartness is highly location specific, so evidence needs to be spatially disaggregated. CSA forces us to shifts the emphasis from policies that aim at a single targets to policies that have multiple objectives. CSA changes the planning time horizon: policies and analyses necessarily span long time periods of 20-30 years. Therefore, CSA requires the use of integrated modeling frameworks that work at multiple geographical scales to:

- *Prioritize investments and provide an accurate understanding of tradeoffs*
- *Increase velocity of technological innovation and adoption taking into account demand side*
- *Design long-term economically and politically sustainable policies*

More importantly, given its complexity, CSA requires an even closer collaboration between policy makers and research community.

CLIMATE INFORMATION TOOLS FOR DECISION MAKING

Dr. Willingthon Pavan
University of Passo Fundo, Brazil

The challenge of agriculture today is to feed the world while being economical, environmentally, and sociable sustainable. The seasonal weather variability is well known as one of a primary source of crop production risks. The main causes of crop failures are associated with either a lack of moisture or excess of rainfall. Other production risk sources, such as insect pest/disease incidence, are also highly related to climate variability. In addition, the challenges posed by climate variability and climate change are increasingly important.

Efforts have been made to develop solutions, based on crop and insect pest/disease simulation models, to help growers to make decisions, understand the agricultural phenomena and reduce the costs with unnecessary use of pesticides while increasing the sustainability of their operations as well as minimizing the risks. Crop simulation models can be used to estimate final yield, as well as simulating growth and developmental dynamics of crops via numerical integration. Crop simulation models operate based on physiological processes that describe crop response to soil, management conditions, and the environment. Simulation outcomes can then be used to predict changes and detect trends in biophysical indicators such as crop yield, nutrient uptake, nitrate leaching, and soil carbon levels. Once set within the framework of comprehensive information and decision support system, the crop models can facilitate the efficient analysis of issues related to agricultural production. The application of crop models in risk assessment is being considered to optimize in-season management for spatially variable fields. However, these applications require accurate crop models able to simulate concurring crop stresses like insects and plant diseases. Simple growth functions-based models can be used to describe outbreaks but not to explain the underlying biological processes. Customized models could be built from this starting point to include biological processes such as the partitioning of the affected individuals into different compartments. Noteworthy is the interaction between host and pest growth. The work in our group constitutes an attempt to develop a software suite and frameworks for the simulation of both generic insect pest and disease models that can be easily coupled with crop models aiming to improve crop yield estimation under different scenarios. Our experience has shown that helping farmers to use effectively forecast and seasonal climate forecasts for reducing production risks and adapting management practices to the expected climate also enhances their ability to face potential climate impacts on crop production.

IS AGROBIODIVERSITY A KEY TO SUSTAINABLE CROP PRODUCTION IN A CHANGING ENVIRONMENT?

Dr. David Ellis

International Potato Center (CIP)

Within and between crop biodiversity is a critical component by which small holder sustenance farmers manage annual fluctuations in crop productivity. For these farmers, this often means relying on centuries old technologies for cultivation, harvesting and storage of their food crops to sustain their families until the next harvest year. The extreme changes in the Andes have greatly exacerbated the annual cycles, resulting in an unprecedented need for immediate adaptation by the farmers as well as a reassessment of the genetic material best suited for this changing landscape. In 1982 in Parque de la Papa, a valley outside of Cusco, potato landraces were cultivated by traditional means as low as 3,820 m.a.s.l. In 2016, just 30 years later, harvests of landrace potatoes in this valley are virtually nonexistent below 4,000 m.a.s.l. A shift upslope in traditional potato farming by 200 m in 30 years is extreme! But this is a reality in the Andes, and elsewhere, with a changing climate. For generations prior to climate change, Andean potato farmers have coped with the changing environment by planting 10-20+ different potato varieties, as well as an assortment of other Andean Root and Tuber crops (ARTCs) as an insurance against crop failures. If one variety does poorly this year, another will fill the gap. The genebank at the International Potato Center (CIP) is a global resource conserving the diversity vital to these farming communities and serving as an invaluable resource for maintaining, supplementing and reviving agrobiodiversity on these small holder farms. CIP holds in trust under the International Treaty for Plant Genetic Resources for Food and Agriculture the global potato collection (>4,350 landraces and >2000 wild accessions), global sweetpotato collection (>4,850 cultivated and >1,090 wild accessions) and the global collections of nine other Andean root and tuber crops. For the past 45 years, CIP has been working with the Peruvian Andean farming communities and as part of this effort, for the past 17 years, the CIP genebank has partnered with communities throughout the Peruvian Andes to give back, or repatriate, potato landraces once farmed in the areas where these communities are living. Such repatriation of germplasm back to communities is ensuring the continued availability of diversity to sustain the livelihoods of the farmers and their families in the rapidly changing environment of the Andes.

IMPLEMENTING CLIMATE INFORMATION SERVICES FOR DECISION-MAKING IN PERU

Eng. Grinia J. Avalos Roldán

National Meteorology and Hydrology Service of Peru (SENAMHI)

Based on the Statement of the Third World Climate Conference (WCC-3) in 2010, the World Meteorological Organization (WMO) decided to establish in 2011 the Global Framework for Climate Services to strengthen production, availability, supply and application of such climate services based upon scientific knowledge.

Climate Services consist of disseminating climate information to a particular user sector for the purpose of interpreting and applying information of climate evolution for decision-making. In this context, the National Meteorology and Hydrology Service of Peru (SENAMHI) has implemented interfaces with users of the agriculture sector for the provision and use of climate information, guaranteeing access, understanding and interpretation of available climate information and to promote more coherent action between scientists and users, facilitating articulated responses to social and economic interests of the country through the proper use of climate information for decision-making.

Being the northern coast of Peru a predominant agricultural region, and considering that this economic activity is closely linked to weather and climate conditions, largely modulated by the inter-annual variability of ENSO, it was necessary to implement an inter-institutional mechanism for decision-making on agriculture under the holistic view of climate services.

Session III

Long-term Solutions for Threatened Fisheries Caused by Climate Change

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WHERE ARE THE FISH? REDUCING CLIMATE IMPACTS ON COASTAL COMMUNITIES AND MARINE INDUSTRY

Ms. Lauren Weatherdon
UNEP World Conservation Monitoring Centre

THE EFFECTS OF CLIMATE CHANGE ON THE CONTRIBUTIONS OF FISHERIES AND AQUACULTURE TO FOOD SECURITY

Dr. Johann Bell
Conservation International

CURRENT AND FUTURE SITUATION OF AUSTRALIAN FISHERIES TO CLIMATE CHANGE

Prof. Elvira Poloczanska
Alfred Wegener Institute (Biosciences | Integrative Ecophysiology)

PRODUCTIVITY AND SUSTAINABLE MANAGEMENT OF THE HUMBOLDT CURRENT LARGE MARINE ECOSYSTEM UNDER CLIMATE CHANGE

Dr. Dimitri Gutierrez Aguilar
Ocean Institute of Peru (IMARPE)

CLIMATE CHANGE EFFECTS ON THE ECONOMICS AND MANAGEMENT OF WORLD FISHERIES

Dr. Ussif Rashid Sumaila
University of British Columbia

CLIMATE CHANGE, FOOD SECURITY, AND THE OCEAN: IS THERE A PATH FORWARD?

Dr. Jake Rice
Department of Fisheries and Oceans Canada

APEC Climate Symposium 2016

Smart Climate Information and Accountable Action:

Achieving Sustainable Food Security in a Changing World

WHERE ARE THE FISH? REDUCING CLIMATE IMPACTS ON COASTAL COMMUNITIES AND MARINE INDUSTRY

Ms. Lauren Weatherdon
UNEP World Conservation Monitoring Centre

Evidence of the influence of climate change on the productivity and ecology of marine ecosystems has been witnessed globally, with over 90% of observed warming having accumulated within the world's oceans. Projections indicate that declines in fisheries' catch are likely to occur in tropical and polar regions by 2050, with species moving towards cooler waters as the ocean warms. Impacts arising from climate change—combined with other pressures, such as overfishing and habitat degradation—are likely to affect areas of the world that depend on marine resources for economic security and access to nutrition. This talk will outline some of the proactive measures that are being applied to mitigate these impacts, such as integrated aquaculture, blue carbon, and ecosystem-based adaptation, and will highlight remaining challenges that require attention globally. This talk will also introduce some of the current initiatives by UNEP, UNEP-WCMC, and other organisations to strengthen international capacity to mitigate and adapt to the impacts of climate change on marine and coastal environments, which are important for the wellbeing of coastal communities throughout the world.

THE EFFECTS OF CLIMATE CHANGE ON THE CONTRIBUTIONS OF FISHERIES AND AQUACULTURE TO FOOD SECURITY

Dr. Johann Bell
Conservation International

By 2050, an additional 75 million Mt of fish will be needed to help feed more than nine billion people. Continued development of aquaculture and improvements to management of capture fisheries hold the promise of providing the additional fish required to maintain average, annual, global fish consumption (~20 kg per person). However, the best laid plans for increased aquaculture production and better fisheries management could be disrupted by climate change and ocean acidification. Assessments of the likely effects of increased greenhouse gas emissions on future production from fisheries and aquaculture have identified 'winners' and 'losers', both in developing country regions and globally. Negative effects are likely to be greatest in tropical and subtropical countries, with positive effects occurring mainly where waters are presently cooler. 'Win-win' adaptations are needed to enable fisheries and aquaculture to provide more fish for growing populations in a way that is resilient to climate change. In this talk, such win-win adaptations will be illustrated with examples from the Pacific Island region, which arguably has the greatest dependence on fish for food security These examples include greater investments in integrated coastal zone to protect fish habitats, diversifying methods to catch coastal fish stocks, transferring effort from coastal fisheries resources to oceanic resources, improving supply chains, and expanding small-pond freshwater aquaculture.

CURRENT AND FUTURE SITUATION OF AUSTRALIAN FISHERIES TO CLIMATE CHANGE

E Poloczanska, C Dichmont, R Pears, S Pascoe, R Deng and R Tobin
Alfred Wegener Institute

I will start by providing evidence of the impacts of climate change on marine biodiversity. Understanding how species, communities and ecosystems will be reorganised under a warmer climate are needed to inform effective conservation and management options. I will provide projections of changes in global marine biodiversity patterns, including commercial species, under climate change scenarios, using climate velocities to drive changes in species distributions. I will draw on Working Group II of the IPCC Fifth Assessment Report to discuss risks and vulnerabilities of fisheries. Commercial fisheries face risks from climate change but are also vulnerable to changes in global economic drivers and from the intrinsic structure of their businesses which may dominate decision-making in the short-term. Fisheries operate in a fluctuating and uncertain environments in terms of their practices and their business models. An existing backdrop of social, technical, economic, financial, legislative and ecological drivers influence fisheries productivity and profitability across a range of spatial and temporal scales. Against this backdrop are set the growing impacts of climate change. We ask "How well positioned are commercial fisheries for current and future challenges and opportunities?" using examples of commercial fisheries in the Great Barrier Reef, Australia through the concept of "typologies". This places businesses within Queensland in more homogenous groups compared to those based on licence holding alone. We applied a situation analysis to define and interpret the present state of fisheries typologies in terms of climate adaptation. We developed a Bayesian Belief Network that included three dimensions of vulnerability: Ecological, Macro-economics and Governance and Micro-scale (which are internal aspects that are within control of fishing businesses). We defined a set of challenges for fisheries businesses focused on the direct and indirect climate change impacts on target species however we also investigated fluctuating fuel price and a holistic management plan. The analysis provides context and a knowledge base for fishing businesses to plan.

PRODUCTIVITY AND SUSTAINABLE MANAGEMENT OF THE HUMBOLDT CURRENT LARGE MARINE ECOSYSTEM UNDER CLIMATE CHANGE

Dr. Dimitri Gutierrez Aguilar
Ocean Institute of Peru (IMARPE)

The Humboldt Current Large Marine Ecosystem (HCLME) is defined to cover 95% of the southeast Pacific, of which the Humboldt Current System (HCS) stretches from around 4 to 40 degrees south, being the most productive of the global Eastern Boundary Upwelling systems in terms of fishing yields. Ecosystem services and benefits are spread in many fields of the economy and societies. Global warming will likely affect marine circulation and land-atmosphere-ocean exchanges at the regional level, affecting the productivity and biodiversity patterns along the HCLME. Notwithstanding recent cooling trends along most of the upwelling areas, it is expected a shift towards a decrease of upwelling productivity in the next decades, which would be amplified by global trends of oxygen depletion and lower pH. In addition, higher frequency of extreme climatic events, such as El Niño in a warmer ocean, might augment the risks for the recruitment success of cold-water resources, especially in the Northern HCLME (off Peru). Non-climatic anthropogenic stressors also combines as threats for biodiversity and biomass yields, with overfishing and pollution as some of the main issues to prevent, reduce or remediate. Improvement of planning and management tools with value addition options for marine products is needed for stakeholders and local populations to adapt to climate change. The challenge for sustainable management of the HCLME goods and services under climate change also requires an effective implementation of an ecosystem-based management.

CLIMATE CHANGE EFFECTS ON THE ECONOMICS AND MANAGEMENT OF WORLD FISHERIES

Dr. Ussif Rashid Sumaila
University of British Columbia

Climate change is projected to redistribute fisheries resources while affecting the productivity of fish stocks. In turn, these changes will affect the economics and management of fisheries in many regions of the world. In this talk, I will discuss how climate change is likely to affect the revenues generated by fisheries world-wide, and using a specific case study on British Columbia, show how climate change would likely affect the household budgets of families around the world via its effects on the supply and price of fish. It seems that many families around the world would have to spend more of their food budget on seafood if they want to maintain the same level of consumption of fish in the face of climate change. I will end my talk with some suggestions on how each segment of society (individuals, cities, communities, companies, NGOs, national governments and regional and international institutes) can contribute to mitigating and adapting to the climate change effects on the economics of fisheries.

CLIMATE CHANGE, FOOD SECURITY, AND THE OCEAN: IS THERE A PATH FORWARD?

Dr. Jake Rice

Department of Fisheries and Oceans Canada

This talk will illustrate the complex web of interactions that must be considered when seeking strategies to achieve future food security in the face of climate change. The talk will first review projections of both human need for protein over the next four decades and of expected change in regional production of main crops under preferred climate change scenarios. The case will then be made for why the protein deficit must be met largely through increasing the food taken from the sea. Strategies for achieving such increases will be presented, first illustrating that simply increasing harvesting pressure while fishing in the present ways will both be unsustainable and will fail to achieve the necessary increases in yield. Alternatives may include great expansion of intensive aquaculture (both coastal and in freshwater) and different strategies for harvesting wild stocks, such as the controversial balanced harvesting of a wider range of marine organisms. Although these strategies may contribute to achieving the necessary increases in yield of fish protein for human consumption, both have serious implications for the economics of fishing and the conservation of biodiversity. These implications will be outlined. The talk will develop the argument that any pathway to food security requires rethinking strongly held policy priorities, and simple trade-off calculations are unlikely to identify globally optimal further pathways. The talk will conclude with discussing the relevance of food security, climate change, and the ocean for the “nexus approach” that DESA is developing for the 2030 Sustainable Development Goals.

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