

## **Summary Report on IUFOST Scientific Roundtable Discussion #2 (SRD2)** **Topic: Climate Change and Food**

*Release - December 20 2019: **Climate Change and Food** was the subject under consideration by the panel of distinguished international experts in the second of the new IUFOST series of Scientific Roundtable Discussions (SRDs) held on December 12, 2019.* This Roundtable was co-chaired by Dr. Roger Clemens, Presiding Officer of the International Academy of Food Science and Technology (IAFoST) and Dr. Fereidoon Shahidi, Chair of the IUFOST Scientific Council. Dr. Vish Prakash, Past Academy President and Immediate Past Chair of IUFOST Scientific Council was the Roundtable moderator.

### **1. Highlights from Panelists:**

**a) Dr. Gordon McBean**, *Immediate Past President, International Science Council (formerly ICSU) and Nobel Laureate as member of Panel on Climate Change* - As the climate is changing, it is important to examine the impacts on the global food system, including agriculture and aquaculture, harvesting and fishing and the food processing, transportation and distribution systems, as well as their roles in modifying the climate system. There have been important assessments of aspects of these issues and it is important to bring together and extend this information to provide a comprehensive, integrated approach with global long-term benefits for global society and future generations.

**b) Dr. Stephane Guilbert**, *Professor, Montpellier SupAgro (French public institution focussed on higher education and research in Agriculture, Food and Environment) INRA* – Focus on food processing and logistics steps as well as mitigation measures, new alternative sources of protein, avoidance of ultra-processed foods are most important considerations for food security as affected by climatic changes. Emerging technologies, plastic packaging, circular economy, and all achievements in microbiological and chemical food safety must be reconsidered with consideration of climatic challenges.

Internationally, an important priority is alternative sources of dietary protein, such as the conversion from biowaste and microalgae; these sources are important as the industry avoids ultra-processed foods (advanced in Brazil and France), and excess CO<sub>2</sub> production via traditional dietary sources of dietary protein.

**c) Dr. Sergio Mora-Castro**, *Engineering Geologist, specialist in risk, natural resources and environmental management, CONSULTARX, Costa Rica* –

1. Frequently there is confusion between what really is climate change (CC), and its differences with climate variability (CV) and anthropogenic global warming (AGW) as well as between the attribution of losses and damages caused by hydro-meteorological hazards, particularly those associated to climate variability, and vulnerability to 'climate change'. Risk, in a defined future temporal horizon, associated to CC (AGW), will be considerably more sensitive to the changes of Vulnerability than its associated hydro-meteorological hazards.
2. Misinformation, half-truth, exaggerations of the extremes (e.g. apocalypse, negationism), and fake news, create confusion, harm the cause of risk management and, of course, of food security.
3. Probabilistic modelling of Risk is a key factor to define policies and strategies to cope with AGW-induced food insecurity hazards.

**d) Dr. Cheikh Ndiaye**, Executive Director, African Food and Agriculture Skills Development Centre, Senegal, former senior scientist with FAO, UNU - “Warming to Warning” –

- Promises have been made and how can these promises be translated into action beyond small scale projects to bring countries together in a global agenda and clear mandate to protect and recover coastlines, protect habitats and livelihoods, especially for Africa and other low income parts of the global economy.
- Changes in climate impacting the food supply and availability clearly form a mandate to address those issues and how to protect the land and livelihoods of people on the continent of Africa.
- Encouraged development of foods from aquatic and marine sources; Traditional crops, such as sorghum, maize and rice are vulnerable to purported changes in weather patterns, especially across the African continent.

**e) Mr. Timothy Sulser**, Senior Scientist, CGIAR Foresight, International Policy Research Institute, Washington, DC. USA – Quantitative foresight modeling; projections of global food system out to mid-Century; major food system drivers; climate change effects on future of food availability and quality; effects of elevated atmospheric CO<sub>2</sub> on nutrient content of primary food items. The Effect of global warming, like other abiotic factors, appears to influence the nutrient content of some foods. Focus on the continual changes of food system to mid-century and beyond as these may affect approaches to food delivery, particularly at-risk populations (e.g., children, pregnant/lactating women, and seniors). Our approach uses quantitative foresight assessment.

**Background, Contributing Papers:**

**Dr. Nina Fedoroff**, member of the U. S. National Academy of Sciences and a 2006 National Medal of Science laureate. Dr. Fedoroff served as the Science and Technology Adviser to two US Secretaries of State and to the Administrator of the US Agency for International Development (USAID) from 2007 to 2010.

Three major points –

- 1) The question of how we feed humanity as the world becomes more divided economically and politically becomes further complicated with Climate Change.
- 2) Technology and Biology are answers to assist productivity and production in areas around global warming.
- 3) Part of the solution can be very quickly reached if even current technologies available are used and adapted creatively and safely. The modernisation of agricultural and food research are key features.

**Dr. Pingfan Rao**, Editor-in-Chief of Nature Journal *The Science of Food*; Vice President of China International Science Council Committee and Chair, Food and Energy Supply Group of China Future Earth Committee.

Major points –While some data suggest global temperatures will increase by about two degrees this century, the food community needs to urgently consider first that in the past 10 years alone people’s diets in many parts of the world have changed to adversely affect health and life expectancy. This community needs to prioritise to handle all these issues in a multi-disciplinary way and to gain access to governments and governmental strategies, and understand the dynamics associated with all data in climate science.

**2. Overarching themes for follow up nationally and regionally through input from all, including Chairs:**

- Global food production, and transportation systems to distribute food make it possible to keep food supply going but international tensions are already heightened; trade disputes could create further food system risks because of global warming concerns and related controversies. There is a strong connection between failure of governments to take action and the issues of food and water crises. Governments at all levels need to work actively and collaboratively through intergovernmental panels with inter disciplinary approaches to address these issues.
- With global warming awareness, food insecurity continues to be a major concern; distribution of fish population will have implications for groups who rely on aquaculture; and there are associated transition

risks associated with changing methods of growing and processing food– the rules and regulations that will implicate climate related food systems; changing green house gas cycles;

- What are the tipping points for the global food system for the future or in other words the “thresholds” that if crossed bring extraordinary changes to culture, environment, and dietary patterns? These need to be analysed and strategies developed through multi-disciplinary approaches and inter-governmental action. One example of a tipping point could be ocean circulation problems with melting ice caps and shifts in ocean currents, that could radically shift localized climates and weather patterns across all continents, which would drastically change food systems.
- Food production changes and demand will alter consumption patterns due climate change issues. It is economically and environmentally feasible to concentrate on CO<sub>2</sub> emissions to start, but support is needed for countries being impacted by changing climate. Recent agreement has been reached through Paris negotiations that developed countries need and must provide financial and other support to help other countries to adapt.
- Most of the major issues now are as a result of changing extreme events related to climate. We need to work together to reduce exposure and vulnerability – through economic support to adapt to changing climate. Need integrated approach – not a simple one dimensional issue – need to support countries being most impacted, but are not the cause of the climate change issues.
- Not all governments and scientific communities accept their responsibilities associated with global weather dynamics; food scientists and technologists need to be present as strategies are developed and to impact decisions made.
- In more developed countries, mass production and concentrated production of food have affected healthy dietary patterns. Issues related to mass production are part of the mix as are the lack of basic understanding by governments and individuals on how food interacts with their bodies – how to feed their bodies and minds through a full understanding of food science, not just nutrition. This is the leadership role that Food Science and Technology must take regarding the health and wellbeing of global citizens and it is part of the work needed related to Climate Change and Food.
- Regarding mitigation to reduce environmental footprint in food processing, food processing and logistics next most important phases – represent almost 30% of green house gas (GHG) emissions – energy intensity and related to emissions from food production, food packing, food transportation – food processing and packaging and logistics can be of major importance – for example the non- renewable resource depletion from packaging represents 50% of food system impact; use of water resources represent 60% of food system impact – current methods not sustainable – mitigation is needed to reduce environmental impact – 1) diet 2) new technologies and 3) food loss and food waste reduction. The agriculture community is an important member of the disciplines addressing the above concerns.
- Foresight to mid-century – economic growth is a stronger driver than average climate changes in affecting food systems through temperature and precipitation at this point, not accounting for extreme events (e.g. Mozambique), which can completely wipe out food systems and survival depends on resilience capacity. Macronutrient availability will remain stable at the global level but distribution is still a major issue at the local level (country level). Attention must begin to be paid to micronutrient shortages as they will be impacted by climate change, for example, through mechanisms in plants to deliver micro-nutrients that are changing – with clear signals that mineral content being reduced while biosynthesized components, such as vitamins and other bioactives, react in mixed ways to climate change. Macronutrient availability will remain stable, but distribution is still a major issue at the local level (country level). Attention must begin to be paid to micronutrient shortages, particularly among at-risk populations, as their availability will be impacted by climate change. For example, through mechanisms in plants to deliver micro-nutrients that is being changed – with clear signals that amount of minerals being reduced. These abiotic stressors, even agricultural practices, affect plant physiology and ultimate nutrient delivery.

- In developing food and nutrition policies, the food science and technology focus must include working to connect policy with the nutritional quality of diets – while still delivering basic calories in some parts of the world (i.e. Africa)
- Imbedding healthy diet goals into policies and programmes – improving human and environmental health at the same time – ‘nudge’ policies to encourage demand side to shift to healthier diet. It is critical that those with an understanding of food systems be part of panels of experts charged with developing policies and programmes at the food, health and environment interface.
- There is not one single solution but particular consideration for environmental and public health issues nationally and even in regions within countries
- A model risk factor is needed to orient an effective risk management policy in all countries. It is essential to cope with potential effects of global warming.
- Doubtful science and misinformation complicate decision making – fake news harms risk management and food security – currently a flawed reformation – information full of myths – communication bias
- Another problem too– Developing Countries do not always have unlimited resources to challenge the effects of global warming and therefore priorities for action are required and these need to be adapted to national scales and need project management. The only way to understand how to establish priorities is to identify and quantify risk first of all, scenarios that will project evolution of patterns of risk and those associated with hazards along the line. Understanding social, environmental and economic cultural vulnerability will become the more important fact to analysis - loss potential during hazards.
- Reducing GHG is a priority– but focus should also indicate types of successful methods already employed - emphasise instead the incremental vulnerability; less heating and alternative approaches in areas of extreme cold weather – reduction of death tolls in extreme winter – improved transportation links - key words of vulnerability and variability
- From a European perspective – producing more vegetables and fruits locally, processed and eaten locally could assist overcoming the problems of climate change. Europe is importing in great quantities of these foods from Africa and elsewhere; the transporting of these and other food products over long distances is a big source of emissions. Changing behaviours and preferences of consumers are important factors to consider.
- Africa has great potential as a source of food, but not exploited because of lack of ‘vitamin m’ – money. Major concerns include core production of major crops is rain fed and become vulnerable to climate change. Although the food process begins with the small-scale farming, the current methods of operation employed with the use of simple farm tools show that this end of the production scale is already practicing low impact agriculture. However livestock is a main contributor to livelihoods on this continent - supplies 30% of agricultural sector – generates income and therefore forms a key element in food security and quality of life.
- Increased demand for access to clean water and energy will exacerbate the fishing industry problems as more storm surges and other climate-related events threaten livelihood and homes.

There is a need to develop agricultural systems that are environmentally friendly and to mitigate-unfavourable policies, low biomass production, access to water, particularly in developing countries. Scientific and - mitigation options – relevant research to help fisheries adapt to climate change reduction of gas emissions – new disease preventative treatments. Climate change implications for population growth – strategies to respond to immediate needs of poor farmers, small and medium size food system enterprises all represent call for action from food scientists and technologists together with partners from all disciplines, to form and initiate government policies and to provide the scientific expertise for solutions for the food supply chain.

### 3. IUFoST SRD purpose and planned outcome:

- IUFoST is preparing a report based on this Roundtable Discussion to be distributed to IUFoST Regional Groupings. The IUFoST Regional Groupings are asked to hold a similar Roundtable on the subject through the IUFoST platform and to prepare a regional assessment around the topic of *Climate Change and Food*. IUFoST Regional Groups represent Europe, the Near East, Africa, Central and South America, and the South East Asia. In areas where there is no IUFoST regional grouping, *Food Losses/Food Waste* Committees are being organized to consider this topic, perhaps by the adhering bodies.
- IUFoST will compile all the regional assessments and Adhering Bodies reports with the first report and issue its assessment and guidance in a paper available to Adhering Bodies, associates, international and governmental organizations and other interested parties.
- The Report is intended to:
  - inform on the work of Food Scientists and Technologists going forward and to find areas of international collaboration across disciplines.
  - define the pathways to reach the goals set scientifically for IUFoST regarding capacity building
  - inform policies nationally and internationally through scientific member countries and
  - raise awareness of this issue by publication in journals – dissemination in different forms of media.

**These are the major points arising out of the nearly 90 minutes deliberations and pave the way for the IUFoST Adhering Bodies and Regional Body Roundtables. This outline and agenda are put forward to ensure a global way of addressing the issues, with not only a modern science perspective but also a traditional view and what is sustainable.** This roundtable is intended to have a ripple effect, increasing action and purpose for food scientists and technologists to address these burning issues and questions.

Note: SRD2 attached **Appendix** offers questions that emerged from the Roundtable for consideration by IUFoST Regional Bodies and Adhering Bodies in their deliberations.

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*The Roundtable ended with thanks expressed to the co-chairs and moderator for their excellent leadership in this second IUFoST Roundtable Discussion. The Panelists and research contributors were thanked for lending their expertise and commitment to the Roundtable Discussion and for making it such a valuable part of this new series. Rapporteur Daisy Lanoi, Post Graduate student at Egerton University in Kenya, and Rapporteur Omolola Arowolo, Post Graduate student, Food Microbiology and Biotechnology at the Federal University of Agriculture, Abeokuta, Nigeria were thanked for their work on behalf of IUFoST. SRD Coordinator Judith Meech ED, IUFoST; Jeremy Hutchings SRD IT Expert; and all contributors and participants also were acknowledged.*

## Appendix 1

### 4. Questions from IUFoST SRD2 that emerged for the Regional Bodies and Adhering Bodies to consider regionally and locally:

- What are the major countries currently suffering from food shortage and what are the major causes?
- How will Climate Change affect the Productivity and Production of sustainable Specific crops in Developing Countries?
- What is the economic rundown from such changes and Livelihood Problems with small and medium farmers?
- When one looks at 17 SDGs many of the Goals are linked to Climate Changes. Can we quantify these and make necessary pathway/ Midcourse corrections having known that it going to be affected?
- How does the Global Nutrition Goals get affected by Climate Changes in the region as It would reflect the Nutrition and Health status?
- Respiratory diseases and other weather and Pollution related diseases will only mount more and more and what measurement we have in the early onset of certain diseases that will manifest added to Food Shortages and Lifestyle Changes?
- What do you think are the key “tipping points” for the global food system that we need to be thinking about or be preparing for? Tipping points, in this case, are thresholds that, if crossed, will precipitate extraordinary changes that will require major adjustments of the food system as we know it today.
- What major drivers, currently outside the food and agriculture sector, have the potential to shift their scope and broaden their influence on the global food system? A previous example would be the rise of alternative energy sources (e.g., solar/wind) which, a decade ago, were not even on the radar as being a viable source of energy for the foreseeable future, but now have huge potential to change how food is produced in different parts of the world.
- New agricultural practices (e.g., agro-ecology, agro-forestry) are very promising but lead to an increase in crop varieties and in the variability of agriculture. How can the food industry be adapted to it; what are the resulting needs for new knowledge in food science?
- Consumers are convinced that local agricultural products are better for the environment and their health. How can the food industry adapt considering many local agricultural restrictions and limitations? What are the related needs for new knowledge in food science?
- The climate is changing and is now and more in the future, impacting all aspects of the global food system. It is important that there be integrated science-based actions to address these issues. How can international science best work together for optimum global benefits?
- In responding to climate change and food projections for the future, there are needs to both adapt to climate change and reduce the net GHG emissions to the atmosphere. Since the food system has major implications for the GHG cycle, how best to optimize the emission reduction strategy with the adaptation strategy?
- Can the clean label approach contribute to reducing the environmental impacts of processed foods?
- How to reduce the use of plastic in food packaging design?
- What are the scientific obstacles to be addressed to promote a circular economy that uses waste and co-products as a resource for food production?
- What should the priorities be, for Risk Management, in developing countries?

- Where should CC (AGW) be amongst them?
- Are there only negative effects associated to CC (AGW)?
- Why are the positive ones are neglected from the mass of assessments?
- What is more relevant in terms of the expected damages and losses associated with food insecurity induced by AGW: The increment of the extremes in hydro-meteorological hazards or the increment of vulnerability of the population?
- How would it be possible for the African continent to benefit from the pledges of billion dollars made to tackle the problems Identified of global warming issues affecting forests, agriculture, infrastructure, coastal aquaculture, flora and fauna.
- Is there any reliable evidence for what the effects of elevated CO<sub>2</sub> might be on other types of nutrients, such as vitamins or other bioactive substances?
- Where do you see particular areas of concern regarding the availability of food (and their associated nutrients) for the coming decades?