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Climate change and implications for food safety

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1. The big picture: the nature and extent of the impact of climate change on food safety.
Globally, nearly one of every ten people fall ill and over 400,000 people die because of foodborne diseases each year; climate change is highly likely to increase this loss. Climate change related impacts are predicted to decrease food production, increase food contamination, and could lead to global food prices rises from 3% to 84% by 2050 (Porter et al. 2014) contributing to food insecurity and malnutrition. Rising temperatures and carbon dioxide levels may directly affect nutrition by decreasing the nutritional value of major crops and can result in an increase in toxin content in some food crops or seafoods, increasing food safety risks. Agricultural and public health practices are a critical complement to environmental policies aimed at preventing the projected climate impacts on peoples' health and livelihoods.

2. Key considerations for decision makers.
Climate change and variability will have direct and indirect impacts on the occurrence of food safety hazards at various stages of the food chain that decision-makers need to consider. Notably, climate impacts such as rising temperatures, changes in rainfall patterns, drought stresses and extreme weather events may lead to increased risks of food contamination and increase the occurrence of foodborne diseases. Although detailed quantitative models of these impacts are limited, there is a strong indication for the need for preparedness to address climate change impacts on food safety. Key issues to be considered by policy makers include:

i) Preparedness for effective management of pests and diseases
Climate change is predicted to alter the distribution of disease vectors and the disease burden in both animals and plants, potentially driving the use of antimicrobials in intensive food production systems. Recent studies have demonstrated an association between increases in local temperatures and antibiotic resistance (McFadden et al. 2018). Currently antimicrobial resistance claims the lives of over 700,000 people each year around the globe, disproportionately in low and middle income countries.

ii) Fungal pathogens of plants
In plant production, the occurrence of toxin-producing fungal phytopathogens is likely to increase and expand into regions where such contamination does not currently occur. For example, it is predicted that the risk for aflatoxin contamination will increase in maize in a + 2°C temperature scenario in Europe (EFSA, 2012). Increases in plant pests may result in more chemical usage and the possibilities of residues entering the food chain. In the absence of

planned strategies and novel methods to rapidly detect, treat and control these infections, productivity is expected to decrease and food safety hazards may increase. Therefore, a more sustainable approach that includes pest prevention and monitoring techniques including habitat manipulation, modification of practices, use of resistant varieties, and pest surveillance practices, is called for.

iii) Bacterial pathogens of food and food production systems

Foodborne and zoonotic diseases are also predicted to increase as a response to climate change. Salmonellosis and campylobacteriosis, two of the most common causes of diarrheal illness, invasive foodborne diseases, and life-long secondary consequences are linked to increased temperatures and flooding, respectively. For example, salmonellosis cases have been found to increase by 12 percent for each degree increase in weekly or monthly temperature above 6oC ambient temperature. Rising ocean temperatures are also leading to higher densities of Vibrio spp., including the bacteria responsible for cholera. This has resulted in an increase in Vibrio-associated infections related to seafood in the USA and seafood from northern waters in the Baltic Sea.

Changes in food contamination may be reduced by 1) implementing preventive good management practices that limit livestock and zoonotic diseases 2) controlling waste flow from farming sites 3) design of livestock waste storage lagoons to withstand extreme weather events, when feasible. Thus, integrating food production within climate change adaptation and disaster risk reduction and management plans.

iv) Aquatic ecosystems

In addition to bacterial pathogens mentioned above, the warming of the seas, in combination with eutrophication, will also increase food safety hazards related to algal toxins and mercury intoxication. Higher ocean temperatures are correlated an increased in the frequency and extent of algal blooms globally. Paralytic shellfish poisoning was recorded off the coasts of Iceland and Greenland for the very first time in 2009 and 2012. Surveillance of antibiotic use and resistance can assist in promoting these sustainable practices. Climate change adaptation strategies relevant to fish and food security can be mainstreamed into national aquaculture and fisheries policies, including, for example, linking practices to climate and weather research and prediction and providing appropriate management and governance mechanisms.

Ocean warming also increase the rate that bacteria in water and sediments convert mercury to its organic form, methylmercury. Methylation of mercury increases by 3–5% for each 1ºC rise in water temperature. Methylmercury accumulates in the food chain (fish, seafood, and mammals), and is a developmental neurotoxicant. Affected children have a decreased IQ which results in diminished economic productivity over life. The loss of productivity due to methyl mercury toxicity amounts to $8.7 billion annually (range, $2.2–43.8 billion) in the USA (Trasande et al. 2005).

v) Changing production systems: re-evaluating risks and optimizating safety management practices

In order to meet growing food demands while meeting climate goals, current food systems are challenged to adapt to and mitigate climate change by the implementation of sustainable intensification practices, food waste reduction, and the introduction of novel food and feed products and technologies. For example, the shortage of quality water could introduce micro-biological and chemical risks at all steps of the food chain where water is used and impact on the safety and hygiene of produced food (JRC 2016). Using alternative sources of water while ensuring food safety is an option to enhance sustainability. Wastewater has the advantage of being readily available, regardless of the weather. Food safety standards and guidelines are needed to ensure that crop, agroforestry and fish production using wastewater streams meet human health standards. It is critical that the policies and practices governing these changes take into account the effects of climate change, for example water scarcity may require water reuse strategies. The food safety impacts of such changes needs to be evaluated.

vi) Surveillance and data sharing across geographies and across sectors

Surveillance for residues, antimicrobial resistance and other food safety-related indicators is a critically important step in determining baseline risks, generating data for analyses, and prioritizing actions when resources are limited. Surveillance is also critical in detecting and assessing new and emerging risks and allowing risk managers to plan, implement and monitor the effects of interventions. Equally important is the need to share, compile, and communicate data on national, regional and global scales in order detect hazards more rapidly permit concerted actions to address food safety hazards associated directly, or indirectly, with climate change. Data should be collected and integrated from multiple sectors (environment, agriculture, health, etc).

vii) Integrating food safety into National Policy

New research on the impact of climate change on food safety should contribute to the Intergovernmental Panel on Climate Change Assessment Reports and to the work on adaptation and health carried out via the Nairobi Work Programme on the impact of and vulnerability and adaptation to climate change. The National Adaptation Plans (NAP) have been established by the UN Framework Convention for Climate Change (UNFCCC) to help Least Developed Countries (LDC) with the identification of adaptation priorities and resource requirements. Most NAPs from LCDs have recognized Agriculture, Food Security and Health as priorities to be addressed. Considering the impacts of climate change in food safety issues LCDs and other countries should consider including priority food safety issues that are affected by climate change into their NAPs. The National Determined Contributions (NDCs) embody efforts by each country to reduce national emissions and adapt to the impacts of climate change. So far only three countries have highlighted food safety in the adaptation sections of their NDCs. The revisions of the NDCs will offer an opportunity to countries to highlight their needs for adaptation to the impacts of climate change on specific food safety issues. The Koronivia joint work on agriculture (KJWA) may offer additional opportunities to countries to highlight their needs for adaptation on food safety and initiatives related to the reduction of food waste and wastage that contribute to food safety. The decision on the KJWA requested the Subsidiary Body for Implementation (SBI) and the Subsidiary Body for Scientific and Technological Advice (SBSTA), to jointly address issues related to agriculture taking into consideration the vulnerabilities of agriculture to climate change and approaches to addressing food security. In order to ensure that the relevant food safety stakeholders are engaged at the National level, representatives of the Ministries of Health and Agriculture should coordinate with the national focal point for the UNFCCC which is usually hosted at the Ministries of Environment.

3.Conclusion

The food system contributes to, and will be affected by, climate change. There is still much to be understood about the implications of climate change and variability on food safety. Notably, there is a need for more quantitative estimations of projected climate change impacts on food safety. Nevertheless, it is imperative that action is taken now to minimize the hazards that are predictable. Importantly, because of the complexity of the interactions between climate and food systems, all players including - public health, veterinary health, environmental health, food safety and climate service practitioners and policy-makers should be engaged in data collection, analysis, decision-making, and preventative actions. Policy coherence across environment, agriculture, food and health sectors is critical. The UNFCCC offers different mechanisms to national authorities to support adaptation planning and funding. Priority food safety issues that are affected by climate change should be included into NAPs and NDCs. Neither climate challenges nor food safety hazards respect geopolitical boundaries; therefore, lessons learned should be shared at national and international level. Failure to act now to known challenges with pro-active actions and policies will likely result in larger increases in the burden of foodborne illness caused by climate change.

REFERENCES

EFSA, 2012. Modelling, predicting and mapping the emergence of aflatoxins in cereals in the EU due to climate
Change. Scientific report submitted to EFSA.

Joint Research Center (JRC), 2016. Delivering on EU Food Safety and Nutrition in 2050 – Future challenges and policy preparedness, EUR27957 EN, Publications Office of the European Union, Luxembourg

MacFadden D.R., McGough S. F., Fisman D, Santillana M., Brownstein J, S.. 2018. Antibiotic resistance increases with local temperature. Nature Climate Change.

Porter, J.R., L. Xie, A.J. Challinor, K. Cochrane, S.M. Howden, M.M. Iqbal, D.B. Lobell, and M.I. Travasso, 2014: Food security and food production systems. In: *Climate Change 2014: Impacts, Adaptation, and Vulnerability. Contribution of Working Group II to the Fifth Assessment Report of the Intergovernmental Panel on Climate Change.* Cambridge University Press, Cambridge, United Kingdom and New York, NY, USA, pp. 485-533.

Trasande, L., Landrigan, P. J., & Schechter, C. (2005). Public health and economic consequences of methyl mercury toxicity to the developing brain. Environmental health perspectives, 113(5), 590-6.