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WATER, SOIL AND WASTE

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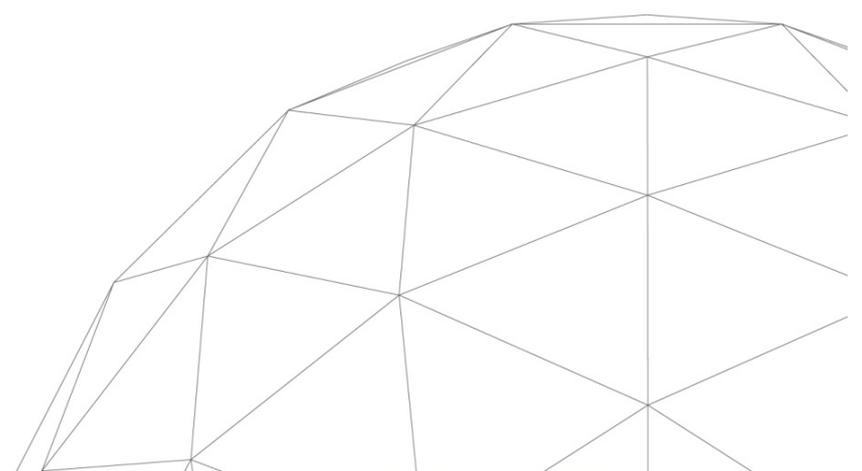
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POSITION PAPER – Extended Summary

Adapting to Climate Change: The Role of Science and Data in Responding to Opportunities and Challenges in the Water-Soil-Waste Nexus

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Day 1 | Climate Change



Adapting to Climate Change: the role of science and data in responding to opportunities and challenges in the Water-Soil-Waste Nexus

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Summary

The Water-Soil-Waste Nexus has a crucial impact on global food security. The resources and by-products of water, soil and waste are all interconnected and have dependent relationships with one another, thus forming a nexus. Water serves as the carrier for nutrients and transports them through the soil to the roots of plants. Soil has the ability to accumulate nutrients and acts as the medium where roots systems, and in some cases fruit, develop. Waste may also contain a significant amount of refused nutrients within its organic fraction, derived mostly from the farming and municipal solid waste. With proper management waste can become a resource with the Water-Soil-Waste Nexus through recycling and reuse. Therefore a better understanding of the interrelated dynamics of the Water-Soil-Waste Nexus would allow for improved production efficiency with a long term benefit for sustainable development. Aside from the opportunities described above there are also many risks driven by the current mismanagement of the Nexus such as contamination with organic and inorganic pollutants; soil erosion; environmental services deterioration; etc.

Climate variability and change play a major role in the dynamics of the Water-Soil-Waste Nexus. Climate has a direct impact on the water cycle. Effects from rising temperatures include increased amounts of water residing in the atmosphere that can lead to more intense precipitation events. Warmer temperatures also lead to higher rates of glacier melting leading to temporary increases in the summer streamflow in some mountain rivers and earlier snow melt; regional changes in the water cycle due to extensive melt of Arctic Ocean ice cover; etc. Climate has a direct impact on soils through the water and carbon cycles (Blum, 2005). Soil profiles and the ability of soils to supply nutrients can be affected by the change in the climate. Precipitation plays a significant role in the formation of soil profiles. Although the connections are more subtle, climate also affects the impacts of waste in the Nexus. Untreated pollutants carried by waste water can contaminate drinking water supplies. Furthermore they can also affect irrigation water and ecosystems causing health and environmental risks. Therefore, changes in climate are expected to affect water availability, soil composition, and waste generation and flows.

Hence, in order to better understand the Water-Soil-Waste Nexus, the up to date knowledge regarding the climate processes should be put in practice. This paper outlines interrelating principles for management of the Water-Soil-Waste Nexus under the ongoing conditions of climate change. The management process usually involves a wide array of actions aiming to align interconnections to achieve an overall strategic goal. In this report three important aspects of the W-S-W Nexus management are reviewed: assessment methodologies of impacts of climate change; adaptation strategies; and observational needs. The first aspect highlights the necessity to determine the local effects of climate change on food production

and water management. Methods for such assessment include: hydrologic and crop models for use in impact assessments; statistical and dynamic downscaling tools that use values from climate models; sensitivity studies; and simulations. The second element deals with the development of strategies for coping with the alterations caused by climate change. The paper advocates for technological as well as economical and policy advances in order to improve regional adaptation capacity - “the ability of a system to adjust to, cope with, and take advantage of climate changes (IPCC Third Assessment Report [2001])”. Depending on the local issues such adaptation measures could have a focus on: protecting sources of water; decreasing the risks from droughts, soil erosion or floods; maintaining the nutrient balance in the soil by reutilizing the nutrients in waste; etc. Successful strategies can include measures such as improved water supply efficiency; land use management, and recycling waste water.

The report concludes with a discussion of the need for observations and data collection of a wide array of variables, in order to determine the rate of change in the Water-Soil-Waste dynamics originating from climate change. A number of sources for these data are described. An important research gap involves the necessity to down-scale areal measurements and predictions to support local decision-making. The report encourages responsible agencies to ensure that their data systems are modernized and their data products and knowledge are made freely available to the world’s food production community.



Richard (Rick) Lawford is a senior scientist at Morgan State University where he undertakes projects in support of NASA’s Water Applications Programme and provides water expertise for the US Group on Earth Observations (GEO) programme. He also is consultant for the Japan Aerospace Agency (JAXA) on matters related to the Global Earth Observations System of System (GEOSS). In this role he serves as the Point of Contact for the GEO Water Task, chairs the Integrated Global Water Cycle Observations (IGWCO) Community of Practice and serves as co-chair of the GEO Societal Benefits Implementation Board. In this capacity he led the preparation of the new GEOSS Water

Strategy and is currently coordinating the development of an Implementation Plan. He is also an associate of the International Institute for Sustainable Development in Winnipeg Manitoba, and an executive member of the Science Committee of the Global Water System Project (GWSP). In this capacity he is the co-lead on a Future Earth Cluster project related to the role of integrated information and improved governance in the Water-Energy-Food Nexus. He has also been collaborating as a consultant with the World Health Organization in the preparation of the Earth Observation Task Team report for the Global Enhanced Water Monitoring Initiative (GEMI) in support of the proposed Water Sustainable Development Goal. His past experience includes directing the Global Energy and Water Cycle Experiment Project Office, serving as a program manager in NOAA Office of Global Programs (now NCPO) and working in a number of different positions in Environment Canada and the former Ministry of State for Science and Technology. He acquired his training in physics and meteorology in Canada in Brandon (Manitoba) and Edmonton (Alberta).