Mohamed Behnassi · Mirza Barjees Baig ·
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Ali Wafa A. Abu Risheh *Editors*

Food Security and Climate-Smart Food Systems

Building Resilience for the Global South

معهد الأمير سلطان
لأبحاث البيئة والمياه والصحراء
Prince Sultan Institute for
Environmental, Water & Desert Research

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Springer

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Foreword: Reversing Climate Change and Restoring Ecosystems as Pre-requisites for a Food-Secure and Resilient Future

Climate-induced impacts and disasters such as drought, heat stress, flooding, and crop pests have led to a decline in crop yields and livestock productivity in many regions, while severely affecting the livelihood and security of vulnerable communities, including small-holder farmers. These impacts and disasters are also critically undermining water security through changes in rainfall patterns, drying-up of rivers, and receding bodies of water. Many global assessments predict that conflicts over natural resources, especially water, may be a growing cause of violent tensions in the future, leading among other implications to mass displacements within and between countries. In this broad context, environmental degradation, climate change, biodiversity loss, and resource scarcity are increasingly impacting food systems and security, thus adding urgency to our fight against poverty and disease.

Yet science and technology now exist to reverse such trends and ensure sustainability and resilience against risks. Some evolving applications have the potential to make crops more viral- and drought-resistant in a changing climate. The Clustered Regularly Interspaced Short Palindromic Repeats (CRISPR) technology, for instance, provides an alternative approach for improving the genetic traits of plants that is easier and generally cheaper than traditional breeding techniques. Many scientific advances have produced new genes that can fortify crops to withstand natural calamities such as pests and diseases and provide higher nutritional value. Innovations

such as smart agriculture, environmental conservation, healthcare and disease prevention, big data-driven bioinformatics, and industrial biotechnology have the potential to help maintain productivity while improving human wellbeing and resilience to shocks. All these pathways can sustainably help meet the food needs of a growing global population. In the same vein, the broad elements of diverse diets, seed and crop diversity, improvements in seed and crop delivery and cultivation, and the maintenance of our agrobiodiversity must be optimized to ensure a healthy and prosperous future for the humanity. Evidence of the wisdom of such investments is strong and growing; therefore, we must continue to invest in in order to enhance the sustainability of food systems, thus meeting a myriad of Sustainable Development Goals.

At the same time as we modernize, we must support local and traditional knowledge systems, such as those related to sustainable farming. Among the features of this preservation are enlightened agriculture and trade policies, intellectual property rights on the conservation and sustainable use of biological resources, the empowerment of women as guardians of these systems, and the equitable sharing of benefits across sectors, genders, and communities. We have as well a special obligation to build a rhetorical bridge between our environment and scientific research. The vital threats of environmental degradation, climate change, and biodiversity loss are themselves nested in the drive to advance human health and wellbeing. And the effectiveness of driving human health and wellbeing is correspondingly leveraged by a continued investment in research and innovation. Our very existence sits at the nexus of not just the interdependent, transdisciplinary nature of scientific research, but in a broader context, at the intersection of nutrition, health, agriculture, economy, environment, and governance.

These investments require, however, sustained operational funding and capital support and the capacity to engage successfully with funders, governments, policymakers, and communities. Significant investment in environmental preservation and climate resilience for sustainable farming systems and food and health security should be simultaneously combined with public-private investment in basic and applied research, building access to sustainable resources, creating appropriate and inclusive legal and policy frameworks, and enhancing innovative capacity-building.

It is true that the world is continuously trying to tackle the challenges of decelerating climate change and restoring ecosystems, but the trade-offs that they require inevitably pit one country's interests against another's. We must thus make use of all possible capacities to jointly fight climate and environmental change, thus creating a liveable and secure planet for all. This challenge is not easy: reaching it depends on the contributions of all, especially highly skilled individuals from everywhere in the world, political courage and foresight, and creative, ambitious innovation.

But it *can* be done, because it *must* be done. Our ability to create a sustained future for ourselves isn't optional: it's existential.

This timely contributed volume, *Food Security and Climate-Smart Food Systems—Building Resilience for the Global South*, falls under this prospect. It aims to provide guiding inputs to the different issues highlighted above. Under the editorship of specialized and insightful scholars, the volume advocates for a

rethinking of agricultural development models through, among others, the enhancement of climate-smart practices, extension systems' innovation, and digitalization. This will help accelerate the transformational change of current food systems towards sustainability, adaptation to, and mitigation of climate change, therefore enhancing the resilience of a food-secure future. By doing this, this volume contributes to the advancement of science, knowledge, and governance settings and inspires change processes.

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This contributed volume, as a part of a series of CERES publications, is the outcome of an international cooperation between 50 authors—scientists, junior researchers, experts, and practitioners—from many countries, disciplines, and professional areas. As mentioned above, the core idea of the volume emerged upon completion of a related volume, which had as objective the identification and analysis of the main emerging challenges to food production and security in Asia, Middle-East, and Africa, especially climate risks and resource scarcity. Building on the findings and conclusions, the current volume aims at identifying and exploring the best ways to overcome such challenges and to build resilience in almost the same regions of the Global South.

I have been honored to share the editorship of this volume with my colleagues: Dr. Mirza Barjees Baig, Prince Sultan Institute for Environmental, Water, and Desert Research, King Saud University, Saudi Arabia; Dr. Mohamed Taher Sraïri, Department of Animal Production and Biotechnology and Head of the School of Agricultural Sciences, Hassan II Agronomy and Veterinary Medicine Institute, Rabat, Morocco; and Dr. Abdlmalek A. Alsheikh and Dr. Ali Wafa A. Abu Risheh, Prince Sultan Institute for Environmental, Water, and Desert Research, King Saud University (KSU), Riyadh, Saudi Arabia. I seize this opportunity to warmly thank all of them for their collaboration and support during the publishing process. Their professionalism, expertise, and intellectual capacity made the editing process an exciting and instructive experience and definitely contributed to the quality of this publication.

I would also like to seize this opportunity as well to pay tribute to all chapters' authors without whom this valuable and original publication could not have been produced. Their collaboration, reactivity, and engagement during the process were very remarkable and impressive.

The chapters published in this volume are also the result of the invaluable contribution made by peer-reviewers, who generously gave their time and energy to provide insight and expertise regarding the volume's content. On behalf of my co-editors, I would specifically like to acknowledge, with sincere and deepest thanks, the following peer-reviewers:

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About the Publishing Institutions

The Center for Environment, Human Security and Governance (CERES), Morocco

CERES, previously the North-South Center for Social Sciences (NRCS), 2008–2015, is an independent and not-for-profit research institute founded by a group of Moroccan researchers and experts in 2015 and joined by many partners worldwide. It aspires to play the role of a leading think tank in the Global South and to serve as a reference point for relevant change processes. Since its creation, CERES managed to build a robust network involving various stakeholders such as researchers, experts, Ph.D. Students, decision-makers, practitioners, and journalists from different spheres and scientific areas. These achievements are being rewarded by the invitation of CERES members to contribute to global and regional assessments and studies (especially Ipbes, Medecc, EuroMeSco, etc.) and the invitation of the Center to become a member of the MedThink 5 + 5, which aims at shaping relevant research and decision agendas in the Mediterranean Basin. The Center has organized so far five international conferences and several training/building capacity workshops, provided expertise for many institutions, and published numerous books, scientific papers, and studies which are globally distributed and recognized. These events and publications cover many emerging research areas mainly related to the human-environment nexus from a multidimensional, multiscale, interdisciplinary, and policy-making perspectives. Through its initiatives, the CERES attempts to provide expertise, to advance science and its applications, and to contribute to effective science and policy interaction.

The Prince Sultan Institute for Environmental, Water and Desert Research (PSIEWDR), King Saud University, Riyadh, Kingdom of Saudi Arabia

PSIEWDR was established in 1986 to conduct scientific research related to environmental issues and water resources. It also engages with vital issues related to the problem of aridity and the desert environment. It conducts development initiatives for the country's desert areas, particularly programs for combating desertification in the Arabian Peninsula. PSIEWDR designed and carried out two major water harvesting and storage programs, including the construction of purpose-built infrastructure, throughout the Kingdom of Saudi Arabia using novel techniques and equipment. The Institute actively applies remote sensing technologies using advanced satellite image processing systems and GIS to study the country's environment and natural resources. In 2007, the Institute published *The Space Image Atlas of the Kingdom of Saudi Arabia*, and it is currently developing *The Environmental Atlas of the Kingdom of Saudi Arabia.* The Institute has been the primary sponsor of the biennial International Conference on Water Resources and Arid Environments (ICWRAE) held in Riyadh, Saudi Arabia since 2004. The institute hosts the General Secretariat of the Prince Sultan Bin Abdulaziz International Prize for Water (PSIPW) which honors scientists all over the world for their innovative water-related research. PSIPW, in turn, has many agreements with various international water associations as well as a close partnership with the United Nations. PSIPW and the United Nations Office of Outer Space Affairs (UNOOSA) jointly produce and maintain the International Space4Water Portal, an online hub for all stakeholders involved in utilizing space technologies for water resources applications.

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