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Editorial

Water-Energy-Food Nexus: A Way Forward for Food Security and Sustainable Agriculture

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Agriculture is sustainable when it nourishes people, restores and protects the land, water and other living creatures. It is sustainable when it is resilient to climate change and offers livelihoods security and dignity to farmers, farm workers and rural communities [1]. Sustainable agriculture presents a potential solution to enable agricultural systems to feed the growing population while effectively operating within the changing environmental situations. Despite of substantial improvement in various areas, human development has been inequitable: around a seventh of the global population – the so called 'bottom billion' – does not have a secure food availability and has only inadequate access to clean water, sanitation or contemporary sources of energy. At the other hand, humans are over exploiting the existing natural resources in many regions. The improved agricultural intensification to produce additional food from the accessible cropland has put the environmental sustainability at risk due to higher emissions, increased use of chemical fertilizers and pesticides, soil health, water quality, loss of biodiversity, etc. [2]. We have severely altered or entirely replaced numerous terrestrial and aquatic ecosystems, and lots of ecosystem services are tarnished [3].

Water, energy and food are indispensable for human well-being, poverty drop and sustainable advances. Global projections designate that requirement of freshwater, energy and food will be significantly more over the subsequent decades under the pressure of population escalation and mobility, economic progress, international trade, urbanization, diversifying diets, cultural and technological changes, and climate change [4]. Agriculture is responsible for 70% of the whole global freshwater withdrawals, reflecting the leading consumer of water. Water is used for irrigating crops, agro-forestry and fish cultivation, along with the whole agri-food supply chain [5]. It is also used in production and/or transportation of energy in diverse forms. The food production and supply chain accounts about 30% of entire energy consumed world-wide [6]. Energy is pre-requisite to produce, transfer and dispense food as well as to extract, pump, lift, collect, transport and treat water. The big cities, industries and many other users, too, demand progressively more water, energy and soil resources, and at the same time, face troubles of environmental degradation and in some cases, resources paucity.

The present situation is anticipated to be intensified in the coming years as 60% more food required to be produced for feeding the global inhabitants in 2050. World energy utilization is expected to higher up to 50% by 2035. Total world water extractions for irrigating crops are likely to move-up by 10% by 2050. As the demand grows, there will be greater competition for the resources among water, energy, agriculture, forestry, livestock, fisheries, mining, transport and other sectors with un-predictable impacts on livelihood security and environmental degradation [7]. Large-scale water infrastructure projects, for example, may have synergetic impacts, generating hydropower and creating water storage space for irrigation and metropolitan uses. However, this might take place at the expense of downstream agro-ecological

systems and with many social implications. Like-wise, cultivating bio-energy crops in irrigated agriculture system may assist in better energy delivery and create employment options, but it may also result in higher competition for soil, land and water resources with negative impacts on local food and nutritional security.

In these circumstances, the Water-Energy-Food (WEF) nexus has appeared as a powerful approach to explain and deal with the multifaceted and interrelated nature of world resources, on which we depend to realize diverse social, economic and environmental goals. This approach helps us in better understanding the complex and dynamic interrelationships between water, energy and food, so that we can utilize and supervise our limited resources in a sustainable manner. It compels us to imagine of the impacts a judgment in one sector can have not only on that particular sector, but on the others. In practical terms, it offers an abstract approach for clear understanding and scientifically examining the interactions between the natural environment and human activities, and to put effort towards a more synchronized management and use of natural resources across the sectors and scales. This can facilitate us in identifying and managing trade-offs and to build synergies through our responses, allowing for more integrated and cost-effective planning, decision-making, implementation, monitoring and evaluation.

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