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Editorial

New Studies to Measure the Effects of Climate Change on the Increase in Environmental Risks

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The impacts of climate change already pose major challenges for the environment, and the trend is rising. Simultaneously, anthropogenic disturbances are altering the terrestrial ecosystems, including changes in the composition of the atmosphere, global and regional climates and land cover and land use modifications. Determining how these changes lead to atmospheric feedback is crucial to address the threat of climate change to human society and natural ecosystems. Research on the effects of climate change on environmental risks in general are of paramount importance. Changes in CO_2 concentrations in the 21st century will be accompanied by changes in temperature, precipitation, nitrogen deposition and other aspects, which means the increase of potential environmental risks. Therefore, to fully understand the effects of climate change on these environmental risks, the monitoring, modeling and development of new methodologies for shaping such effects must be considered.

This Special Issue (SI) was proposed with the aim of collecting the latest methodological developments and applications to study the influence of climate change on the degradation of landscapes, agricultural losses, emerging diseases, water pollution, loss of monumental heritage, forest fires or floods at different scales [1]. This collection of papers shows great contributions that explore the impacts of different experiences on management all over the world, and new methods/technologies used in the measurement of climate change. The study of ecosystem responses to perturbations such as nitrogen deposition and extreme weather events can improve future projections of terrestrial biosphere attributes. In particular, understanding the effects of climate change on increased environmental risks offer new insights into the ecological/hydrological/biogeochemical implications of regional-scale management efforts. In total, this SI collected seven original papers across the Americas, Asia and the African continent. From a methodological point of view, a variety of methodologies, including field observations, modeling studies and remote sensing work, were utilized to develop these contributions at multiple scales. Specifically, the topics covered by the contributions include studies on the hydrological cycle (including the relationships between vegetation and precipitation in a tropical dry forest, lake water and its sources in arid areas, quality of groundwater in karst systems and water), as well as the impacts of drought on the structure and function of ecosystems.

In the field of hydrological cycles, Brasil et al. [2] evaluated the relationships between canopy development, gross precipitation and throughfall characteristics in a tropical dry forest, with a total of 95 events of natural precipitation during December 2019–July 2021 in Northeast Brazil. Despite retention in the canopy being very difficult to quantify [3], the authors reported that with a low leaf density, at the beginning of the rainy season, a greater fraction of rainfall was converted into throughfall, which declined as leaf density increased. For events higher than 3 mm, the number of throughfall drops was always

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higher than that of gross precipitation and with smaller diameters, regardless of the stage of canopy development, indicating fragmenting of the rain drops by the vegetation canopy. Liu et al. [4] investigated the dynamic changes in lake water resources in arid areas by using remote sensing datasets to interpret the changes in water level, and areas with alpine lakes as well as non-alpine lakes, improving previous research that only analyzed water level changes but not lake area [5]. The dynamic changes in the lakes and their relationship with glacial meltwater, precipitation and runoff in their basins were detected. The authors reported that the changes in alpine lakes were closely related to the supply coefficient (basin/lake area ratio) but weakly related to the G–L ratio (glacier/lake area ratio), and the spatial pattern of lake change was consistent with that of climate change. Such changes in the lake were caused by precipitation, glacial melt, snowmelt and other multi-factors. Zhu et al. [6] identified the hydrogeochemical characteristics of groundwater in the Nandong Karst Water System. The authors reported that the water chemistry types of groundwater were mainly HCO_3–Ca and HCO_3–Ca-Mg. Surface water and groundwater were initially recharged by atmospheric precipitation, and the measured hydrogen and oxygen isotopes were heavier in surface water due to the strong evaporation. According to these authors, the main factor affecting the quality of surface water and groundwater was the input of anthropogenic contaminants. The study provides a basis for the rational exploitation and effective protection of surface water and groundwater in the karst area. Wang et al. [7] analyzed the water quality variations along the middle route of the South-to-North Water Diversion Project (MR-SNWDP) and in the Miyun Reservoir (China) under atmospheric deposition. The authors reported that there was a significant impact of atmospheric deposition on the quality of water of the MR-SNWDP, and the effects of atmospheric deposition on the water quality of the middle route and Miyun Reservoir showed different variation rules. The constant water diversion scheme helped to reduce the effects of atmospheric deposition. According to the research results, strategies for water resource management are highly encouraged.

Regarding the impacts of climate change on the structure and function of ecosystems, Orimoloye et al. [8] reviewed environmental and other impacts of drought in South Africa. The authors showed that due to its natural water shortage, South Africa experiences climate fluctuations with an average annual rainfall of 860 mm per year, far below the global average. The authors demonstrated that drought has seriously affected daily life and agricultural production. On the other hand, Liu et al. [9] quantified the impacts of climate change on alpine ecosystems, studying the relationships between vegetation dynamics and climate change, and the direct and indirect effects of climate factors on vegetation dynamics. The authors reported that the correlations and effects of growing season evaporation (GSE), growing season average relative humidity (GSARH) and growing season precipitation (GSP) on vegetation dynamics were weakened. GSE was the main direct effect factor, and the latter two were indirect effect factors through GSE. Growing season average temperature (GSAT) had little effect on vegetation dynamics. The study provides information for understanding the characteristics of vegetation dynamics of alpine grassland in the Qinghai–Tibet Plateau (China). Teshome et al. [10] investigated the spatio-temporal dynamics of rainfall and temperature in the past (1988–2017) and projected periods of 2030 and 2050 under RCP4.5 and RCP8.5 in East and West Hararghe zones, Ethiopia. The authors stated that annual and seasonal and monthly rainfall showed high variability, but that the changes were not statistically significant over the last three decades in the studied region, and the minimum temperature of the '*Belg*' season showed a significant increment. The study concluded that there was an increasing trend in the *Belg* season minimum temperature. Significant increasing trends in rainfall and temperature were projected compared to the baseline period for most of the districts studied, in agreement with other studies [11]. In order to counteract the drastic effects of climate change, the study suggested that it is necessary to develop climate-smart crop and livestock production strategies, as well as an early warning system.

During the past few decades, a wide range of conceptual, methodological, and technological advances have been made to help locals to develop climate change mitigating strategies. However, as shown by the contributions to this SI, climate change has numerous underlying causes which involve a complex interplay among biophysical and anthropogenic dimensions. Therefore, it is very important to study the responses of the ecosystem's structure and function to climate change. In conclusion, the present SI provides new avenues for recognizing the past, present and future influences of climatic change on different biomes. The contributions within are helpful for understanding the relationship between climate change and hydrological cycles, as well as between ecosystem structure and function, thus providing a basis for formulating management strategies.

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