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Editorial

Strategies to Assure the Sustainability of Groundwater Resources

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Received: 26 October 2020; Accepted: 31 October 2020; Published: 4 November 2020



Climate-related changes that have occurred over the last few decades are particularly induced by changes in large-scale hydrological cycle processes. Simulations obtained through climate models developed in the 21st century consistently predict that precipitation will increase in large areas of high latitude and tropical regions, while it will decrease in subtropical and mid-latitude regions. This implies that climate change will lead to extreme climate conditions in the short term. The increasing intensity and variability of precipitation will cause floods or droughts in numerous regions. In addition, the increase in water temperature will not only lead to extreme weather phenomena, such as floods and droughts, but also have negative impacts on water quality, thereby increasing water pollution in different ways. First, it is important to consider that changes in water quantity and quality due to climate change will also affect the availability, stability, accessibility, and usability of foodstuffs as well as the sustainability of water resources. Furthermore, the sustainability of water resources will also gain attention as a core issue for national defense and healthcare policies in the future. Mineral resources such as petroleum and coals have substitutes, but water is irreplaceable. Water is elemental to all kinds of life on earth, and most human activities require considerable amounts of water. However, it is well known that a jointly effort has not been achieved worldwide to establish sustainable policies that may address climate change and to manage water resources according to the effects of climate change.

In the 21st century, the frequency and scale of droughts caused by climate change have increased rapidly worldwide. Consequently, groundwater as a resource has attracted increasing importance. Groundwater, which represents a major fraction of the water resources functional to humans, is highly impacted by climate change because the recharge rate and the depth of the groundwater surface have been considerably affected. Applications using groundwater are increasing because it has the advantage of source recharging in a shorter period compared to that of surface water, and it is a reliable source of clean water at a low cost. However, when the quantity of groundwater exploited exceeds the water quantities obtained through rainwater or surface water, or water quality is deteriorated because of pollutant infiltration, long periods will be required for water regeneration, recovery, and restoration. Therefore, a rational water management plan must be established by considering all water quantity and quality parameters as well as by evaluating the distribution of water resources and the environmental variables of surrounding regions.

The following strategies are essential to promote the utilization and conservation of groundwater for enhancing its potential as a water resource: (1) development and utilization strategies for increasing the utilization value of groundwater; (2) conservation and management strategies for securing the future value of groundwater; (3) water quality management strategy for ensuring the cleanliness and safety of groundwater; (4) advanced groundwater management strategies based on continuous investigation, observation, and strengthening of infrastructure for the suitable utilization of groundwater; (5) strategies for industrialization, such as expanding the market in the groundwater

sector and penetrating the international market. There have been changes in the hydrological cycle owing to the aforementioned climate changes; consequently, the importance of and interest in groundwater is increasing globally as an alternative water resource capable of responding to these changes. In reality, preemptive and proactive strategies are required in accordance with changes in the groundwater utilization environment, such as groundwater development, larger utilization facilities, and saline groundwater, and geothermal utilization. Hydrological scholars should have a strong sense of scholarly responsibility and focus on the establishment of national water security strategies. Water welfare through groundwater supply in water-poor areas and response to extreme climate changes are areas that need especial focus from the academic point of view.

In addition, a strategy is required to expand the use of water supply sources in the current situation, where interest in groundwater as an alternative source of drinking water is rising due to the increased demand for clean water. Furthermore, a strategy for fostering the industry using groundwater is also required. The market for the groundwater industry is expanding significantly in numerous countries around the world. Accordingly, while increasing its added value, groundwater should be concomitantly used as a driving force of future growth. This can be achieved through quantitative and qualitative groundwater management and utilization strategies and advancement of the groundwater resource development industry. In this special issue, we examine the strategies required to environmentally protect groundwater resources against natural and artificial threats for the benefit of the next generation.

Funding: This research was funded by the National Research Foundation, grant numbers 2019R1I1A2A01057002 and 2020 Research Grant from Kangwon National University.

Conflicts of Interest: The authors declare no conflict of interest.

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