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Assessment of the impact of winter snowfall on the occurrence of forest fires in the east coast, Korea

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Abstract: The frequency of wildfires is increasing due to climate change caused by global warming. This has led to issues such as longer dry seasons, rising temperatures, and decreased humidity. Among these factors, the rise in temperatures and the decrease in humidity have a significant correlation with wildfires (Won et al., 2006; Kwon et al., 2012). Warm and dry weather leads to a decrease in soil moisture, which in turn results in reduced plant activity. As the activity of vegetation decreases during the spring season, the risk of wildfires naturally increases. This phenomenon is also observed in South Korea. The warm and dry weather during the winter season in Korea directly affects the decrease in soil moisture during spring, ultimately increasing the probability of wildfires occurring between March and May. Therefore, research is being conducted to increase soil moisture during the winter season as a means to reduce the occurrence of spring wildfires. One such study focuses on increasing soil moisture through artificial snowfall, and it is currently being carried out domestically. By increasing winter snowfall, snowmelt is increased, leading to a subsequent increase in soil moisture. In this study, we aim to simulate this process through modeling. The models used for this purpose are the WRF (Weather Research and Forecasting) model and the PRMS (Precipitation Runoff Modeling System) model, without any additional modifications beyond the functionalities provided by the models. The research process can be summarized as follows: First, we simulate artificial snowfall data using the WRF model. Subsequently, we utilize the USGS PRMS model to simulate the increase in soil moisture resulting from artificial snowfall in the Doam Dam watershed. PRMS is a rainfall-runoff model that allows for the simulation of hydrological processes, including those influenced by snowfall. Using the PRMS model, we aim to simulate the variations in snowmelt and soil moisture resulting from artificial snowfall. Finally, based on the simulated data, we will conduct an assessment of the wildfire impact using the wildfire risk index. Through this study, we aim to provide evidence of the effectiveness of artificial snowfall in suppressing spring wildfires. Additionally, it is anticipated that this research can also propose alternative water resources for addressing spring drought conditions, among other benefits.

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