Spatio-temporal pattern of ecological droughts by using the Standardized Water Supply Demand Index in the Hwang River.

Sayed Shajahan Sadiqi*, Eun-Mi Hong**, Won-Ho Nam***

....

Abstract

Ecological drought consequences have received a lot of attention in recent years. Thus, ecological drought was proposed as a new drought category to characterize the impact of drought on ecosystems. The current study used a unique drought index, the standardized supply-demand water index (SSDI), and a run theory to detect ecological drought occurrences and characteristics such as drought-affected area, drought severity, drought duration, drought frequency, and drought orientation in the Hwang River, an environmentally valuable region. Hence, to assess drought-prone areas, the bivariate probability and return period will be calculated using a two-dimensional joint copula. The core results show that (a) the Spatio-temporal characteristics of ecological drought were successfully recognized using the spatial and temporal identification approach; (b) in comparison to the SPEI meteorological drought index, the SSDI is more credible and can more readily and effectively capture the entire properties of ecological drought information; (c) the Hwang river had seen the most severe drought occurrences between the late 1990s and the mid-2020s, with 48.3 percent occurring before the twenty-first century; (d) Severe ecological drought occurrences occurred more frequently in most areas of the Hwang River (e) Only the drought duration and severity in the Hwang area were more responsive to temperature when temperatures rise around 1.1°C, the average drought duration and severity rise around 16 % and 26 %, respectively. This suggested that the Hwang River has been exposed to more severe heat stress in the twenty-first century. Thereupon droughts in the twenty-first century occurred with bigger affected regions, longer durations, higher frequency, and more intensity.

Keywords : Ecological drought; Drought identification; Spatio-temporal characteristics; Probability' return period and SWAT model; Hwang River.

*Ph.D. Student, Department of Environment Science, Kangwon National University E-mail : sayed@kangwon.ac.kr

**Assistant Professor, Department of Environment Science, Kangwon National University E-mail : eunmi.hong@kangwon.ac.kr

***Assistant Professor, Department of Bioresources and Rural Systems Engineering, Hankyong National University E-mail : wonho.nam@hknu.ac.kr