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Spatial Vulnerability Map and Distributed Response Strategies for Irrigation System Under Climate Change

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It is an important issue whether irrigation systems can continuously provide quality service under climate change conditions. The streamflow irrigation system, which delivers water from a river directly, is still widely applied in Taiwan. Due to the impacts of climate change, the amount of available streamflow may decrease during dry season and higher variation of flows can be expected, which influences irrigation systems severely. Furthermore, sub-irrigation areas may have different levels of impacts under climate change. Instead of applying the adaptation strategies to the whole irrigation areas, different adaptive measures should be considered according to the vulnerability of each sub-irrigation area in order to face the impacts of climate change. The purposes of this study include defining the carrying capacity of an irrigation system, developing spatial distributed assessment methods through geographic information system and discussing how to develop adaptation systems for the areas which are more vulnerable. In this study, both agricultural and domestic water supply systems of the Touchien creek watershed are considered in this study. Future water demands of agriculture are estimated under the change of temperature and rainfall, and the amount of water supply to each sub-irrigation area is calculated according to its area and water losses. As for public water uses, the most restrict scenarios are taken in, e.g. the largest impact toward agriculture in the Touchien creek watershed. Then, the vulnerability of sub-irrigation areas is quantified by agricultural shortage index (ASI). ASI represents the percentage of crop yields in that area comparing with its potential crop yields. At last, the spatial distribution of vulnerability is established in order to emphasize the climate change impacts on each sub-irrigation area and to analyze their possible responses. Possible distributed adaptive strategies are proposed in this study too.

Keywords: Vulnerability, Climate Change, Irrigation, GIS