Commentary
Volume 12:2, 2023

Irrigation & Drainage Systems Engineering

ISSN: 2168-9768 Open Access

Water Use Efficiency and Benefits in an Irrigation District are uncertain and Variable

Bethen Joseph*

Department of Environmental Engineering, University of Calabria, Rende, Italy

Description

A variable fuzzy assessment model was developed in order to scientifically and rationally evaluate irrigation districts' water use efficiency and benefits. By altering the model's parameters, the evaluation level of the sample can be obtained in addition to the relative membership degree and relative membership function of the sample indices in each index's standard interval. Five indices, the canal water utilization coefficient, the field water utilization coefficient, crop water productivity, the effective irrigation rate in farmland, and the water-saving irrigation area ratio, were chosen as evaluation factors in accordance with the actual situation of the Beitun Irrigation District, which is located in Altay City, Xinjiang Uyghur Autonomous Region. The model was used to evaluate the benefits and efficiency of water use in various years in the Beitun Irrigation District. The comprehensive evaluation indices from 2006 to 2008 were all at the third level (medium efficiency), and the 2009 index rose slightly to fall between the second level (relatively high efficiency) and the third level, indicating an improvement in the Beitun Irrigation District's water use efficiency and benefits. This demonstrated that the model was reliable and simple to use. In similar irrigation districts, this model can be used to evaluate water use efficiency and benefits. [1].

An increase in irrigation water use efficiency can be attributed to China's recent focus on the development, utilization, conservation, and protection of water resources and the formulation of a number of policies and regulations to enhance water use efficiency and benefits in irrigation districts. But in the coming decades, the distribution of the available water resources will change a lot because other sectors, like the natural environment, will need more water and China will get less rain because of climate change. In terms of water efficiency and benefits, China still lags behind developed nations. As a result, in order to alleviate the severe pressure caused by a lack of water in China, we need to further increase the efficiency of irrigation and fully investigate the potential of agricultural water-saving measures such as strengthening and perfecting projects for irrigation and water supply and establishing effective projects for water saving in the field [2].

The world's largest use of fresh water is irrigation water. About 60% of the world's water resources are used for agricultural irrigation, according to the Food and Agriculture Organization. Water's role in agricultural production is extremely complex and influenced by numerous factors. Because different irrigation districts in China use different amounts of water, it is important to use a scientific and reasonable method to evaluate the benefits and efficiency of water use in each irrigation district. This can provide a scientific basis for making decisions and organizing subsequent water conservation efforts. The fuzzy comprehensive evaluation method, the comprehensive evaluation method based on principal component analysis, the remote sensing-based method (and distributed ecohydrological modeling) are just a few of the studies offering methods for evaluating the water use efficiency and benefits in irrigation districts. Agricultural water use efficiency is a key index in the assessment of irrigation water use from the water source to the crop. Traditionally, field experiments are conducted to quantify and evaluate water management practices in irrigation systems. However, each of these approaches has its own set of limitations. The algorithm used to process large and small values in the fuzzy comprehensive evaluation method is unreasonable, and the maximum membership degree principle-related issues must be resolved. The selection of various eigenvalue vector combinations for the comprehensive principal component analysis evaluation method may result in a wide range of fluctuations in evaluation results. Specific recommendations gleaned from field experiments cannot generally be applied to different ecohydrological conditions at the regional level. There is general agreement regarding the significance of locating a method that is both more widely applicable and more efficient in assessing the benefits and efficiency of water use in irrigation districts [3].

The variable fuzzy evaluation method, which is capable of scientifically and reasonably determining the relative membership degree and relative membership function of sample indices in the standard interval of each index, has demonstrated the highest reliability and operability of the developed methods. Numerous fields, including reservoir water quality assessment and flood risk assessment, have also made extensive use of the variable fuzzy evaluation method. It can be used with less quantitative information than other methods and can make the mathematical process simpler, allowing us to analyze complex multi-criteria problems. However, the method's application to the evaluation of an irrigation district's water use efficiency and benefits has received little attention. Therefore, the goal of this study with the Beitun Irrigation District was to use the variable fuzzy evaluation method to determine the irrigation district's reasonable water use efficiency and to evaluate the benefits of water use [4,5].

***Address for Correspondence:** Bethen Joseph, Department of Environmental Engineering, University of Calabria, Rende, Italy, E-mail: Bethen joseph098@unical.it*

Received: 01 February 2023, Manuscript No. idse-23-90175; **Editor assigned:** 03 February 2023, PreQC No. P-90175; **Reviewed:** 15 February 2023, QC No. Q-90175; **Revised:** 22 February 2023, Manuscript No. R-90175; **Published**: 28 February 2023, DOI: 10.37421/2168-9768.2023.12.372

Acknowledgement

None.

Conflict of Interest

None.

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How to cite this article: Joseph, Bethen. "Water Use Efficiency and Benefits in an Irrigation District are uncertain and Variable." *Irrigat Drainage Sys Eng* 12 (2023): 372.