利用 SWAT 模型，
進行高屏溪流域作物生長階段水足跡核算

Water Footprint Accounting of Crop Growth Stage in the Gaoping River Basin Using the SWAT Model

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摘　要

水資源管理是應對氣候變遷的關鍵議題之一。其中水足跡是一個被逐漸重視的環境指標，係用於評估個人、組織、產品或服務在整個生命週期中直接和間接使用水資源的情況，以及對水資源和水生態系統造成的潛在影響。人類活動消耗和污染了大量的全球水資源，尤其是農業用水佔了人類用水的 90%。傳統的水資源管理往往忽視了生產和供應鏈的影響。水足跡概念的提出，量化產品和服務中的虛擬水含量，根據水足跡網絡(Water Footprint Network)提出水足跡評估手冊(The Water Footprint Assessment Manual)和 ISO 14046 標準，將可以為系統邊界內水使用和污染提供全面的度量。

本研究旨在利用 Soil and Water Assessment Tool(SWAT)模型，評估歷年高屏溪流域內玉米、水稻和果園生長階段的水足跡，其包括綠色、藍色和灰色水足跡。通過分析每年作物生長階段的水足跡變化，以及不同作物之間的水足跡差異，了解高屏溪流域作物的生長階段的用水、水污染情況，並提出永續農業實踐的建議。研究結果可以提供農民、企業和決策者作為參考，幫助他們在種植、採購和水資源管理方面做出更佳的決策，以促進高屏溪流域農業的永續發展。

關鍵詞：水足跡，SWAT，水資源管理

Abstract

Climate change is an important topic that is associated with such aspects as water resource management. The water footprint is an increasingly recognized environmental indicator that is used to evaluate direct and indirect uses of water, as well as impacts on the natural environment, human health, and water-related resources throughout the life cycle of a person, an organization, a product, or service. Human activity consumes and pollutes most of the global water, accounting for 90% of agricultural water use. However, traditional water management practices fail to consider the effects of the production and supply chains. The water footprint expresses the virtual water embedded in goods and services, which yields a total indicator of water consumption and pollution inside the system borders, as defined by the Water Footprint Assessment Manual of the Water Footprint Network, as well as the ISO 14046 standard.

This study aimed to use the Soil and Water Assessment Tool (SWAT) model to evaluate the water footprints of corn, rice, and orchards at their growth stages in the Gaoping River Basin. These include green, blue, and gray water footprints. By analyzing the annual variations in crop water footprints across growth stages and the differences among crops, this study seeks to understand the water use and pollution patterns of crops in the Gaoping River Basin and recommend sustainable agricultural practices.

The results of this study can provide insights to help farmers, companies, and policymakers make better-informed decisions about planting activities, procurement processes, and management of water resources, which will eventually contribute to sustainable agricultural development in the Gaoping River Basin.

Keywords: Water footprint，SWAT，Water resource management