農田水利工程植生固碳新思維-以水圳綠道為例

New Thinking on Plant Carbon Sequestration in Irrigation and Water Conservancy Engineering - A Case Study of Canal Greenways

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摘　要

全國廣大農業區域水路阡陌交錯、縱橫其中，過去長久以來農業渠道肩負農業生產區域灌溉、排洪功能，對於渠道維護改善著重於功能維護與精進，較少考量到農業環境綠化與生態環境功能。

近年來，因應全球氣候變遷，減碳淨零議題，農田水利工程亦提出功能性維護以外，植生綠化之固碳新作法，對於渠道改善工程隙地進行植生規劃，並研議相關植生原則，進行固碳量評估。

以嘉南大圳水圳綠道為例，全線橫跨 3 個縣市 31 個鄉鎮，沿著嘉南大圳堤頂圳旁施設，為營造農業文化、親水休閒及結合生態環境之騎乘環境，水圳綠道沿線種植約 13.5 萬株喬、灌木及地被，樹種擇定以臺灣原生樹種作為各縣市植生特色，喬木搭配灌木綠籬植栽輔以地被點綴。除維護大圳原有灌溉功能，亦改善整體水環境及增加生態價值。111 年度種植喬灌木約 9.5 萬株，112 年規劃沿線腹地再種植約 42.5 萬株喬、灌木綠籬植栽，共計完成植生區域約 50 公里。除此之外，本研究試以內政部建築研究所之「綠建築解說與評估手冊」所提綠覆率與植栽二氧化碳固定量之相關性，推估水圳綠道沿線種植區之二氧化碳固定量與全線種植區域綠覆率，植栽綠化四十年生命週期內總二氧化碳固定當量約 1.27 萬公噸；另依據林務局林木樹種之二氧化碳固定能力研究結果，計算水圳綠道全線植生每年二氧化碳固定量，進行評估比較與適用性討論。

綠建築評估手冊-基本型與主要造林樹種之二氧化碳固定能力研究結果進行比較，於前者有明確將不同植栽類型進行固碳當量分類，而後者僅針對喬木進行固碳量推估，在計算上因水圳綠道綠化區域植栽類型多樣，使用前者計算方式較能針對不同植栽類型(如複合類型、單植喬木、灌木或地被等)進行估算，經計算後求得一年之固碳當量為 317 公噸，後者計算上將灌木視為喬木加上原規劃之喬木進行估算，綠化範圍內灌木數量約 50 萬株，經計算後求得一年之固碳量為 3,898 公噸，如換算成植栽綠化四十年生命週期，其前者固碳當量為 1.27 萬公噸，後者固碳量為 15.6 萬公噸，兩者差異 12 倍之多。爰此，計算上如已知該綠化範圍內所種植之樹種類型，建議以綠建築評估手冊-基本型之固碳當量公式進行綠化範圍內每年度固碳當量計算，較符合實際綠化後所帶來之效益。

農田水利渠道改善納入植生綠化規劃，除維護重要農業水資源穩定與防災，透過樹

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木碳匯功能，將二氧化碳封存，降低環境中二氧化碳濃度，進而增進農田水利減碳效益，減緩氣候變遷衝擊。

關鍵詞：水圳綠道、二氧化碳固定量、樹木碳匯

Abstract

In the vast agricultural areas of the country, waterways crisscross each other. In the past, agricultural channels have long shouldered the functions of irrigation and drainage in agricultural production areas. For channel maintenance and improvement, emphasis is placed on functional maintenance and improvement, and less consideration is given to agricultural environmental greening and ecological environment functions.

In recent years, in response to global climate change and the issue of carbon reduction and net-zero emission, the irrigation and water conservancy engineering has also proposed a new method of carbon sequestration for plant greening in addition to functional maintenance. Plant planning is carried out for the gap of the channel improvement project, and the relevant planting principles are studied, and the carbon sequestration assessment is carried out.

Taking the Greenway of Chia-Nan Irrigation Channels as an example, the whole line spans 31 towns in 3 counties and cities, and is constructed along the side of Chia-Nan Irrigation Channels. About 135,000 trees, shrubs and ground cover are planted along Canal Greenways. The tree species are selected to be native Taiwan tree species as the planting characteristics along the counties and cities. The trees are matched with shrubs and hedges, supplemented by ground covers. In addition to maintaining the original irrigation function of Chia-Nan Irrigation Channels, it also improves the overall water environment and increases ecological value. About 95,000 trees and shrubs will be planted in 2022, and about 425,000 trees and shrubs will be planted in the hinterland along the line in 2023, with a total planting area of about 50 kilometers. In addition, this study tried to use the correlation between the green coverage rate and planting carbon dioxide fixation mentioned in the manual of the Architecture Research Institute to estimate the carbon dioxide fixation amount in the planting area along Canal Greenways and the green coverage rate in the entire planting area. The total amount of carbon dioxide fixed in the 40-year life cycle of planting and greening is about 12,700 metric tons. In addition, according to the research results of the carbon dioxide fixation capacity of forest tree species by the Forestry Bureau, the annual planting carbon dioxide of the entire Canal Greenways is calculated. A fixed amount for evaluation comparison and applicability discussion.

According to research results, compare the carbon sequestration capability for Green Building Assessment Manual (basic) with the ones for major species for afforestation, the former estimates carbon sequestration equivalence classification for different plant types explicitly, but the latter only estimates carbon sequestration for trees. Due to the variety of plant

types for green spaces in canal greenways, utilizing the calculation formula for Green Building Assessment Manual (basic) is more applicable for different plant types (e.g., mixture type, tree, shrub, ground cover). The calculation result for carbon sequestration equivalence is 317 tons per year. The estimation principle for major species for afforestation is considering shrubs as trees, the number of shrubs within green spaces is about 500,000 and the calculation result for carbon sequestration is 3,898 tons per year. The carbon sequestration equivalences are 12,700 (former) and 156,000 tons (latter), respectively, in plant greening 40-year life cycle. The content for latter one is about 12 times larger than the former one. Therefore, if the types of tree species planted within the green spaces are known, it is suggested to adopt the carbon sequestration calculation formula for Green Building Assessment Manual (basic) to estimate every-year carbon sequestration equivalences within green spaces. That is more consistent for the benefits brought by actual greening effect.

In addition to maintaining the stability of important agricultural water resources and preventing disasters, the improvement of agricultural channels is included in the plant greening plan. Through the carbon sink function of trees, carbon dioxide is sequestered and the carbon dioxide concentration in the environment is reduced, thereby enhancing the carbon reduction efficiency of irrigation and water conservancy and mitigating the impact of climate change.

Keywords: Canal Greenways, fixed amount of CO_2, carbon sink