

不同土地利用型態對於泥炭地之溫室氣體排放 影響

The Influence of Different Land Use Categories on Greenhouse Gas Emissions in Toushe Peatland

經濟部水利署水 利規劃分署	經濟部水利署水 利規劃分署	經濟部水利署水 利規劃分署	經濟部水利署水 利規劃分署	國立臺灣大學農業零 碳技術與管理創新研 究中心
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摘 要

泥炭地雖僅佔地球陸地面積的 3%，累積超過 6000 億公噸碳，約佔了全球碳庫 1/3。台灣南投頭社早期因三面環山形成封閉性地處水結構，形成地層後達 40 公尺的泥炭土，過去因農耕及治理需求快速排洪，也造成了泥炭地轉換成碳源，本研究分析不同土地利用型態對於溫室氣體排放之影響。該研究區域包含三種土地利用類型：果園、旱地與娛樂用地。研究共調查十個樣區，採集至 1 公尺深度的土壤樣本並測量溫室氣體排放情形。

研究結果顯示，農民過去曾在地表施加約 40 至 50 公分的外來土壤。樣區土壤有機碳含量範圍為 12.75 至 54.04kg-C / m²，遠高於臺灣代表性農地表土 100 公分土壤總碳儲量 7.00 (5.41-7.85) kg-C / m²，碳氮比(C/N)介於 7.7 至 52 之間，均高於台灣一般農地。甲烷 (CH₄) 通量變化範圍為 2.16 至 790nmol/m²/s，僅於覆土的娛樂用地排放。一氧化二氮 (N₂O) 排放範圍為 0.01 至 371nmol/m²/s，最高值出現在旱地種植絲瓜的地區，主要原因為施肥所造成的排放。

關鍵詞：泥炭土、土壤有機碳、溫室氣體、甲烷、氧化亞氮

Abstract

Peatlands comprise merely 3% of the Earth's terrestrial surface yet sequester around 600 gigatons of carbon, which constitutes roughly one-third of the global soil carbon reservoir. In the Toushe Basin of Nantou County, Taiwan, a naturally enclosed hydrological system, encircled by mountains, facilitated the deposition of peat layers reaching depths of up to 40 meters. Nonetheless, historical agricultural practices and soil drainage have swiftly converted this region into a carbon source. This study assesses the impact of different land use types on

greenhouse gas (GHG) emissions from peat soils. Three land use categories were analyzed within the study area: orchard, dryland agricultural, and recreational land. Ten plots were examined, with soil samples obtained to a depth of one meter. Greenhouse gas emissions were directly quantified from these maps. Historical records and field observations suggest that around 40 to 50 cm of external soil was deposited on the ground surface in the past.

The soil organic carbon (SOC) level varied from 12.75 to 54.04 kg-C/m², considerably exceeding the SOC stock of typical agricultural topsoil in Taiwan, which is 7.00 (5.41–7.85) kg-C/m² within the top 100 cm. The carbon-to-nitrogen (C/N) ratio varied from 7.7 to 52, above standard values observed in traditional agriculture. Methane (CH₄) fluxes varied from 2.16 to 790 nmol/m²/s and were exclusively seen in recreational areas with surface soil covering. Nitrous oxide (N₂O) emissions varied from 0.01 to 371 nmol/m²/s, with peak values observed in dryland plots grown with loofah (*Luffa cylindrica*), presumably attributable to fertilization techniques.

Keywords: peatland, soil organic carbon, greenhouse gases, methane, nitrous oxide