



**Asian Regional Task Force-  
Climate Change (ARTF-CC)**

## **Chinese Taipei Case Study-- Paddy Fields Multi-Functionality for Sustainable Environment and Climate Change in Taiwan**

**Chinese Taipei Committee, International Commission  
on Irrigation and Drainage (CTCID)**

**October 16, 2011**

### **Background**

- ❖ Due to change of agricultural policy after joining the WTO in Taiwan, the cultivation area of paddy rice has reduce from 659,600 ha in 1982 to 307,037 ha in 2002.
- ❖ The eco-environmental benefits of multifunctional roles declined significantly due to the reduction of paddy cultivation areas.

## Background

- ❖ The “Preservation of eco-environmental functions of paddy fields and groundwater recharge” project has been implemented from 1996 by the Council of Agriculture (COA), Taiwan .
- ❖ The total research budget have exceeded 200 million NT\$, with 55% in the ecology study, 20% extension, 19% irrigation management, 3% production function, 2% livelihood function and 1% others.

## Purpose and Goal

- ❖ To promote the paddy field preservation policy along with the change of the society and the environment through enhancing the people’s knowledge of multi-functionality of paddy fields and influence of climate change.
  - Step1 : To quantify and evaluates the (direct or indirect)multi-functionalities of paddy fields including the functions of soil water conservation and the amount of ground water recharge from terraced field within fifteen irrigation associations in Taiwan

## Purpose and Goal

- Step2 : To study the effect by paddy fields including carbon-dioxide absorption and temperature cooling effect and to analyze the influence of climate change to crop irrigation requirements and yield based on field experiment and application of AquaCrop model developed by FAO.
- Step3 : To disseminate the importance of paddy fields' multi-functionality in paddy fields and influence of climate change.

## Present Situation

- ❖ In the section of policy extension, activities such as the demonstration and promotion of environmental protection of paddy fields, hands-on experiences of planting paddy rice for elementary school students, photograph contest of multi-functionalities of paddy fields, and web-based digital demonstration of the roles of paddy field were implemented.

## Ecological Conservation Education for Paddy Fields



Chinese Taipei Committee, ICID

Oct 16, 2011

## Photo contest with the theme "Beauty of Paddy Fields"



Chinese Taipei Committee, ICID

Oct 16, 2011

## Establishment of portal site for Eco-environment of Paddy Fields



Chinese Taipei Committee, ICID

Oct 16, 2011

## Effect and Result

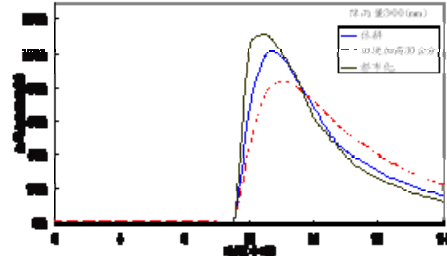
- ❖ COA has supported totally 93 research projects for several years, including:
  - flood mitigation evaluation
  - groundwater recharge assessment
  - evaluation of regulate micro-climate
  - reduction of carbon dioxide emission
  - restoration of aquatic fauna in fallow paddy fields
  - irrigation water requirements for paddy fields

Chinese Taipei Committee, ICID

Oct 16, 2011

## Flood mitigation

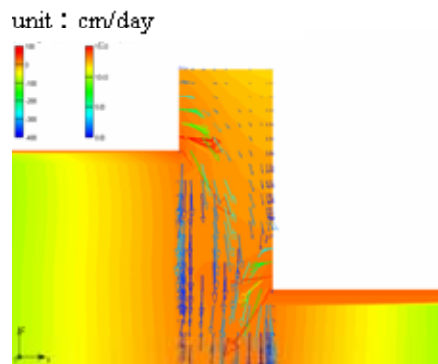
- ❖ The “quantitative investigation and benefit evaluation on flood mitigation effect for paddy fields” project was to quantify the contribution of flood alleviation or reduction direct or indirect caused by the existence of paddy fields.
- ❖ It is found that paddy fields, similar to artificial wetland areas, can effectively reduce the peak discharge rate and gradually defer water movement.



Runoff curve with 300 mm rainfall in the Sicutiao drainage area. The solid black line was urbanization, blue line was paddy fields

## Ground water recharge

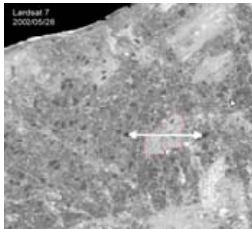
- ❖ A study entitled “Comprehensive Evaluation of Terraced Field to the Recharge of Groundwater and Conservation of Water and Land” which comprehensively evaluates the functions of soil water conservation and the amount of ground water recharge from terraced field.
- ❖ The three dimensional model, FEMWATER, was applied to simulate percolation and lateral seepage in the terraced fields under various conditions.



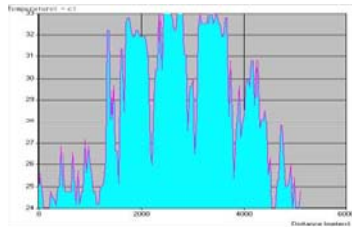
Flow direction and amount of the percolation and lateral seepage in the terraced fields near the bund as simulated by FEMWATER.

## Regulate micro-climate

- ❖ A project entitled “Assessment of microclimatic impacts for paddy field eco-environment” was supported by the COA to study the carbon-dioxide absorption and temperature cooling effect by paddy fields.
- ❖ The temperature profile and the neighborhood analysis of the region illustrated that the THSR station performed as a heat island to the vicinity, while the agricultural land absorbing the heat.



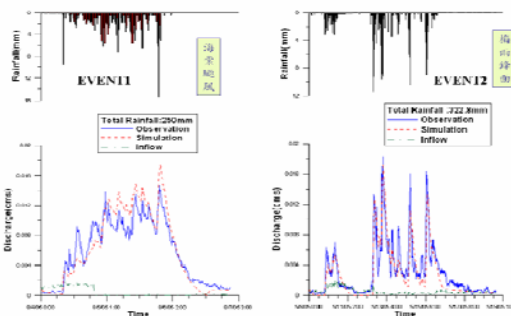
The development area of the THSR Chinpu station, circled by red dot, was significant in Landsat ETM+ image



Temperature profile of the THSR and surroundings. The central part (THSR) of the surface temperature was notably higher than the two ends (agricultural lands)

## Soil conservation

- ❖ To understand the soil and water conservation of rice-terraced field under fallow and alternative upland cropping pattern
- ❖ The experiment site is a steep rice-terraced field and surrounding fields under alternative upland cropping pattern
- ❖ The results showed that the steep rice-terraced fields had an erosion quantity of 0.77 ton/ha/yr, which is much lower than the average of the steep fruit farm



Observed and simulated results of runoff curves with a strong rainfall (HaiTang typhoon) and a low intensity rainfall. Red line represents simulation with the bund of terraced rice paddy demolished, while blue line is with bund

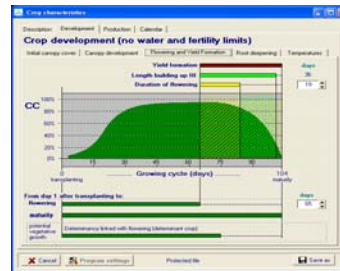


## Irrigation water requirements for paddy fields

- ❖ Global warming and climate changing will influence the type of rainfall and temperature as well as the agricultural water requirements from paddy fields.
- ❖ The research executed field experiment for paddy fields with different methods in the HsuehChia Experiment Station of ChaiNan Irrigation Association
- ❖ the crop production model of AquaCrop, developed by Food and Agricultural Organization, was used to simulate the crop water requirement for different climate change environment



Field experiment for paddy fields in HsuehChia Experiment Station of ChaiNan Irrigation Association



AquaCrop models to evaluate crop water requirements with climate change for paddy fields in ChaiNan Irrigation Association

## Keys for Success--Government's support

- ❖ **Experienced trouble--**The COA came to have a sense of crisis that the reduction of paddy cultivation areas would linked to loss of the beautiful paddy field landscape and increase of adverse effects such as land subsidence actually brought about in alluvial plains in Taiwan.
- ❖ **How to overcome--** COA decided to start the "Preservation of eco-environmental functions of paddy fields and groundwater recharge" project in 1996 and has been supporting this project. The total research budget has exceeded 200 million NT\$.



## Keys for Success-- Dissemination

- ❖ **Experienced trouble**--If the research results shared only among researchers or government officials, people would not understand the importance of multi-functionality of paddy fields and its relations to climate change. As a result, COA would face difficulties to promote paddy field protection policy in order to preserve multi-functionalities and to cope with climate change effects.
- ❖ **How to overcome**--COA has made efforts to transmit the research results to the people with the variety of methods. These activities were effective to make more people understand the ecological importance or flood mitigation of rice paddies its relations to climate change.

## Keys for Success-- Key points or requirements for success

- ❖ **Making different advertising methods for different target**
  - Web pages designed especially for the children to understand the importance of paddy fields with a lot of easy understanding texts and graphics
  - Promotion projects, integrating the capacity of local governments, agricultural groups, and academic institutes
  - Hands-on experiences of planting paddy rice for elementary school students
  - Photograph contest of multi-functionalities of paddy fields.

**Thank you**