ICID2015
26th ERC & 66th IEC

CONSTRUCTION OF NEW IRRIGATION AND DRAINAGE SYSTEMS AIMED AT POLLUTION EMISSION REDUCTION IN RICE-BASED CROPPING SYSTEMS, SOUTH OF CHINA

Dong Bin, Cui Yuanlai and Mao Zhi

Wuhan University, China

dongbin@whu.edu.cn

Presentation outlines

1. Background
2. Research needed
3. General aproaches
4. Methodology
5. Study sites
6. Results and conslusions

ICID2015
26th ERC & 66th IEC

Background

Rice, one of staple food crops in China, is also the crop consuming much water and fertilizer.

- **27.4% of total planting area**
- **36.3% of total food crop production**
- **55-65% of total agricultural irrigation water amount**
- **180 kg/ha nitrogen fertilizer applied in average, double the world average level**
- **20~30% nitrogen fertilizer utilization efficiency**

Background

Data in 2014 from Ministry of Agr. showed that in China, agricultural non-point source pollution (ANPSP) has already become the main source of total nitrogen and total phosphorus emissions

Data shows that the nitrogen and phosphorus load in water in unit area of paddy field caused by seepage and runoffs is more than 4 times higher than that in dry land

ICID2015
26th ERC & 66th IEC

Research needed

1. From water quantity management only to both quantity and quality management through multiple disciplinary study
2. From the simply water saving and yield improving point view to integrated approaches for saving water, yield sustainability, efficient water and fertilizer use and nutrient loading reduction

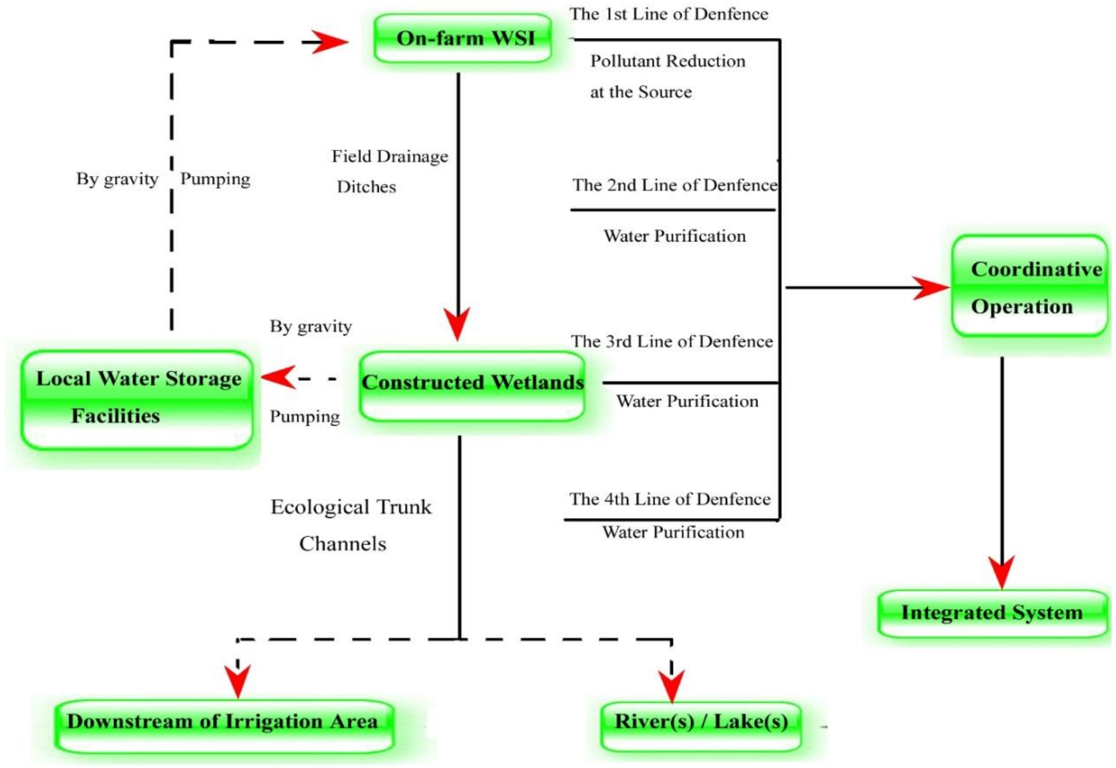
3. Farm water environment restoration
4. Spatial and temporal variation of nitrogen and phosphorus losses
5. Modeling development for management, evaluation, knowledge transfer and scenarios simulation

General approaches

Concept of Four Lines of Defense

1. Efficient water and fertilizer utilization at farm level
2. Field drainage ditches (Eco-ditches)
3. Constructed wetlands: such as irrigation ponds & reservoirs, or created wetlands
4. Ecological trunk channels

General approaches



ICID2015
26th ERC & 66th IEC

Methodology

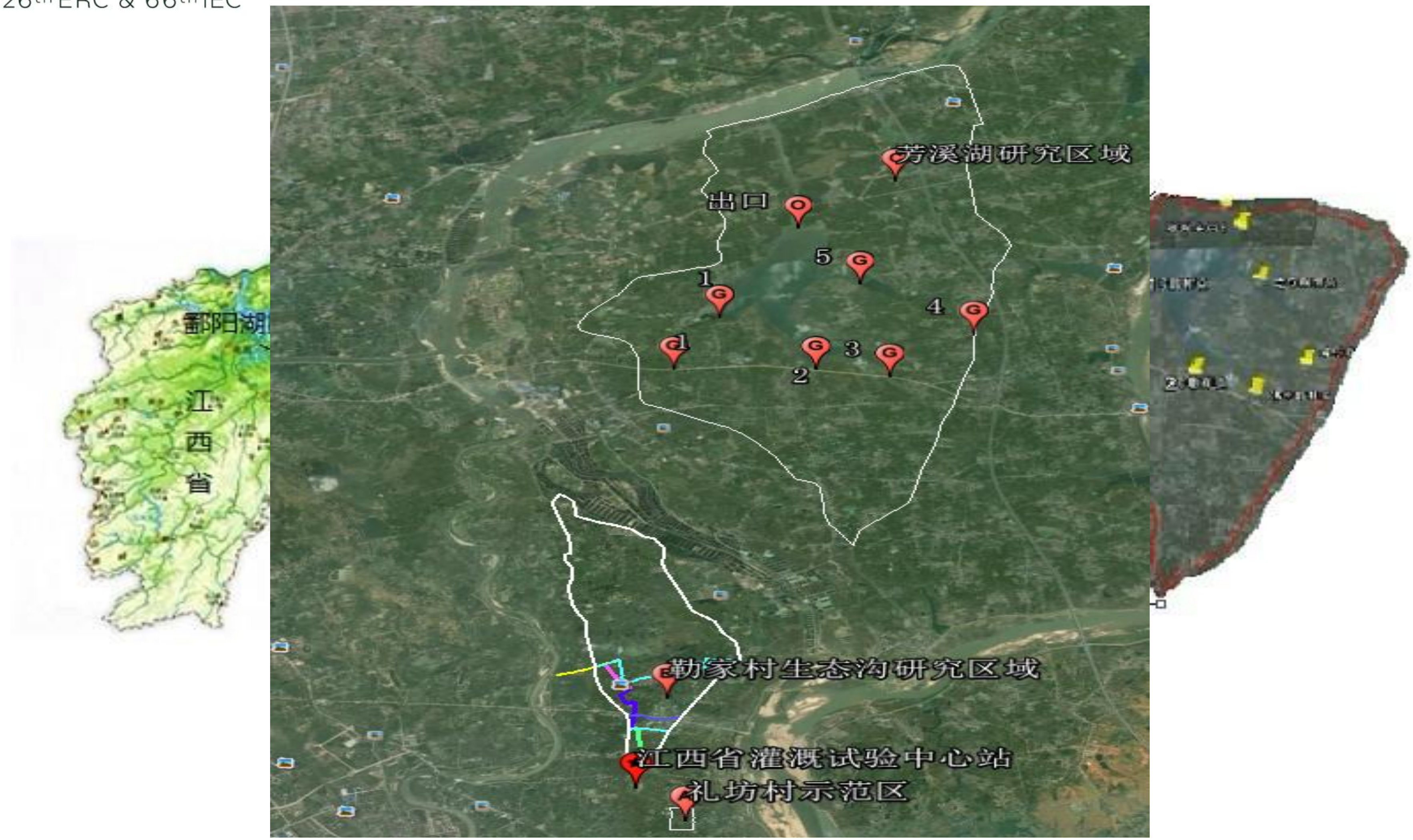
Method	Subject of Study	Expected Results
Lysimeter experiments →	Mechanism of saving water, fertilizer use	
Plot experiments →	Performance of water saving, yield improvement, efficient water & fertilizer use and nutrient loading reduction	• Reducing nutrient losses at the source • Target setting for saving water, sustaining yield, efficient use of water & fertilizer and nutrient loading reduction
Field experiments →	Typical regulation mode and its adaptability in different regions	

Methodolgy

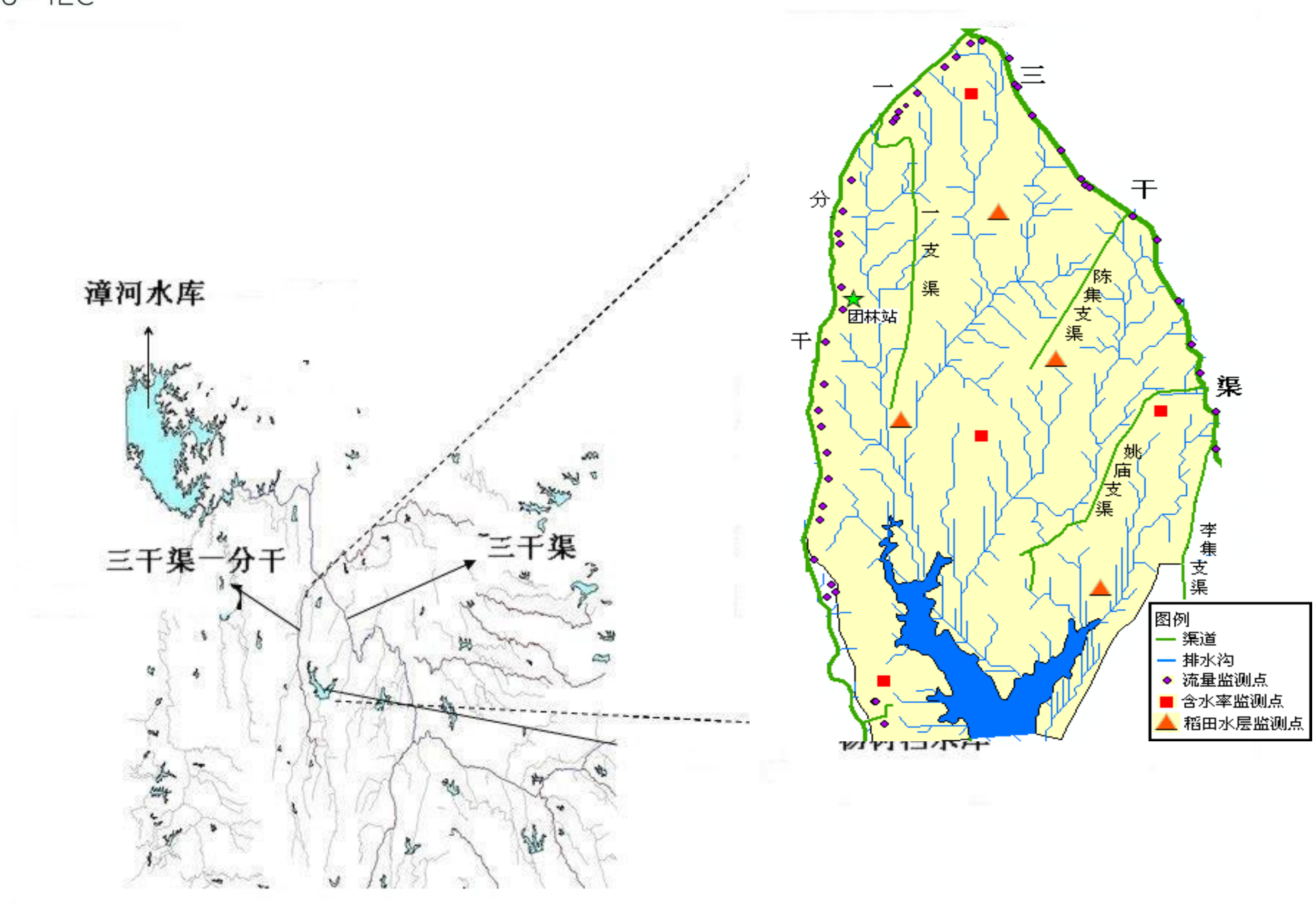
Method	Subject of Study	Expected Results
Field drain. ditches, Pond wetlands & ecological trunk channels	Ecological treatment of ANPSP	Removal efficiency, Hydraulic efficiency Design criteria
Experiments at different scales	Scale effects of nutrient loading	• The variation and mechanism of nutrient loss from the source to water body (river/lake) • Removal efficiency at different scales • Eco-effect at sub/basin scale
Modeling development	Impact factor and its variation of nutrient loading	
Dissemination & application	Mobilization, organization and implementation	Economic, social and environmental benefits

ICID2015
26th ERC & 66th IEC

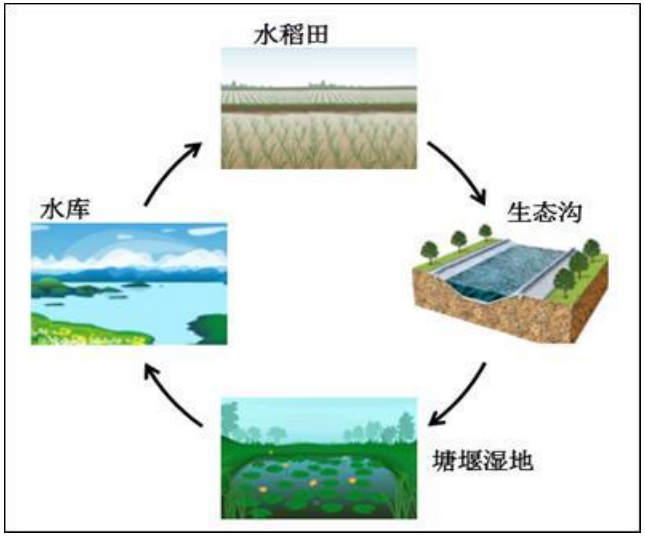
Study sites



Study sites


漳河水库
三干渠一分干
三干渠
三
干
渠
一
分
干
一支渠
团林站
陈集支渠
姚庙支渠
李集支渠
图例
渠道
排水沟
流量监测点
含水率监测点
稻田水层监测点

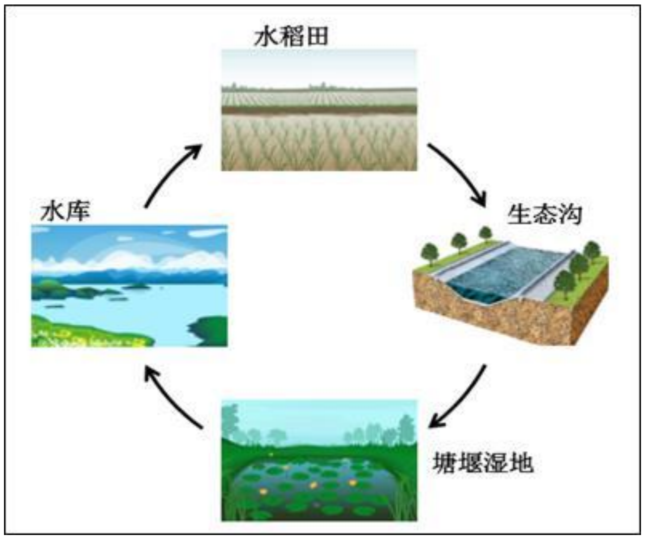
Results and conslusions

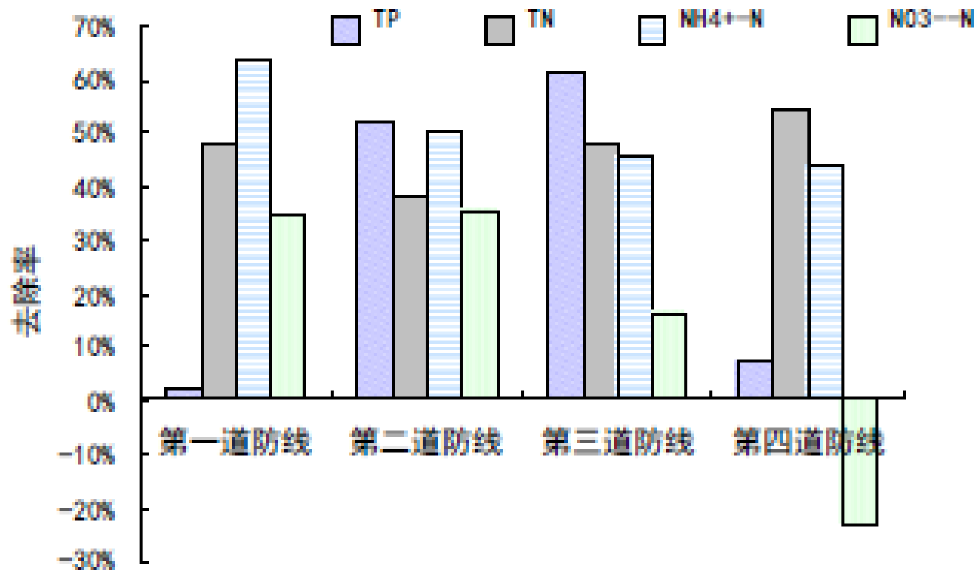


Combined effects of the Four lines of defence (%)

Pollutants reduction	TN	TP
1st line of defence	16	8.5
2nd line of defence	23.7	14.9
3rd line of defence	52.7	50.0
4th line of defence	30	12
Total reduction	69	61

Results and conslusions





Combined effects of the four lines of defence (%)

Pollutants	TP	TN	NH_4^+-N	NO_3^--N
1st reduction	**1.8~21.2**	**15.0~47.8**	**63.34**	**34.38**
2nd reduction	**7.9~51.6**	**23.7~49.2**	**49.90**	**35.50**
3rd reduction	**43.9~61.1**	**11.4~47.8**	**45.44**	**16.28**
4th reduction	**7.3**	**54.50**	**43.70**	**-23.30**
Total reduction	**61.0~82.8**	**69.0~92.3**	**94.4**	**64.6**

ICID2015

26th ERC & 66th IEC

Acknowledgment

1. National Natural Scientific Foundation of China
2. “948” Program, Ministry of Water Resources
3. Jiangxi Provincial Water Resources Bureau

Thanks !