Influences of land use with different crops on soil fertility and productivity in the area above the Three-Gorges-Reservoir of China

Ma Li[1,3], Wang Qingren[2], Li Yuncong[1]

1 UF/IFAS Tropical Research and Education Center, Homestead, FL 33031, USA; 2 UF/IFAS Miami-Dade Extension, Homestead, FL 33030, USA; 3 Institute of Soil Science, Chinese Academy of Sciences, Nanjing 210008, China

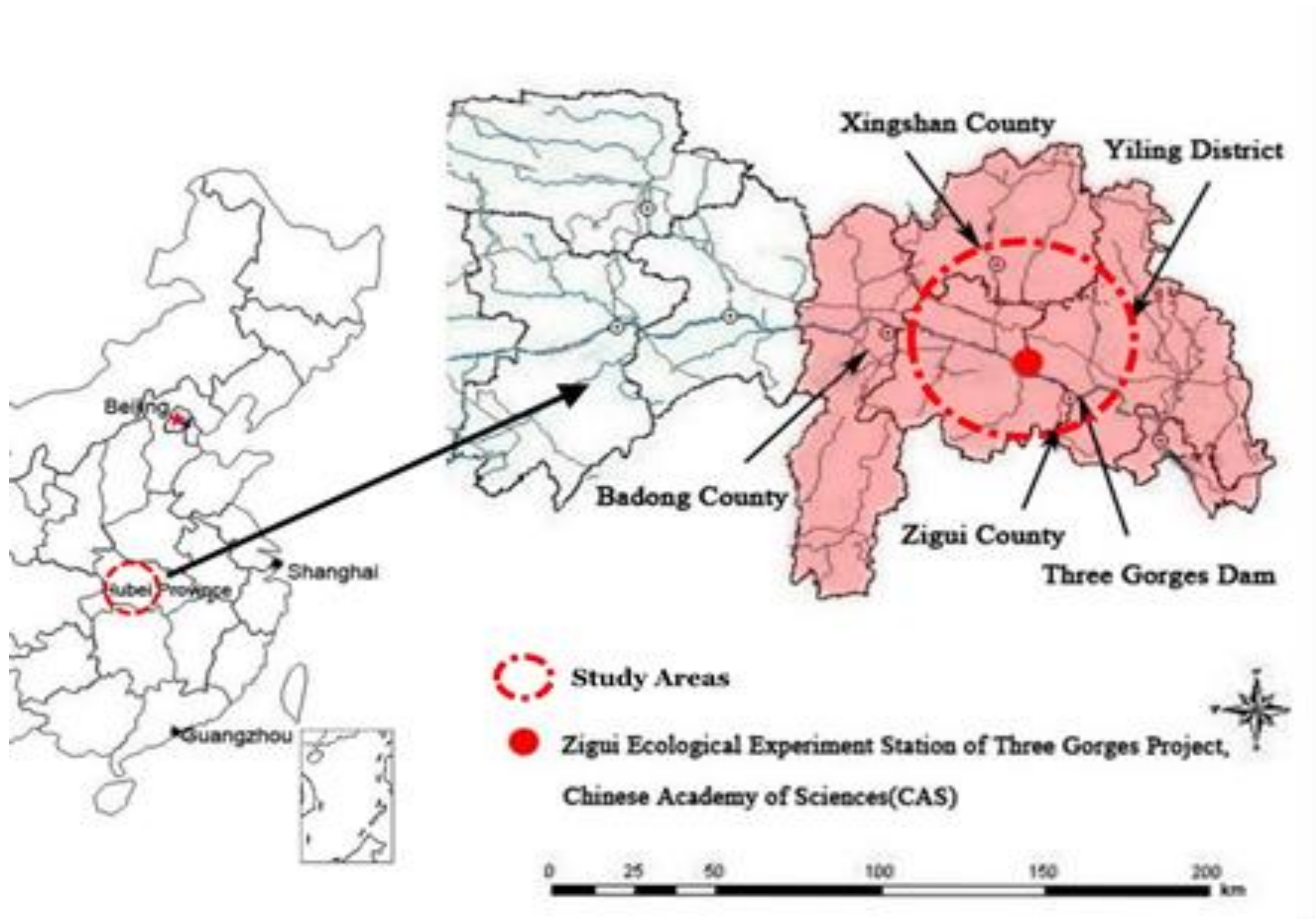
Introduction

✓ The Three Gorges Reservoir (TGR) area in China is an ecologically fragile area with the contradictions between human and land resources.

✓Groundwater level rising after the Three Gorges Dam (TGD) built may create a potential impact on soil fertility, land productivity and the development of sustainable agriculture in the area above the TGR.

✓To optimize the management of agriculture development in the mountain area, a long-term research work in soil fertility monitoring was carried out.

Materials & Methods



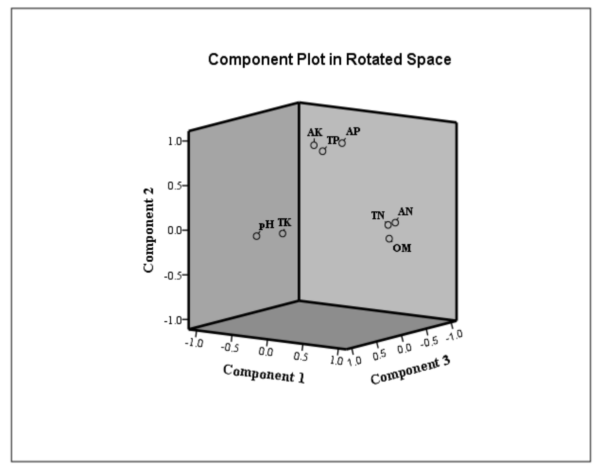
✓A comprehensive study was conducted from 2005 through 3 counties (Zigui, Xingshan, and Badong) to evaluate the soil fertility, land productivity and economic output from different land uses including cereal/vegetable crops, citrus, and tea crop at various altitudes in the agricultural area above the TGR.

✓86 soil monitoring plots were distributed around the area of Zigui, Xingshan, Badong counties and Yiling District, Hubei Province in the area above the TGR.

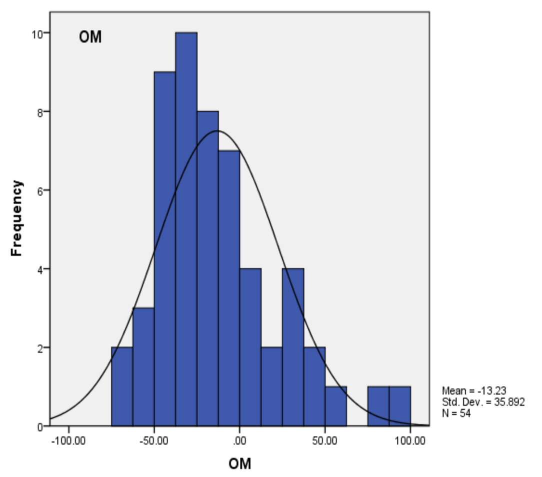
✓Soil fertility analysis items include soil bulk density, porosity, pH, SOM, TN, TP, TK and available NPK etc. More than 500 soil samples have been collected since the beginning of soil fertility monitoring in 2005.

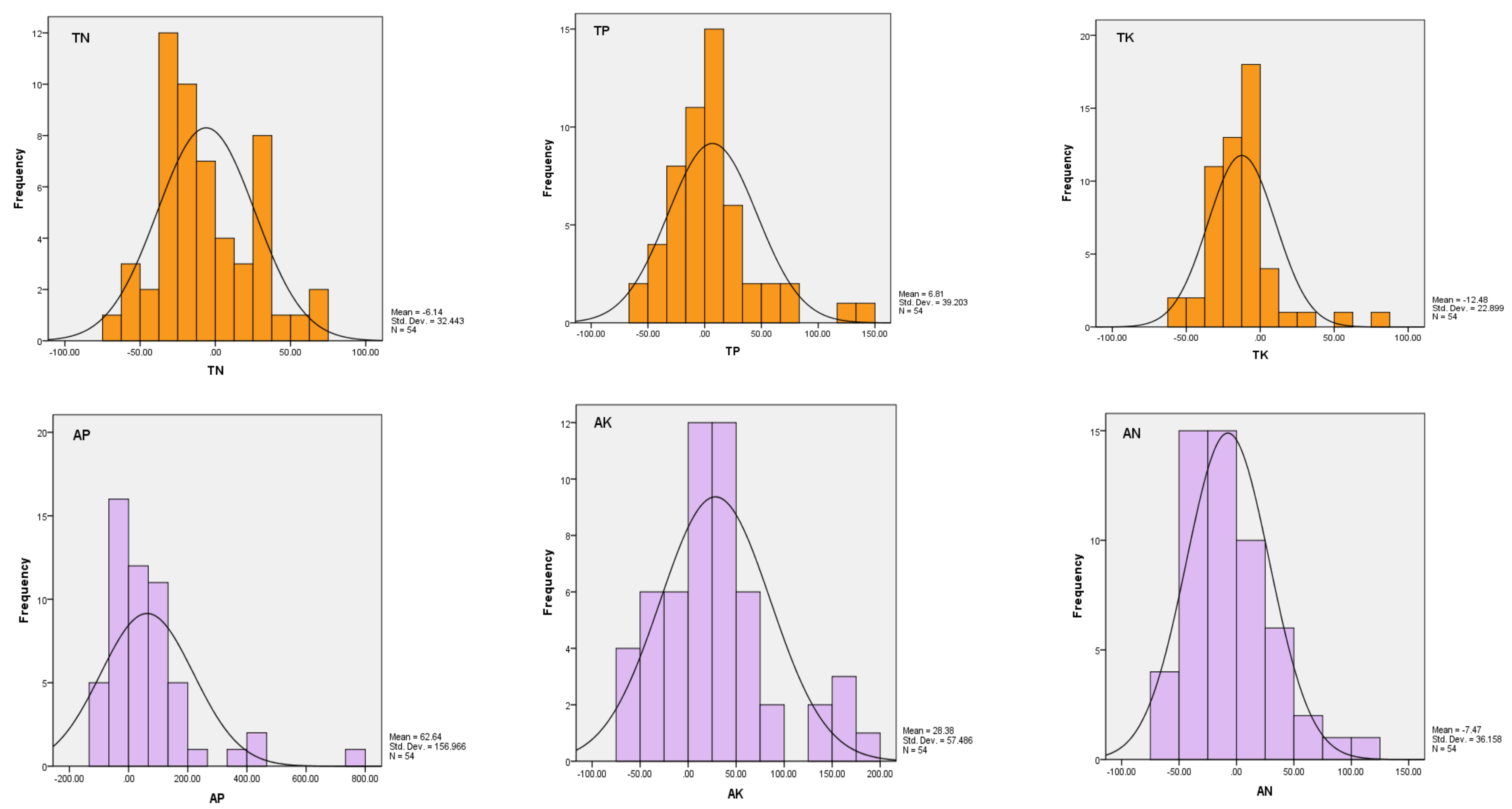
Results

Component Matrix of soil fertility factors



	Component		
	1	2	3
pH	-.592	.298	.572
OM	.739	-.418	.313
TN	.811	-.269	.349
TP	.436	.771	.144
TK	-.225	.227	.819
AN	.831	-.312	.118
AP	.572	.706	-.246
AK	.321	.851	-.038





Analysis of variation frequency of soil fertility in 2014 and 2005.

The X-axis was percentage of different value of 2014 and 2005 (%), the Y-axis is frequency.

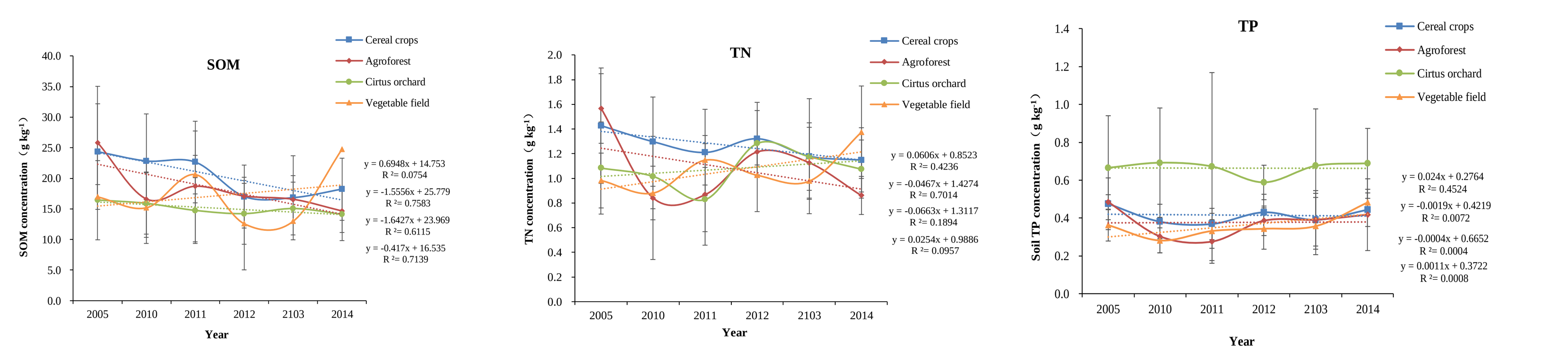
Soil nutrient status in middle and low altitude area under different land use

Land use	OM (g/kg)	TN (g/kg)	TP (g/kg)	TK (g/kg)	AN (mg/kg)	AP (mg/kg)	AK (mg/kg)
Paddy field	29.93±5.74	1.65±0.25	0.41±0.01	15.38±0.94	129.71±19.66	7.48±3.59	46.67±5.20
Slope land	20.40±10.69	1.18±0.46	0.63±0.28	19.44±2.64	96.39±22.29	17.15±19.27	64.17±10.10
Terrace Field	26.08±4.53	1.44±0.52	0.47±0.03	14.48±0.93	159.46±5.45	17.98±5.91	60.00±5.00
Sig.	ns	ns	ns	s	s	ns	s

Soil nutrient status in low altitude area under different land use

Land use	OM (g/kg)	TN (g/kg)	TP (g/kg)	TK (g/kg)	AN (mg/kg)	AP (mg/kg)	AK (mg/kg)
Slope land	13.29±2.00	1.12±0.31	0.77±0.09	22.34±1.26	79.43±10.25	75.79±52.10	213.13±28.16
Terrace field	22.10±6.26	1.44±0.20	0.98±0.29	16.55±1.45	117.74±20.43	117.11±58.04	317.50±125.32
Terrace field intercrop	16.36±7.59	0.88±0.29	0.68±0.25	19.58±4.74	80.33±13.20	36.84±31.03	130.00±49.16
Slope land intercrop	11.15±3.79	0.74±0.18	0.37±0.07	19.68±3.34	55.34±17.12	11.32±7.23	112.50±45.18
Sig.	ns	s	s	ns	s	s	s

Typical soil profile in the area of the TGR



Changes of soil fertility of different land use from 2005 to 2014

The Three Gorges Project

Landscape of the Three Gorges Reservoir area

Zigui Ecological Experimental Station

Zigui Cirus

Conclusion

1. Terraced fields and protective cultivation were commonly implemented in the study area. For instance, the area in altitude 600-700 m was mainly opened for citrus orchard, and the area in altitude 700-900 m was mainly growing cereal/vegetable crops.
2. A 10-year monitoring result (2005-2014) displayed that soil fertility was generally decreasing in this area, which has become a main constraint to the local agricultural production.
3. A change from slope to terrace farming helped improve soil fertility including soil nitrogen and phosphorus, which might be resulted from the reduction of water runoff and soil erosion.
4. The degradation in soil fertility without efficient approaches in soil and water reservation can also be a major concern for a sustainable development of agriculture in this area.

Acknowledgement

The program was supported by the monitoring project of the Three Gorges Project ecological environment monitoring system (SX[2015]-016) and the National Natural Science Foundation of China (No. 41301307)