



# Impact of non-point source pollution on water quality of Pengxi River using SWAT model after 175-meter water project operation of the Three Gorges Dam

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**Wuhan University**

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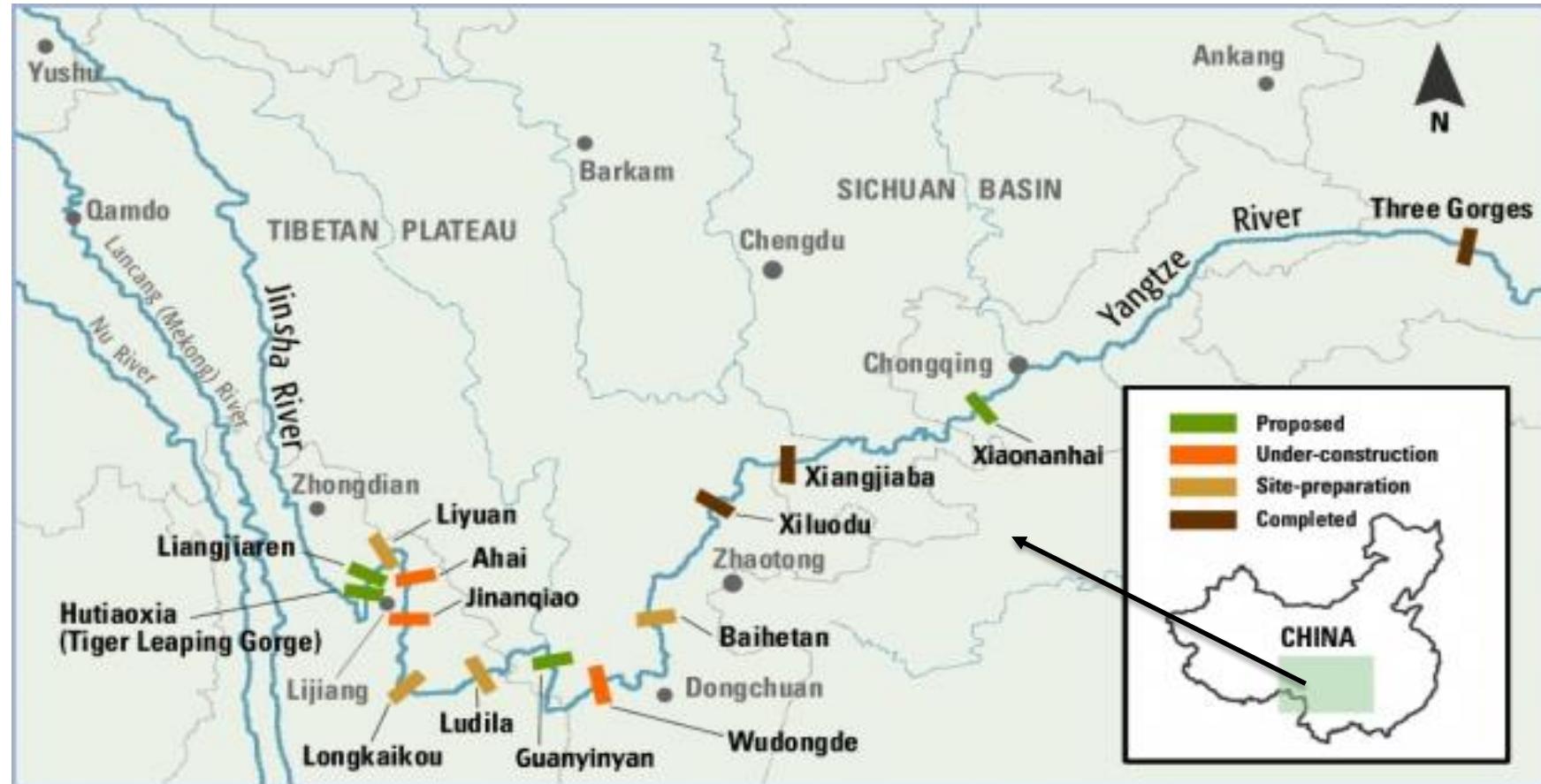


- Introduction
- Methods
  - Study area
  - Data
- Objective
- Results



# Three Gorges Project

- The Three Gorges including Qutang Gorge, Wu Gorge and Xiling Gorge, span 193 kilometer from the western-upriver city of Fengjie in Chongqing to Yichang Nanjinguan in Hubei Province.



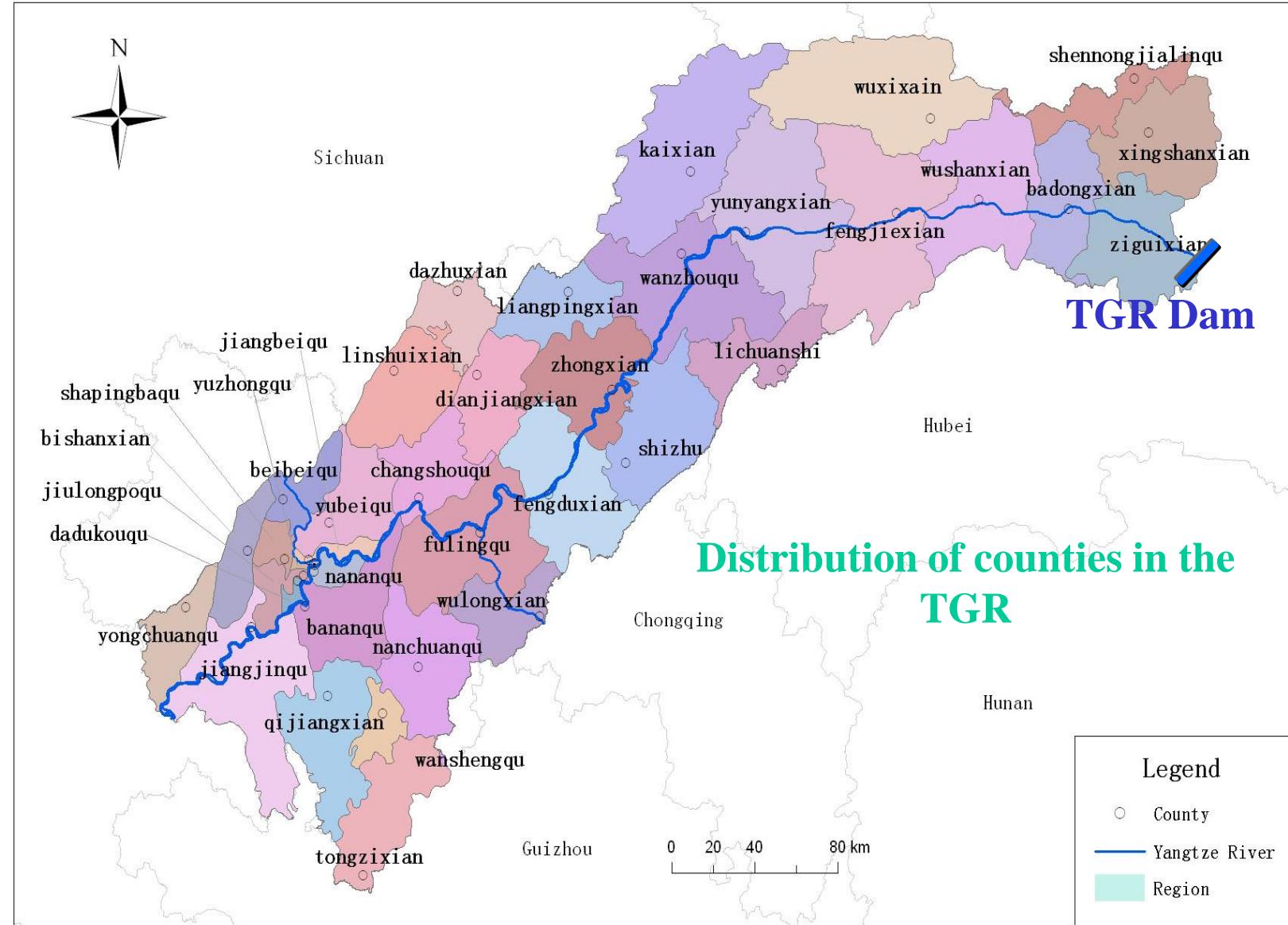
# CONTENTS

## Introduction

## Methods

## Data

## Results



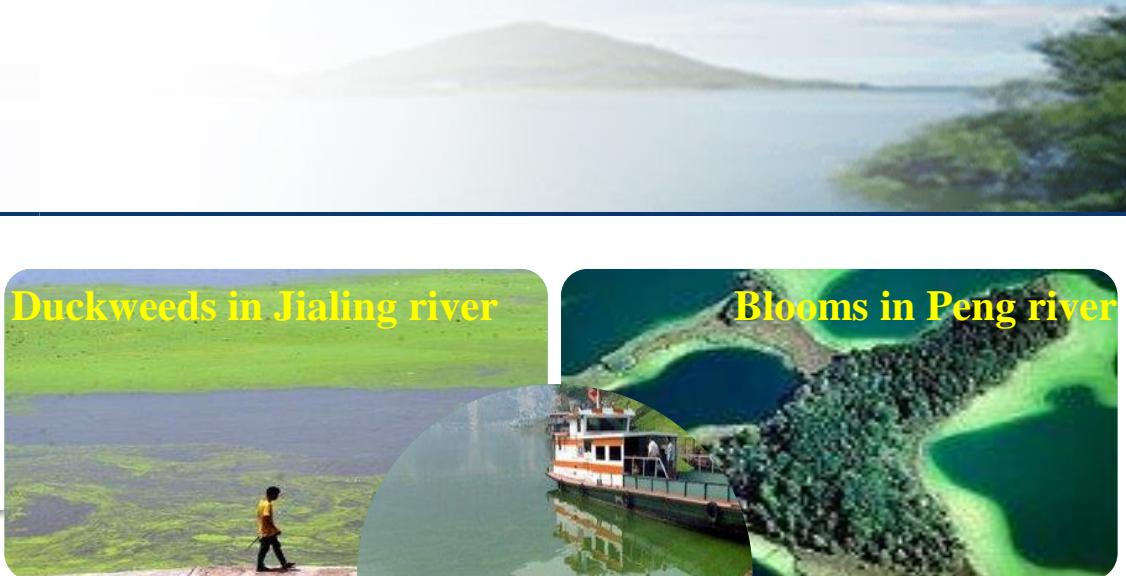
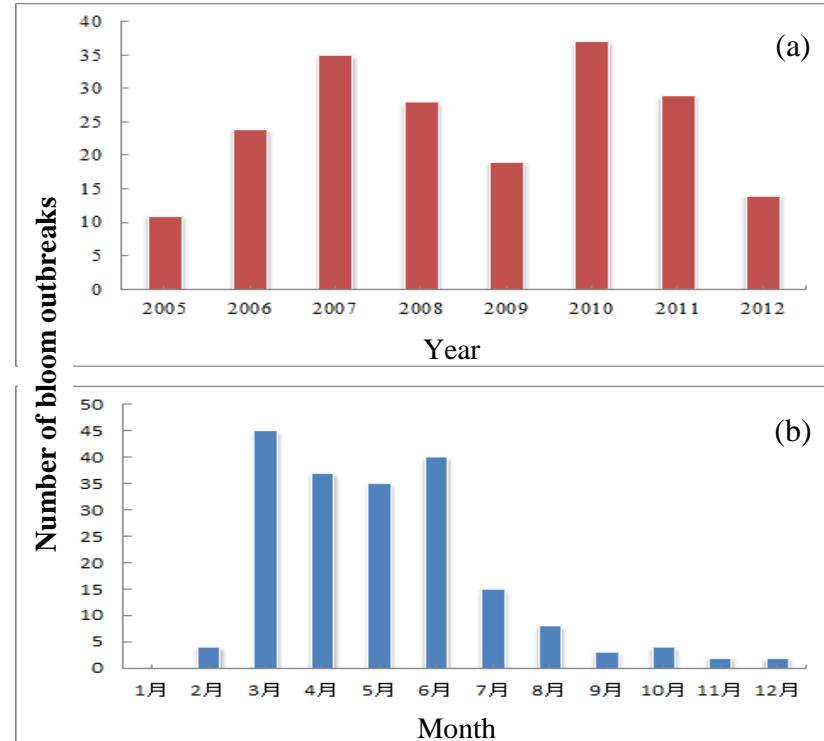
Climate: subtropical monsoon

Catchment area: 54,000 km<sup>2</sup>

Population: 16.8 million

# Algae Blooms

- ◆ From 2003 to 2012, algal blooms have occurred in more than 20 tributaries, a total number of 197 cases.



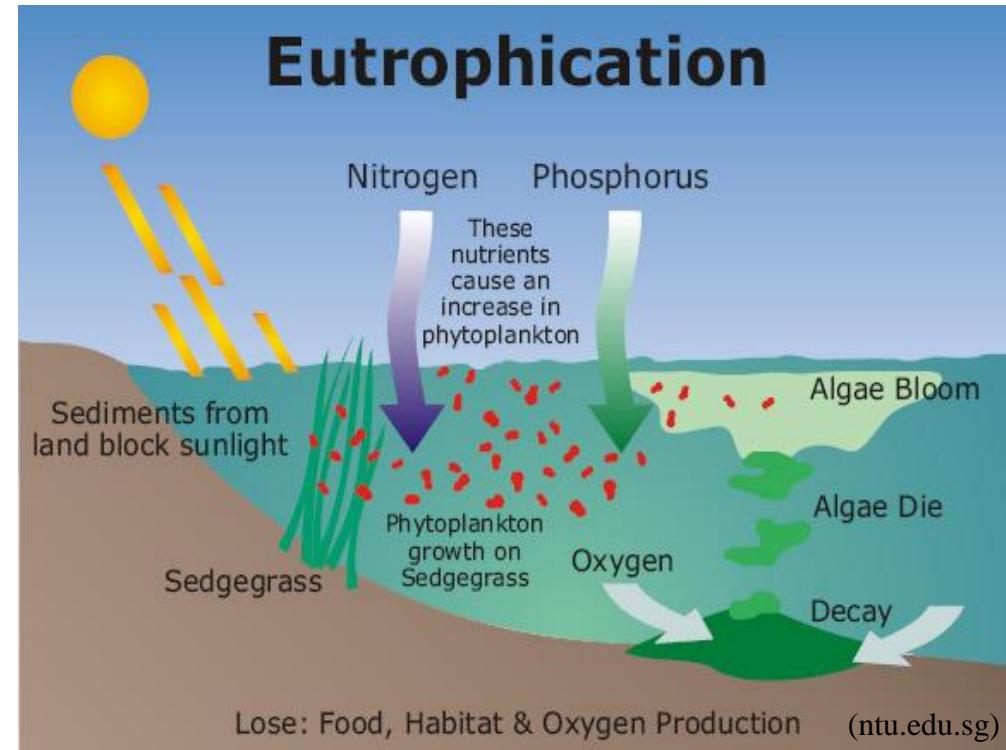
## CONTENTS

### Introduction

### Methods

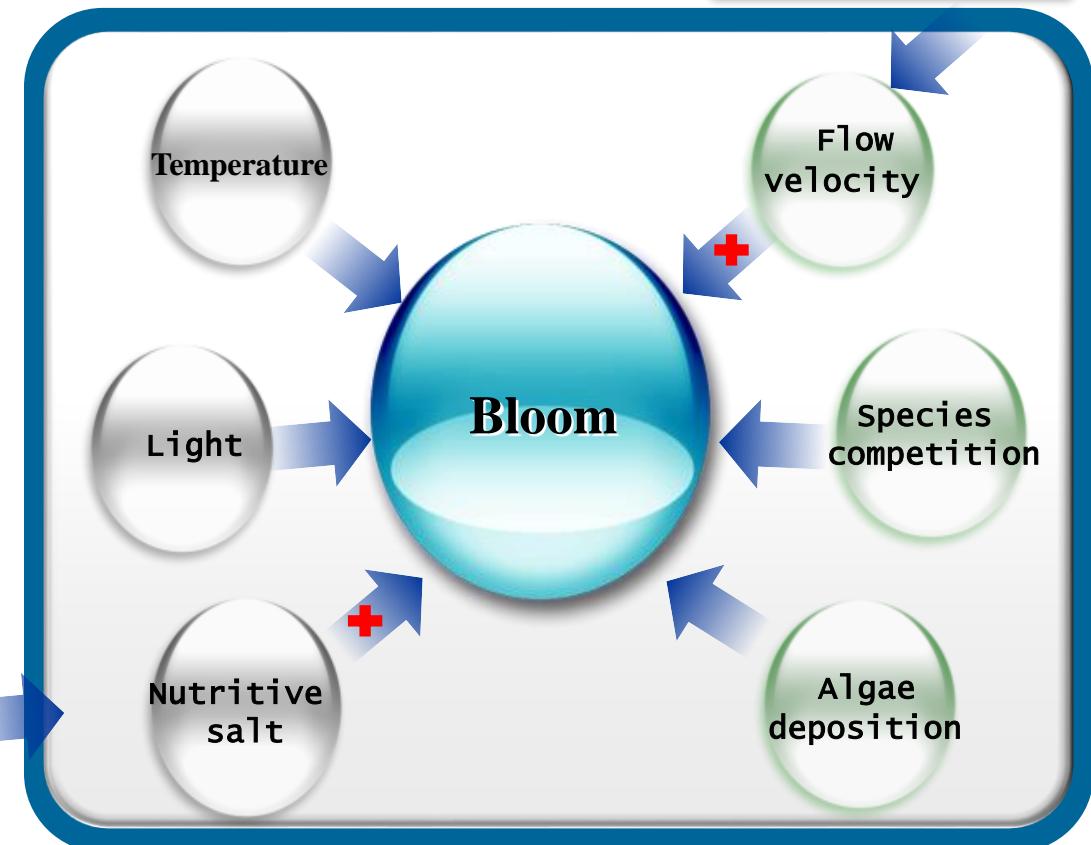
### Data

### Results



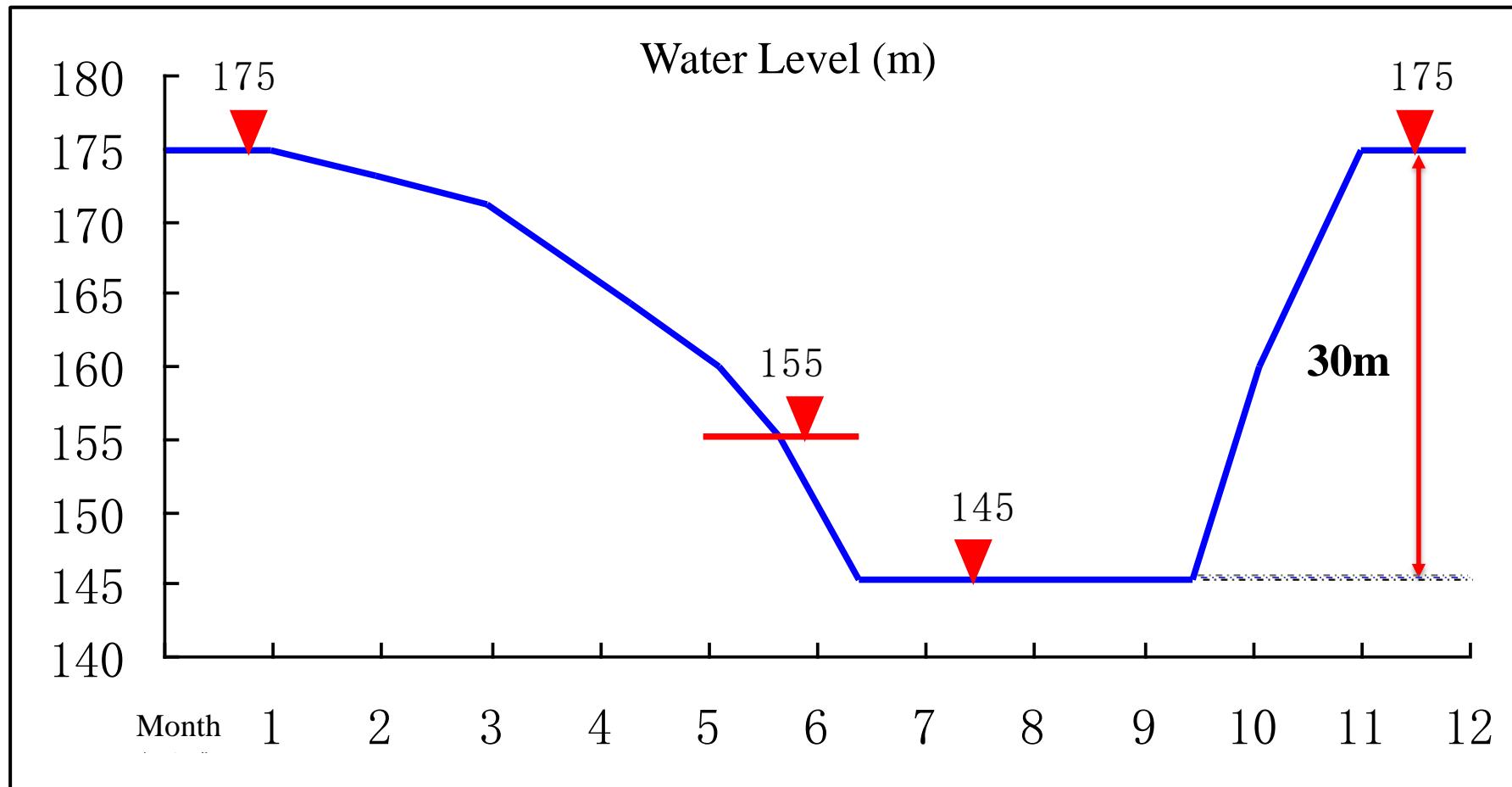
Nitrogen  
Phosphorus  
etc.

### Factors influence algae blooms



# Basic Situation of Reservoir Inundation

- Since the TGR has reached a sufficient water-level scheduling interval from 145 to 175 meter, creating a 30-meter water-level-fluctuation (WLF) zone.



# Water Environment – Tributaries

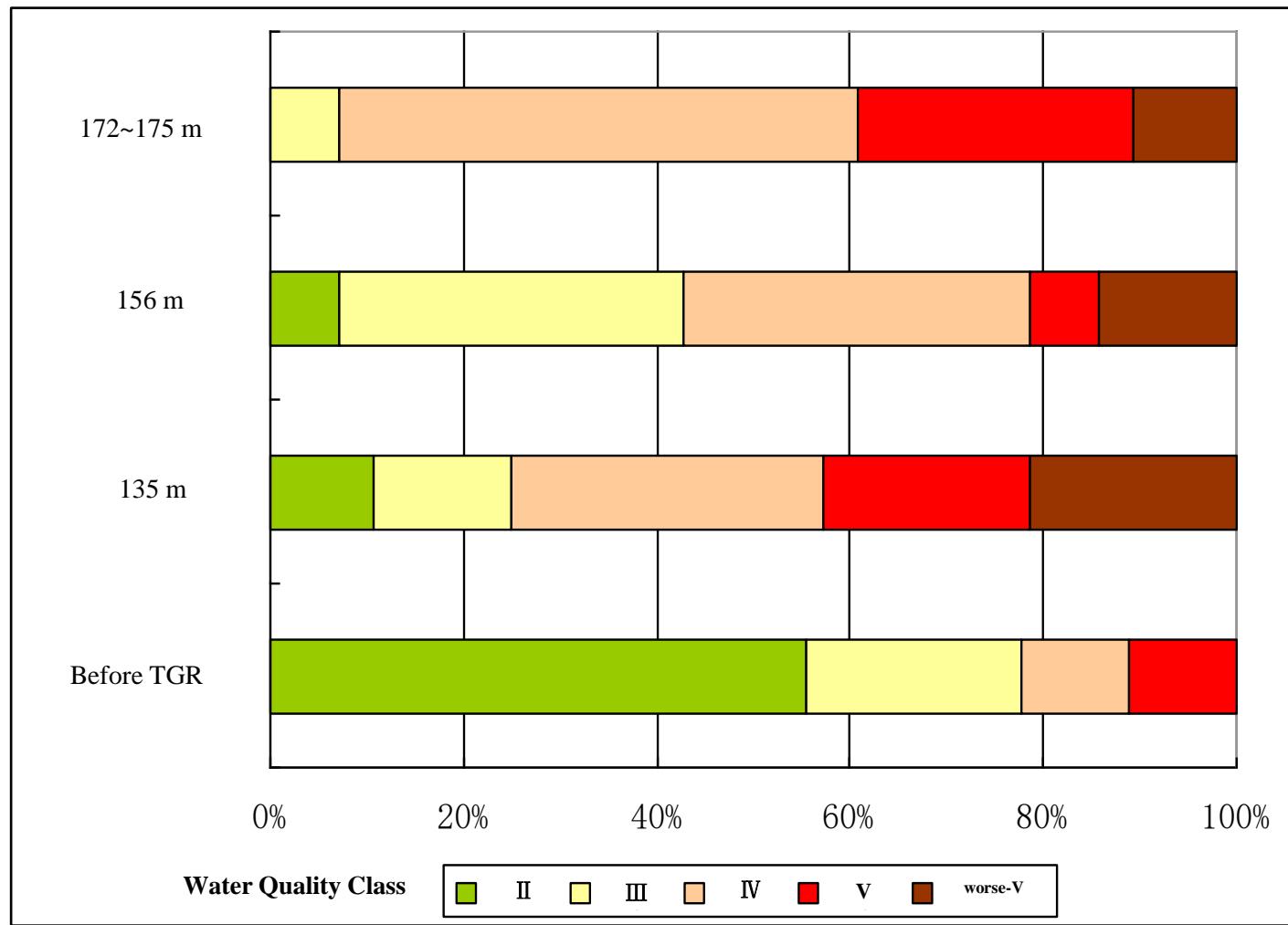
## Introduction

## Methods

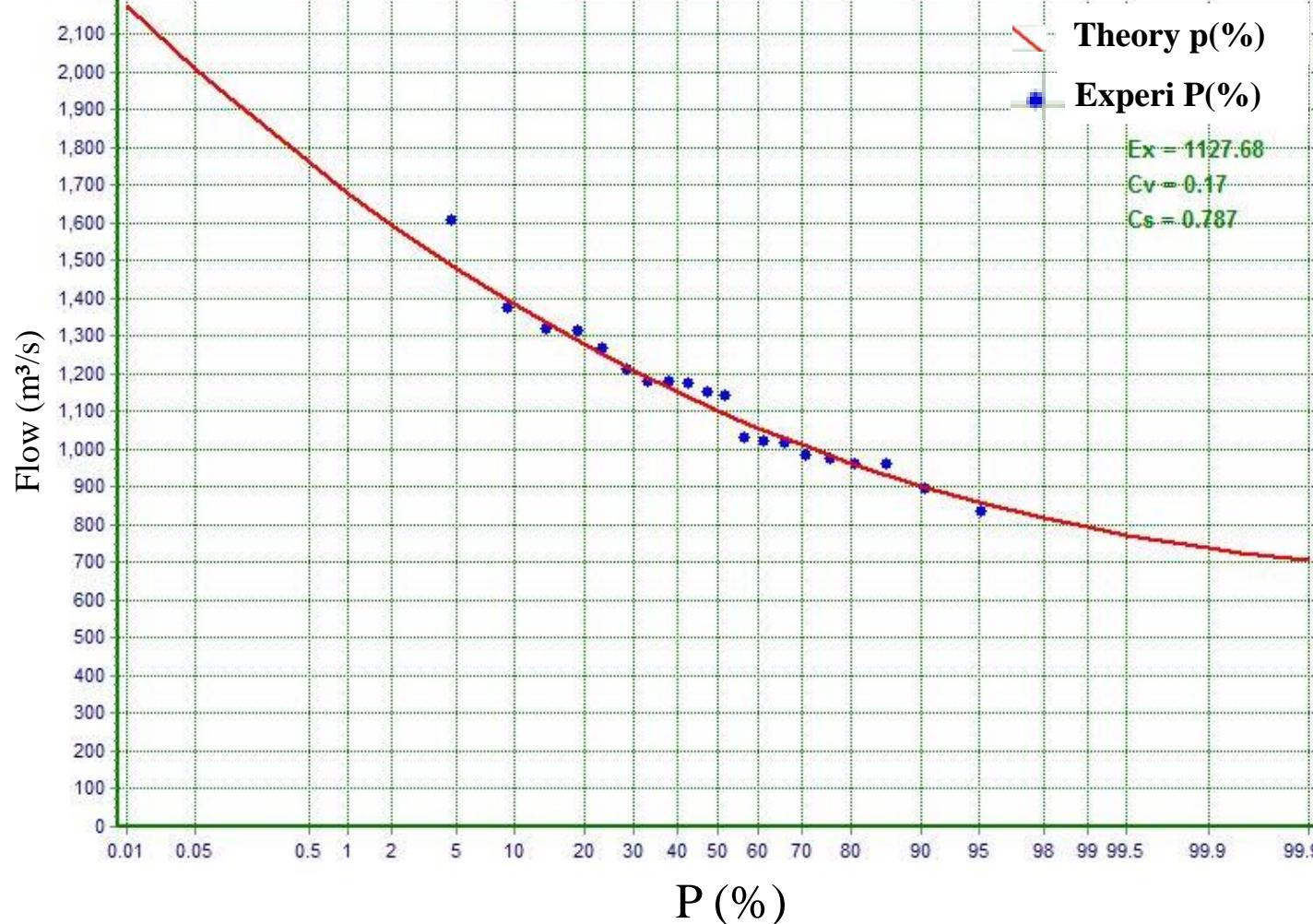
## Data

## Results

Water quality changes in tributaries at different stages of operation pattern



# Chances of different precipitations in Pengxi River basin



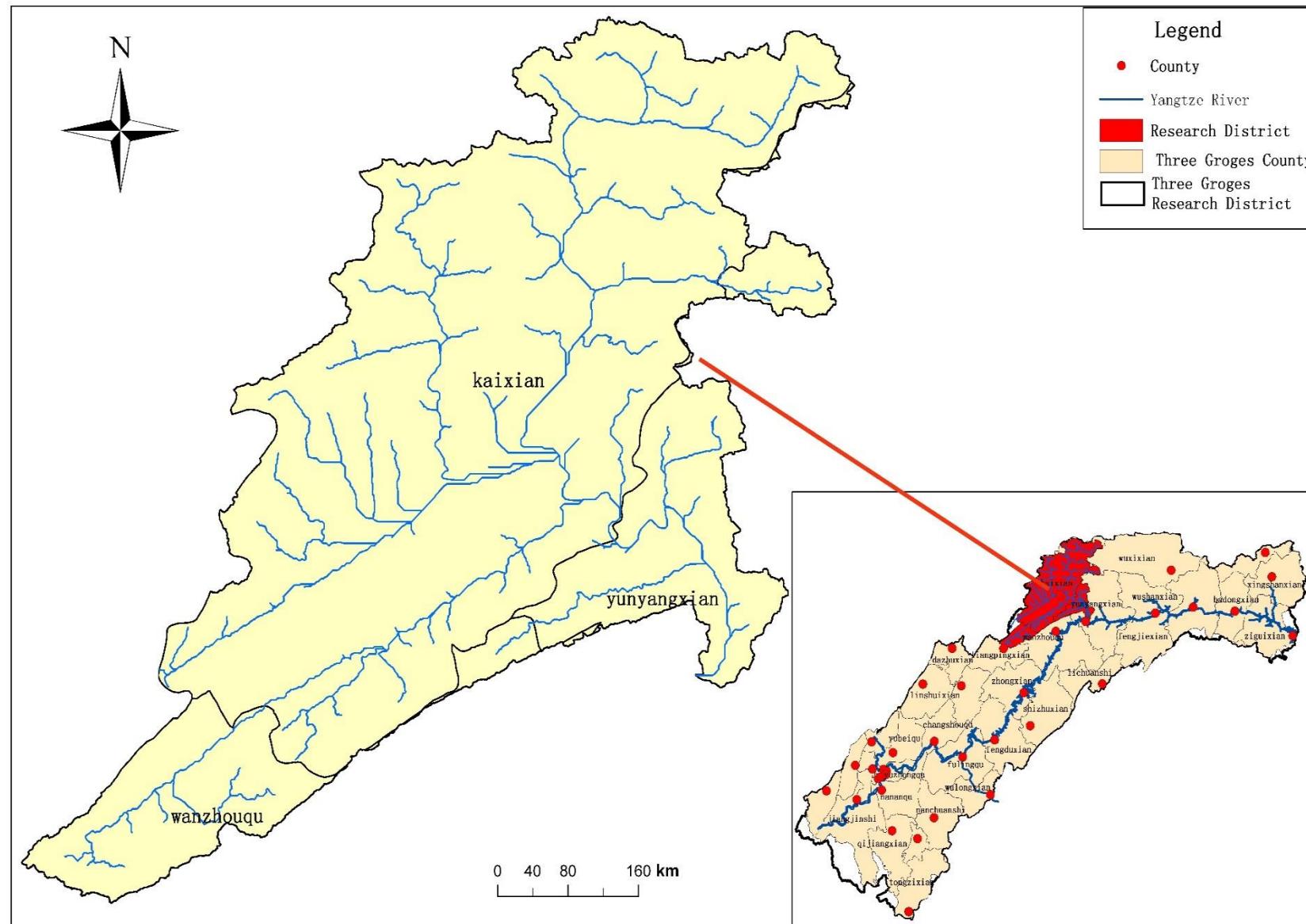
## Study area

## Introduction

## Methods

Data

## Results



**Located in  
E107° 56'~108° 54',  
N30° 49'~31° 42'**

## Climate: subtropical monsoon

Annual rainfall: 1149.3  
mm

River length: 182.4 km

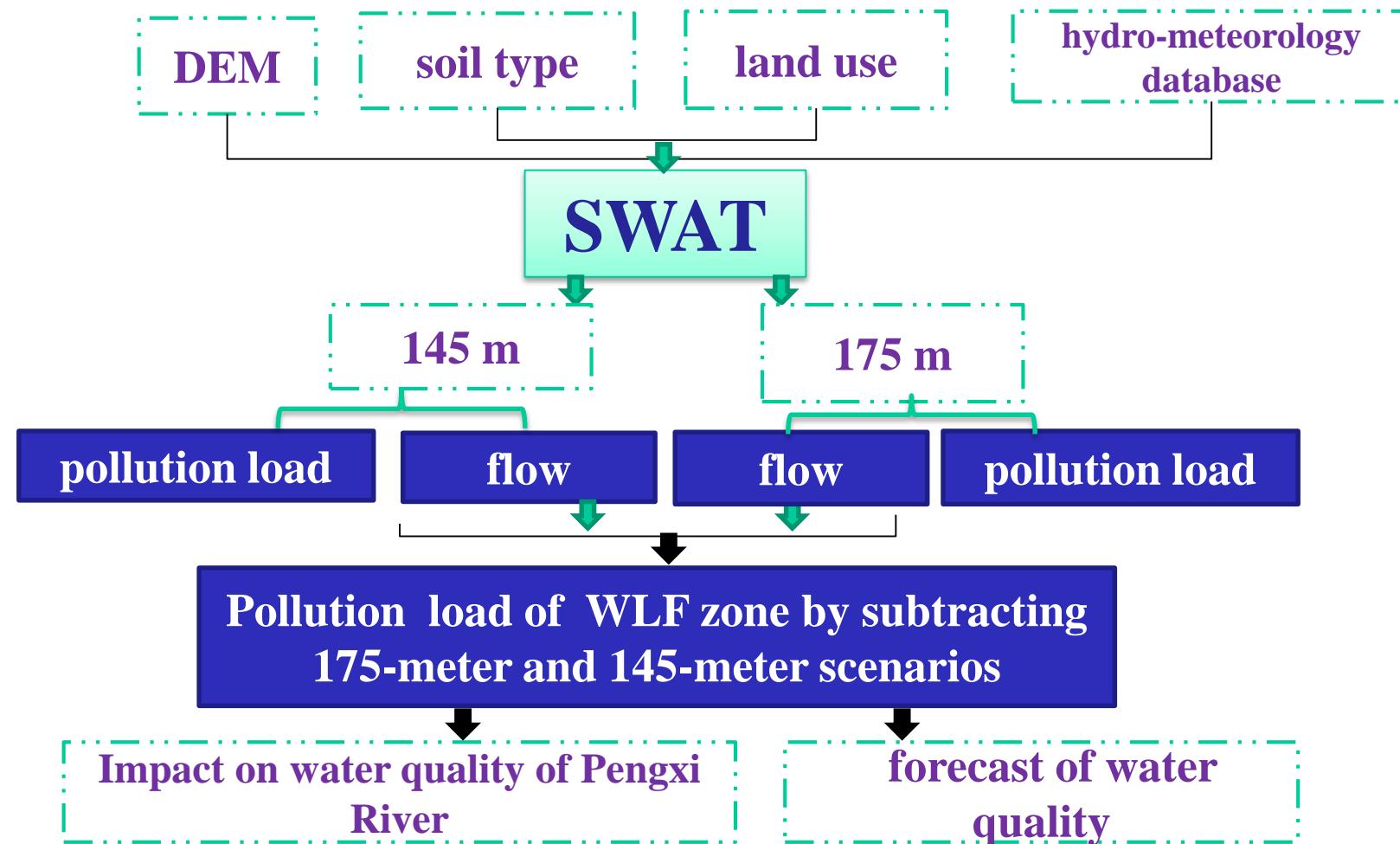
Catchment area: 5,173 km<sup>2</sup>

Annual runoff: 3.4 billion  
 $\text{m}^3$

Population: 1630000

# Framework

- Study Aim: applying SWAT model, we investigate the impacts of non-point source pollution on water quality of Pengxi River based on 145-meter and 175-meter impoundment scenarios.



# Data preparation

Data	Data type	Resolution or Scale	Source
<b>DEM</b>	Raster	30 m * 30 m	Chinese Academy of Sciences Data Mirror
<b>Soil type</b>	Raster	1:4000000	China Soil Scientific Database, Institute of Soil Science, Chinese Academy of Sciences
<b>Land use types</b>	Vector	1:250000	GEODATA.CN
<b>River network</b>	Vector	1:250000	Hydrographic Office, Yangtze River Commission
<b>Meteorology</b>	Database File		China Meteorological Data Sharing Service System

- **Calibration:** 5 years (2007-2011)
- **Validation:** 2 years (2012-2013)

## CONTENTS

Introduction

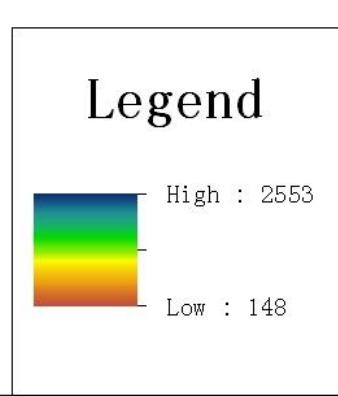
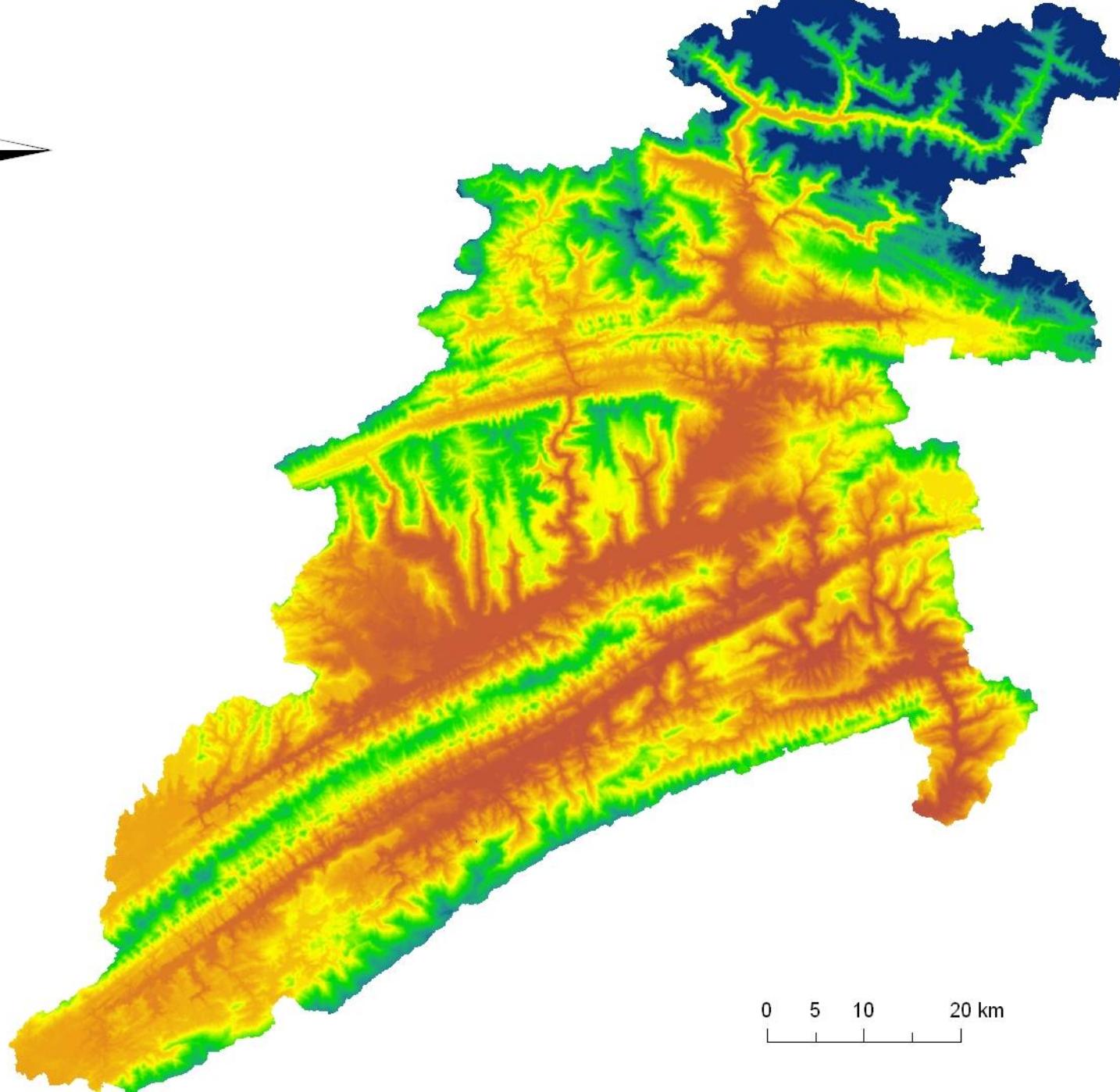
Methods

Data

Results



**DEM**



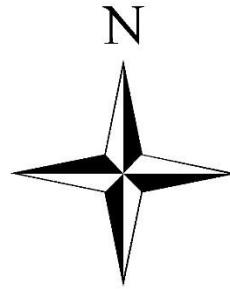
## CONTENTS

Introduction

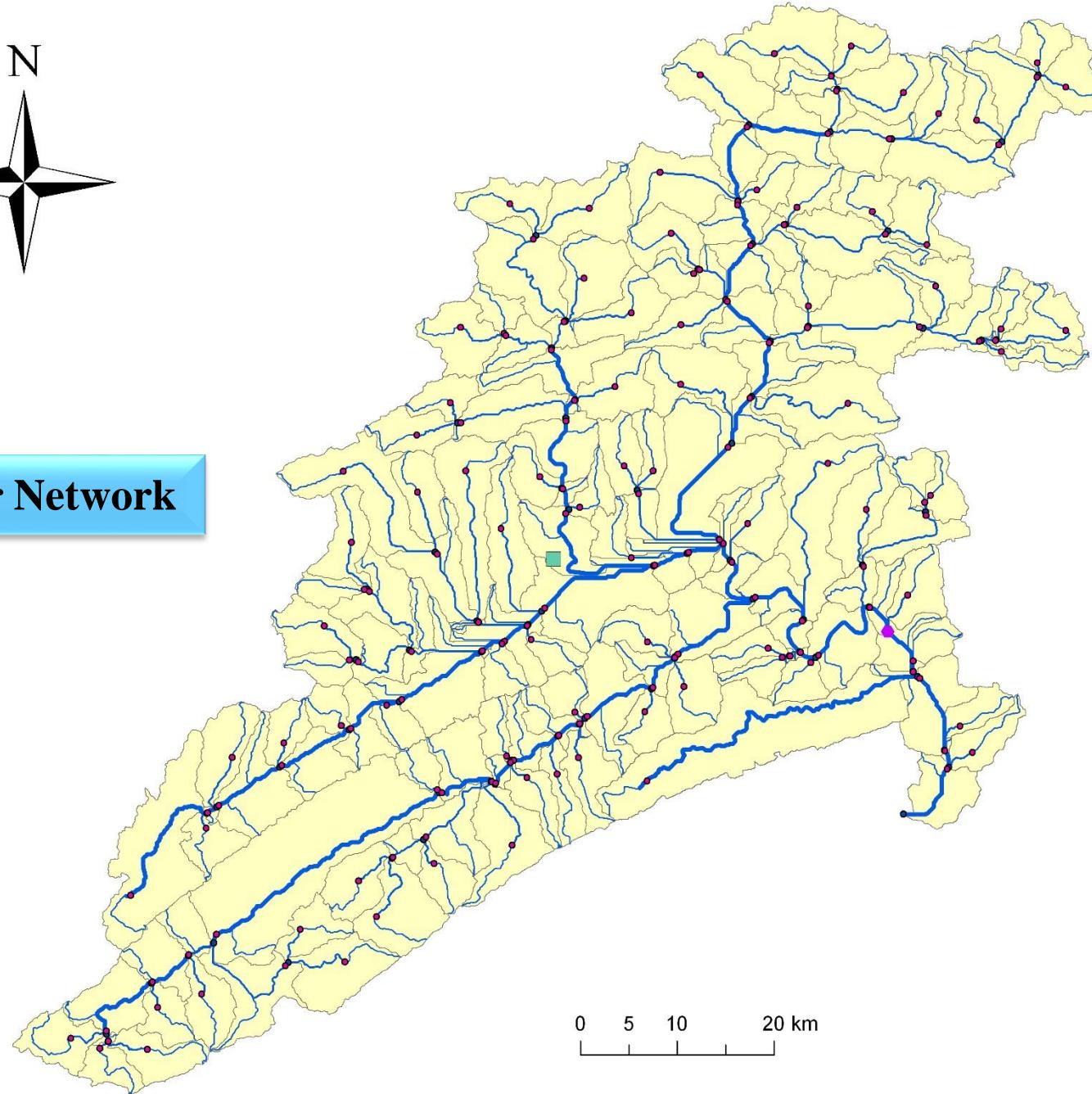
Methods

Data

Results



### River Network



**171 subbasins**  
**1252 HRUs**

#### Legend

- Linking stream added Outlet
- Manually added Point Source
- Reservoir
- Precipitation Gage
- Temperature Gage
- Humidity Gage
- Wind Gage
- **Outlet**
- Linking stream added Outlet
- River**
  - Reach
  - LongestPath
- Watershed
- Basin

## CONTENTS

Introduction

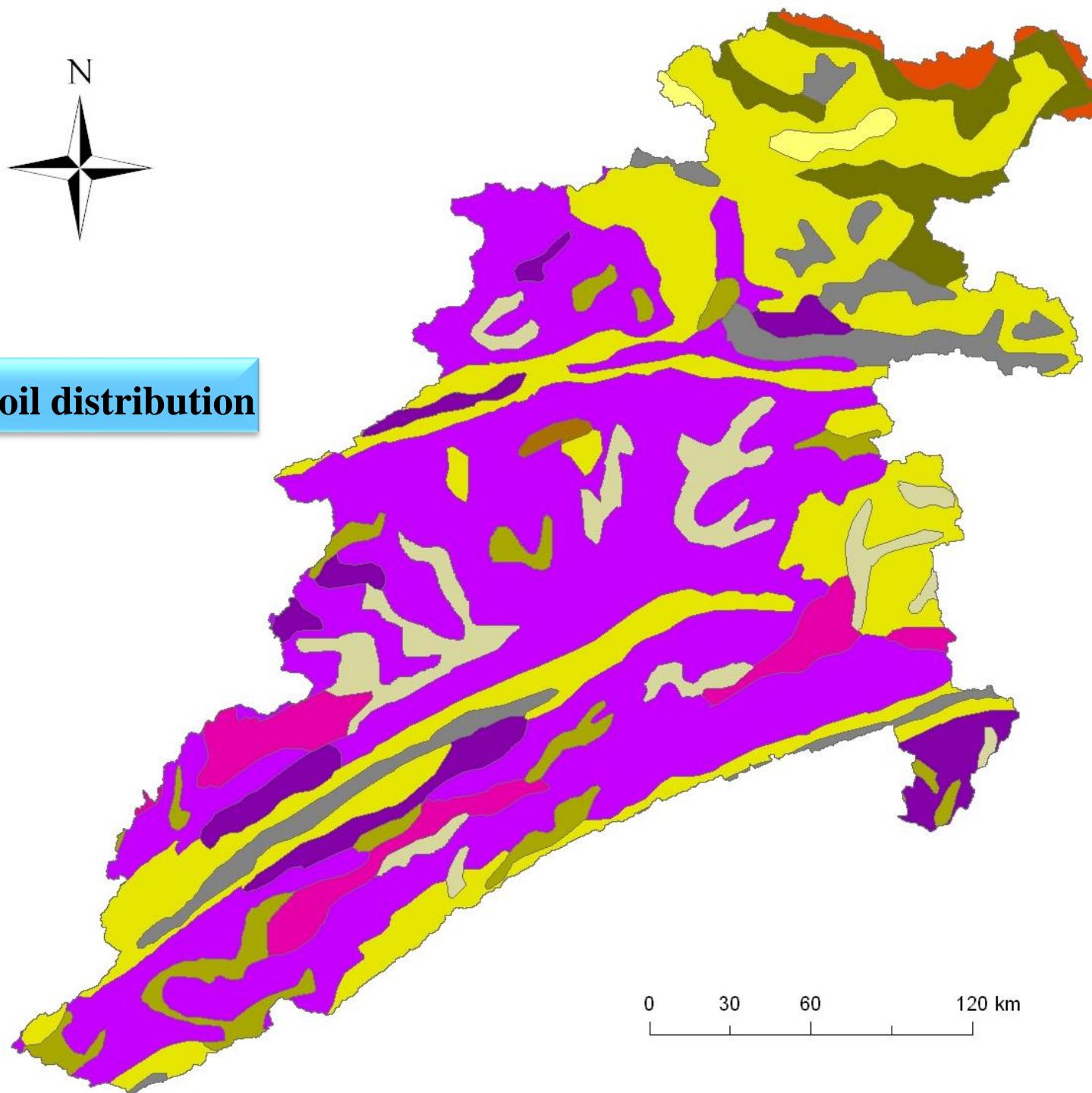
Methods

Data

Results



## Soil distribution



### Legend

#### SoilClass

- Acid purple soils
- Brown earths
- Calcareous purple soils
- Dark-yellow-brown earths
- Flooded paddy soils
- Limestone soils
- Neutral purple soils
- Paddy soils
- Permeability paddy soils
- Purplish soils
- Storage paddy soils
- Yellow calcareous soils
- Yellow earths

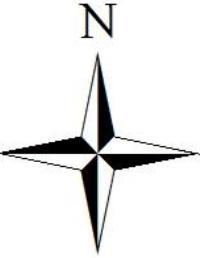
## CONTENTS

Introduction

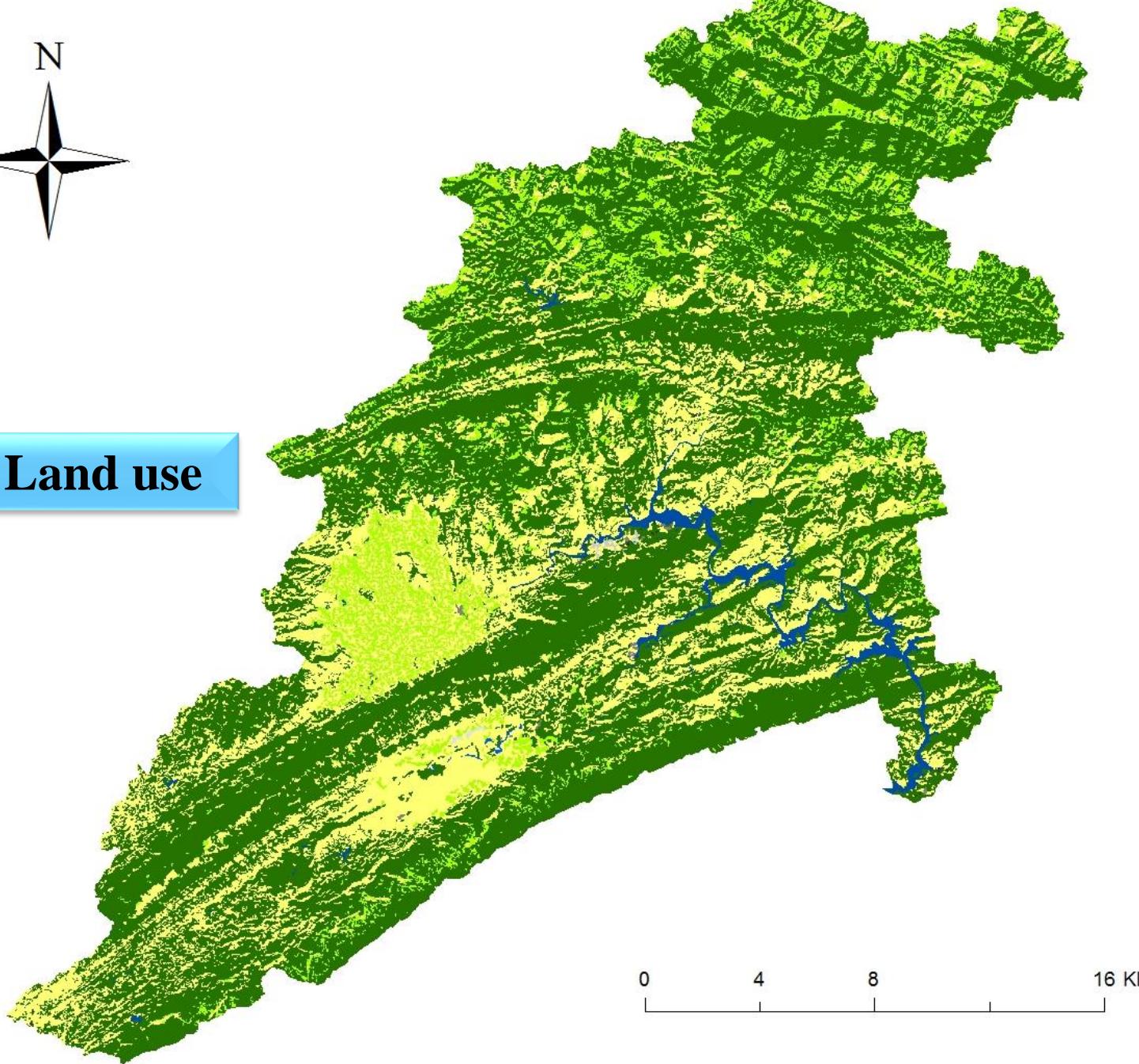
Methods

Data

Results

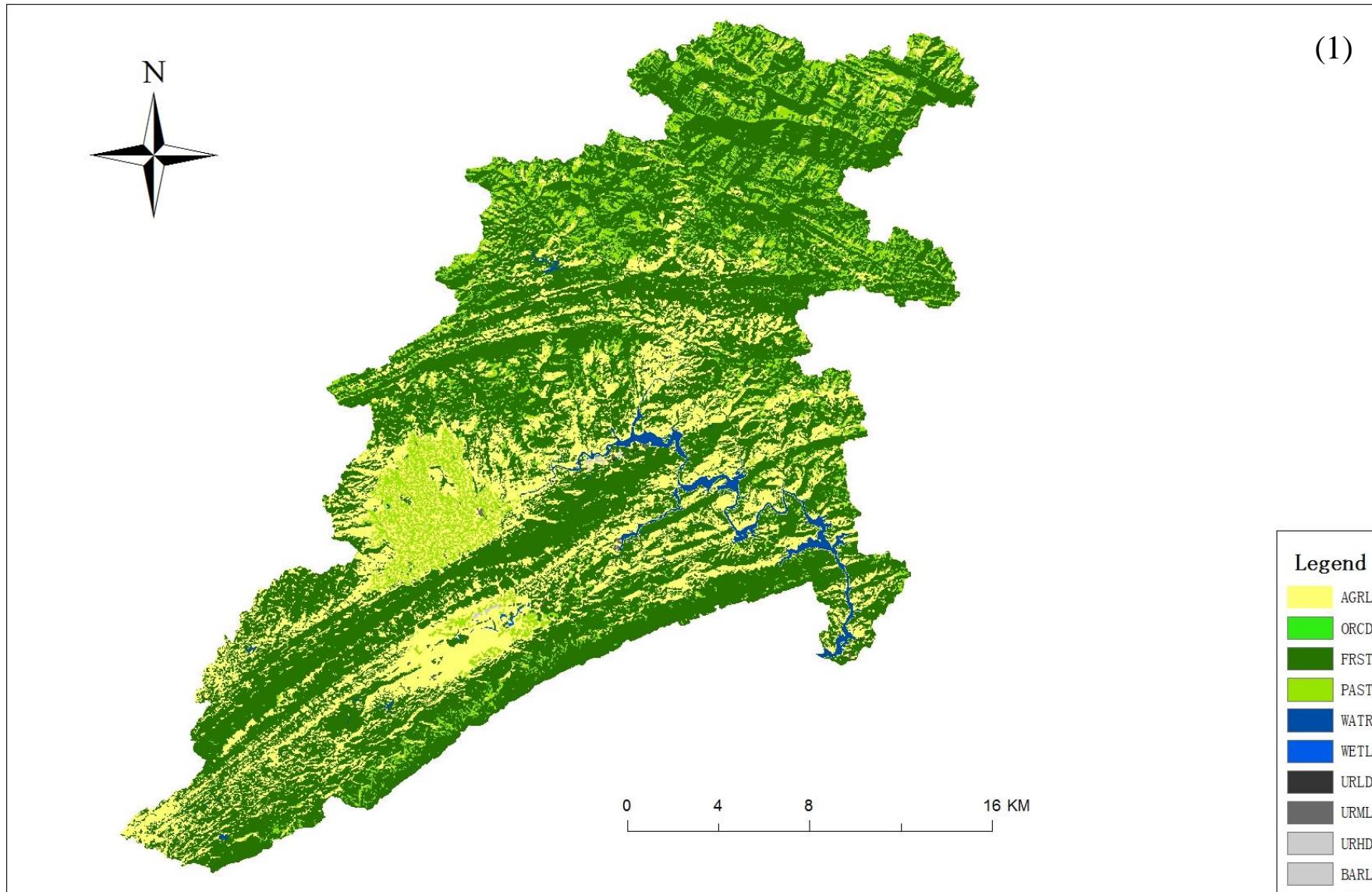


## Land use



Legend
AGRL
ORCD
FRST
PAST
WATR
WETL
URLD
URML
URHD
BARL

# Land use changes between 145-meter and 175-meter impoundment



# CONTENTS

Introduction

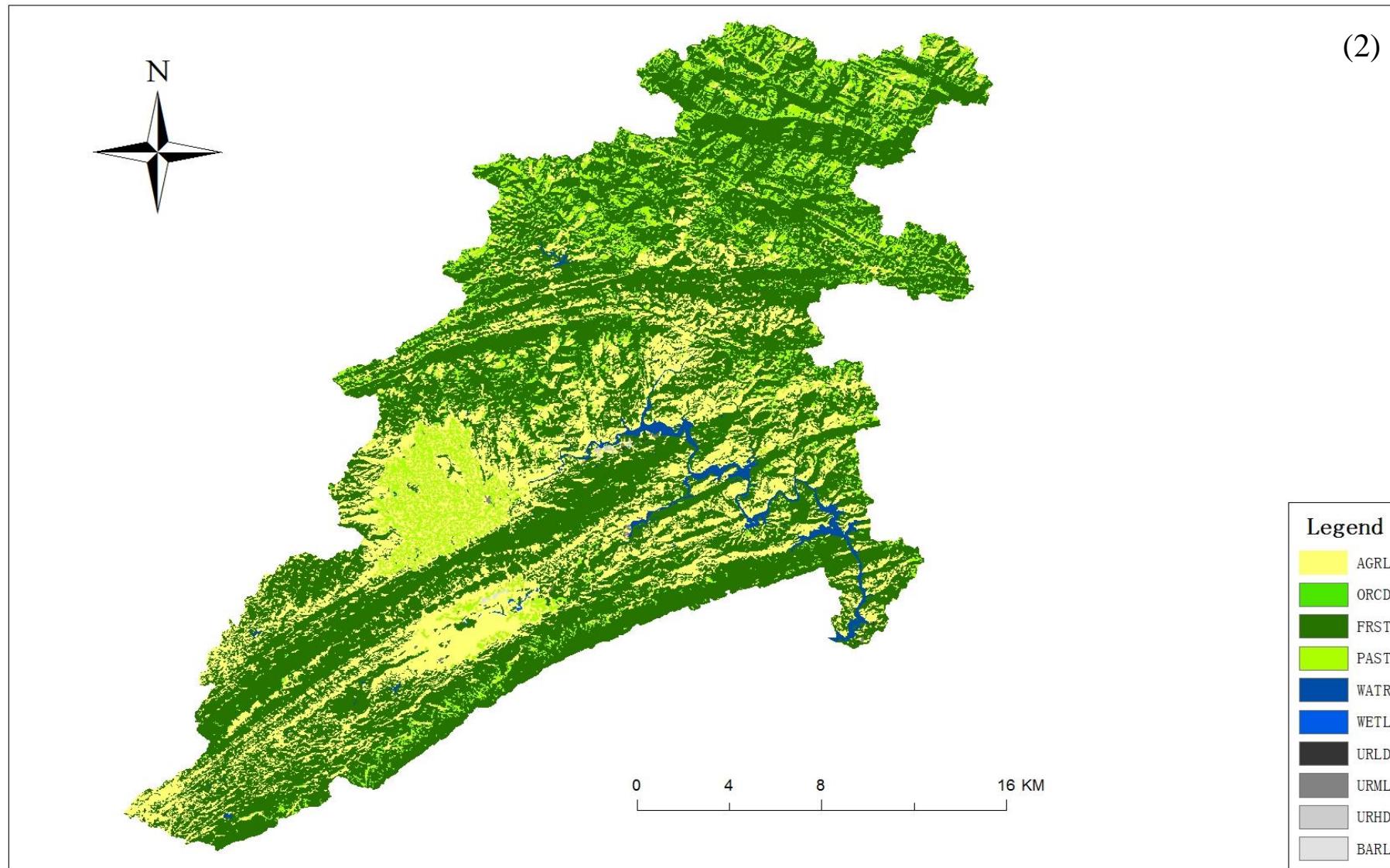
Methods

Data

Results

(2)

## Land use in 175-meter scenario



# CONTENTS

Introduction

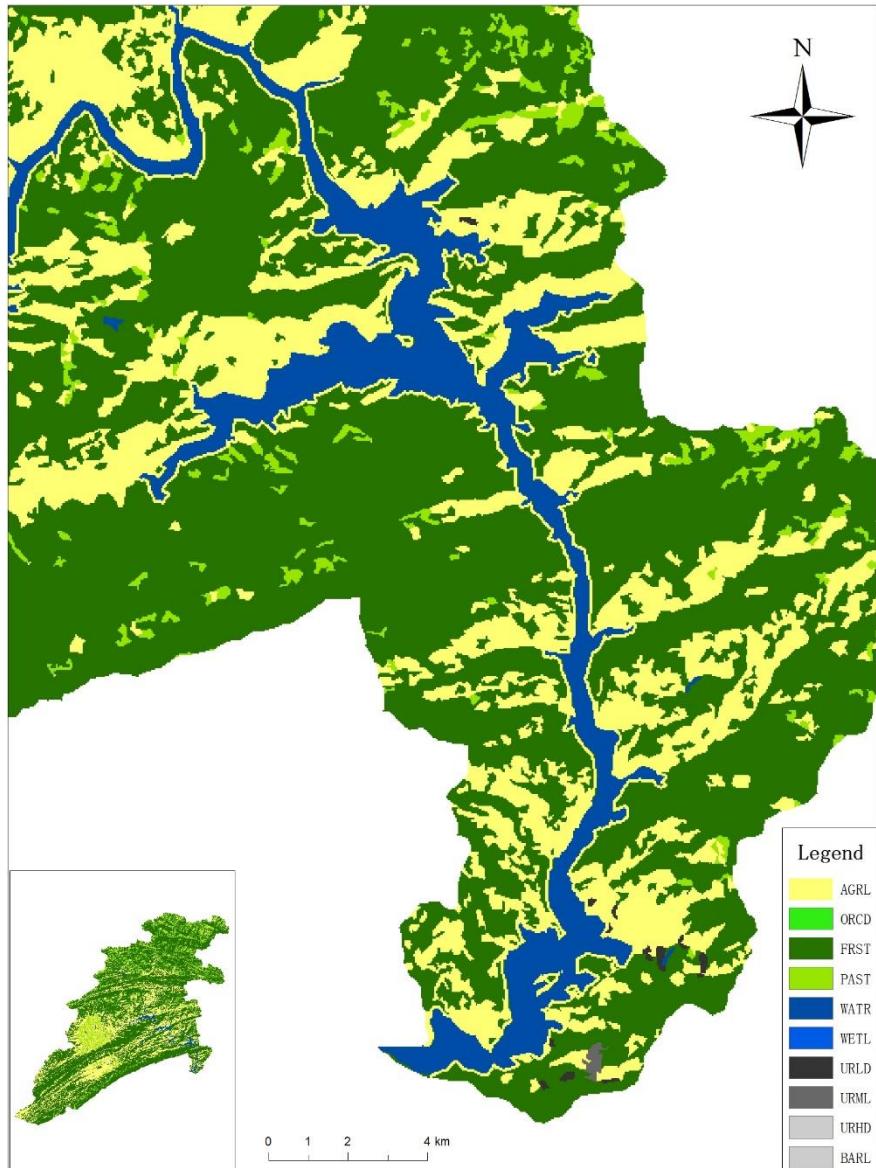
Methods

Data

Results

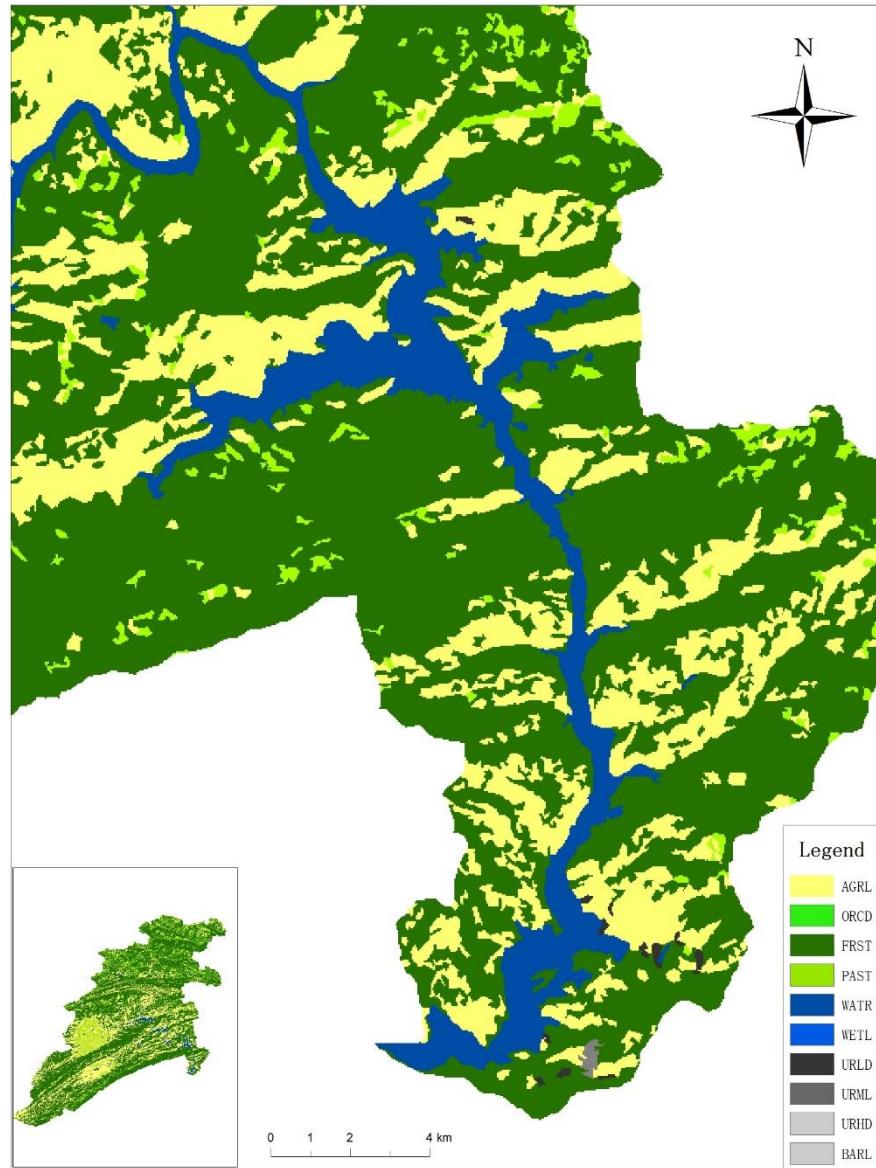
145-meter

(3)



175-meter

(4)



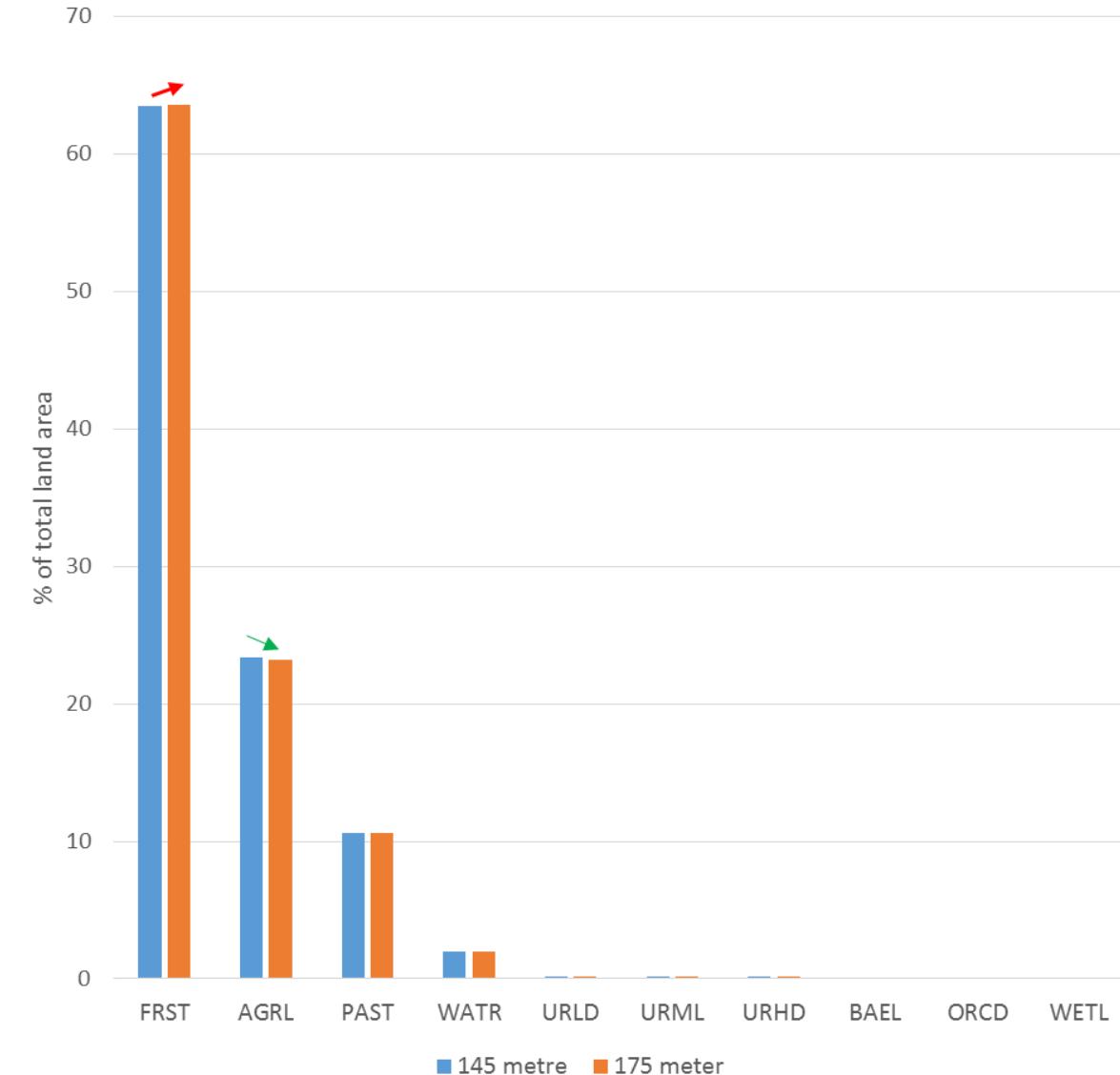
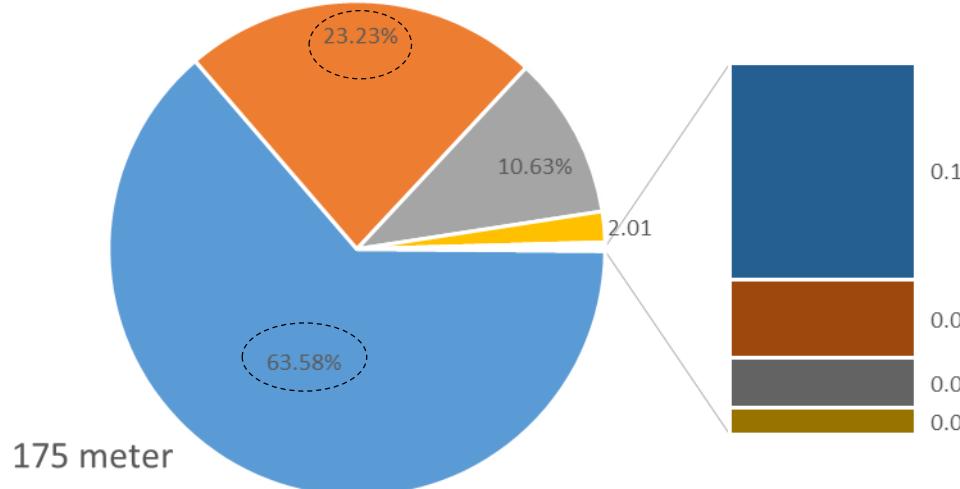
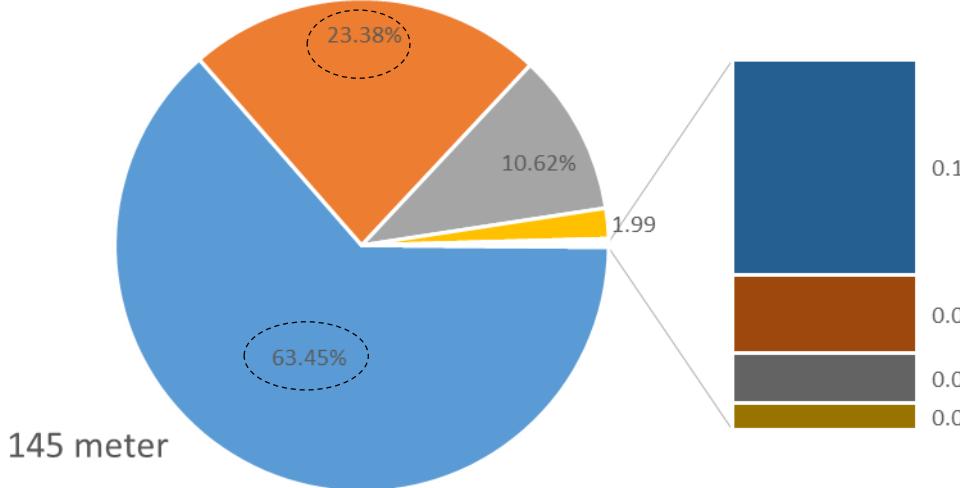
# Proportion of land uses between 145-meter and 175-meter water level scenarios.

Introduction

Methods

Data

Results



# Calibration Parameters

Introduction

Methods

Data

Results

Calibration		
	CH N2	Manning's "n" value for the main channel
	SURLAG	Surface runoff lag coefficient
	ESCO	Evaporation compensation coefficient
	SOL K	Saturated hydraulic conductivity
	SOL-AWC	available water capacity
	GWDELAY	Groundwater delay time(days)
	CANMAX	maximum canopy storage
	CN2	Initial SCS runoff curve number for moisture condition
	EPCO	Plant uptake compensation factor

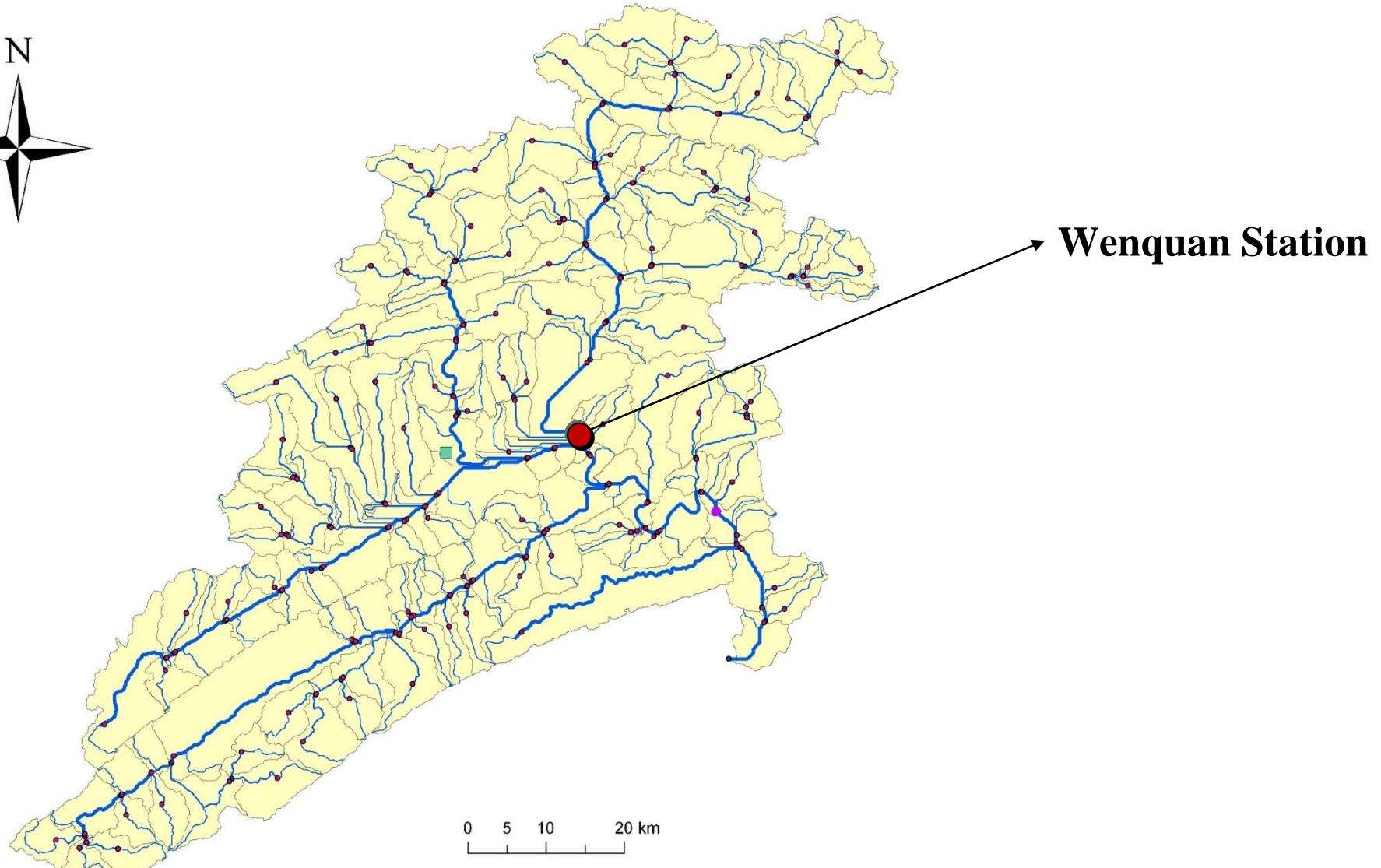
# Sampling Location

Introduction

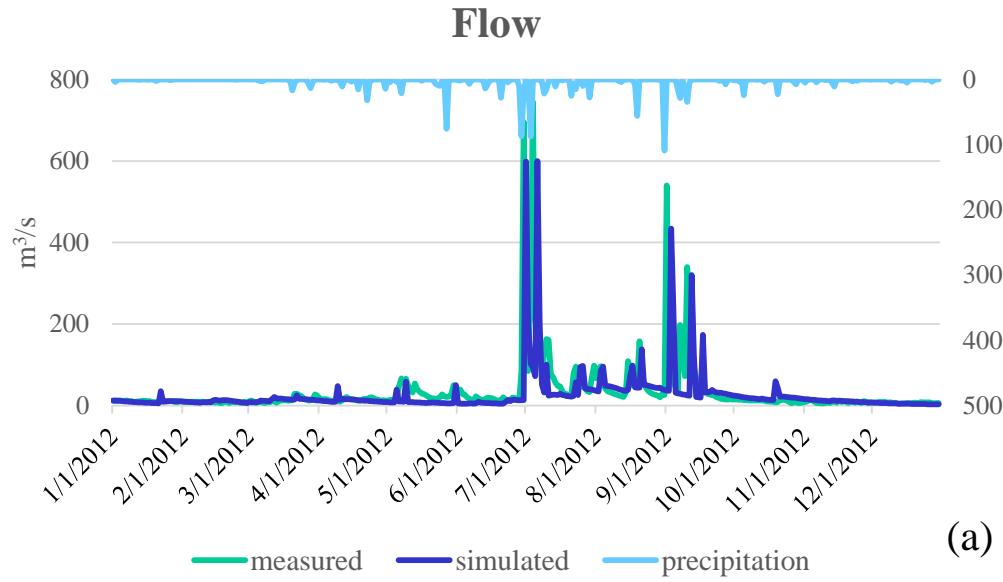
Methods

Data

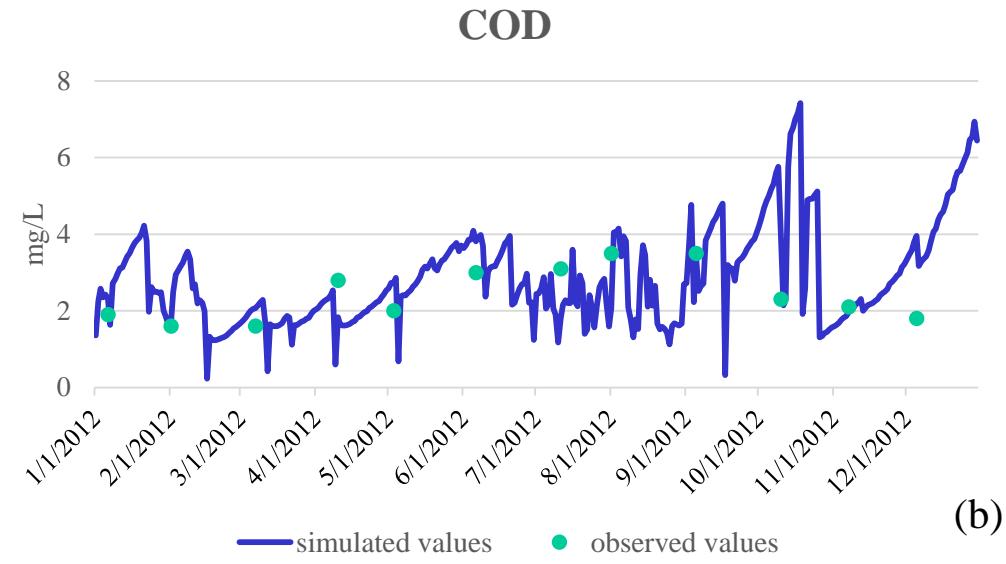
Results



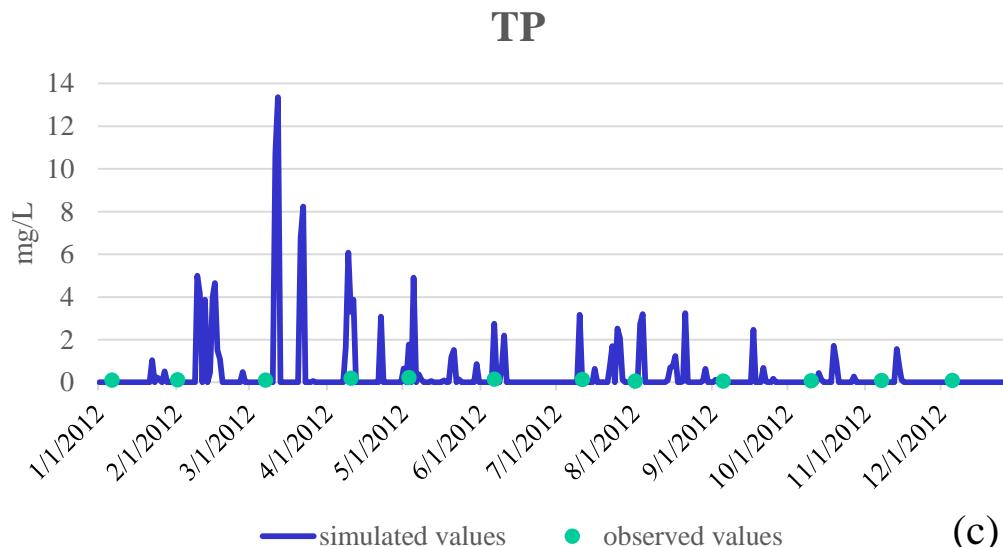
# Validation



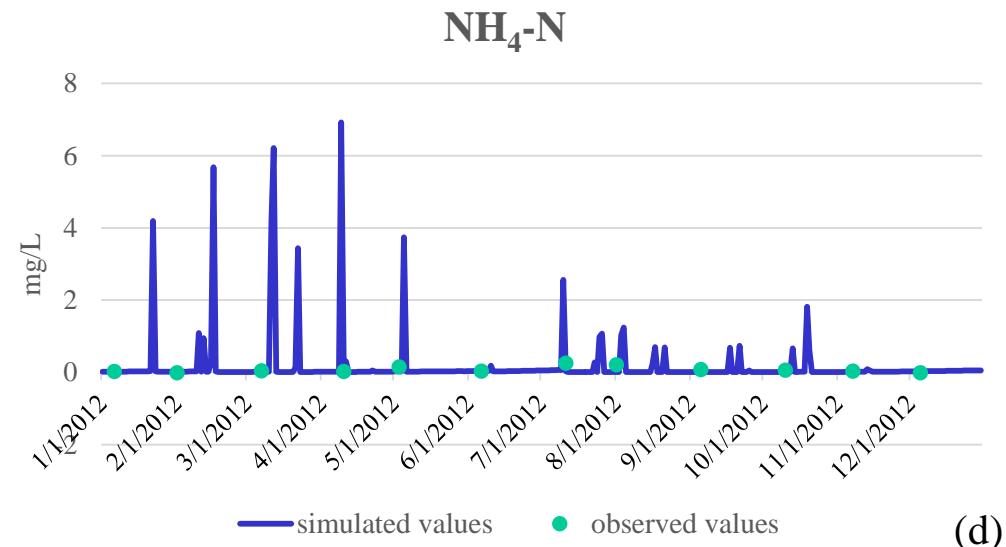
(a)



(b)



(c)



(d)

# CONTENTS

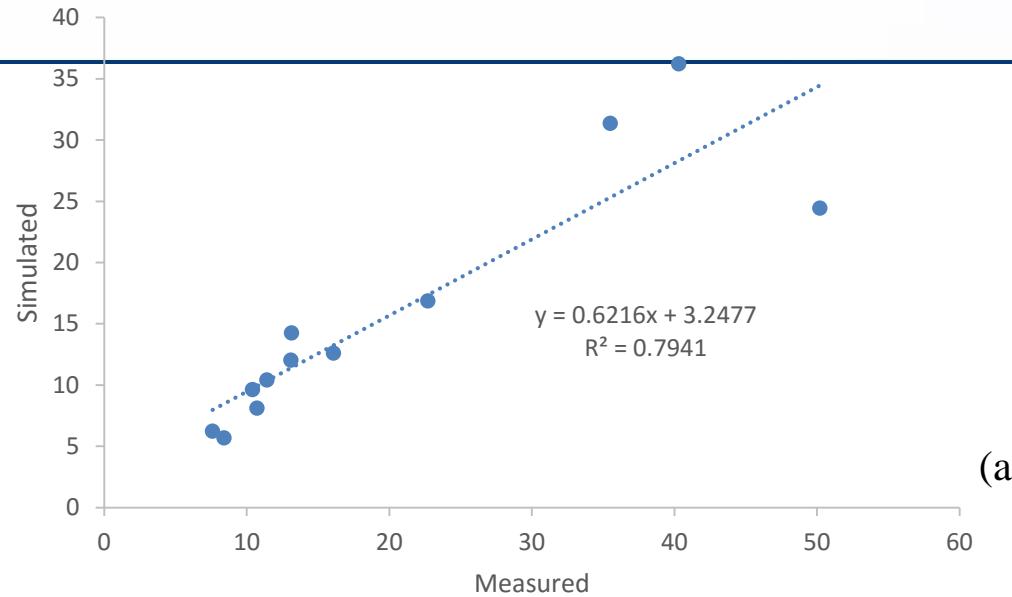
Introduction

Methods

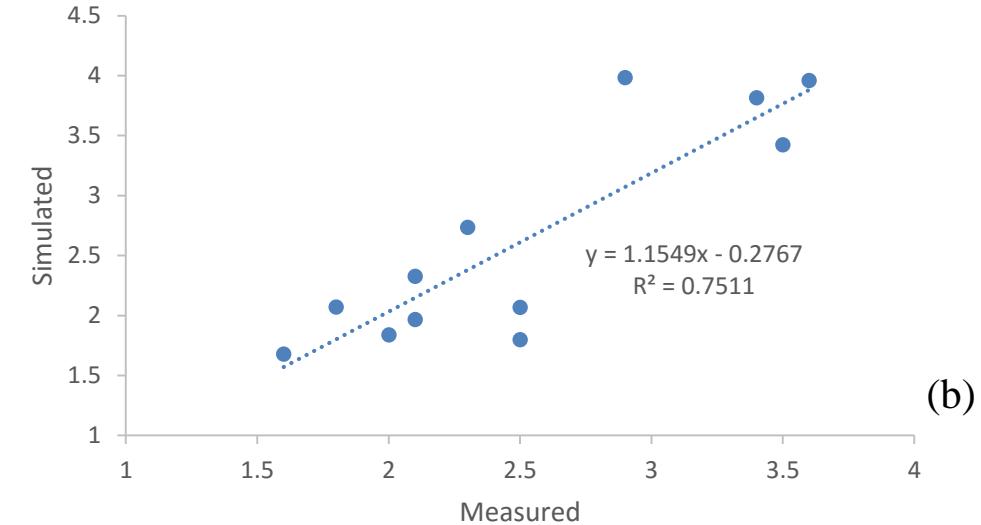
Data

Results

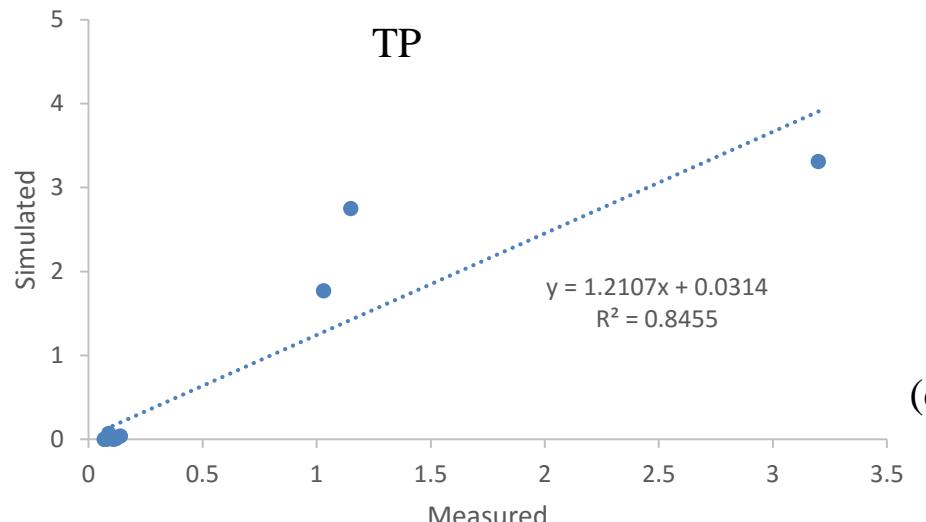
Flow



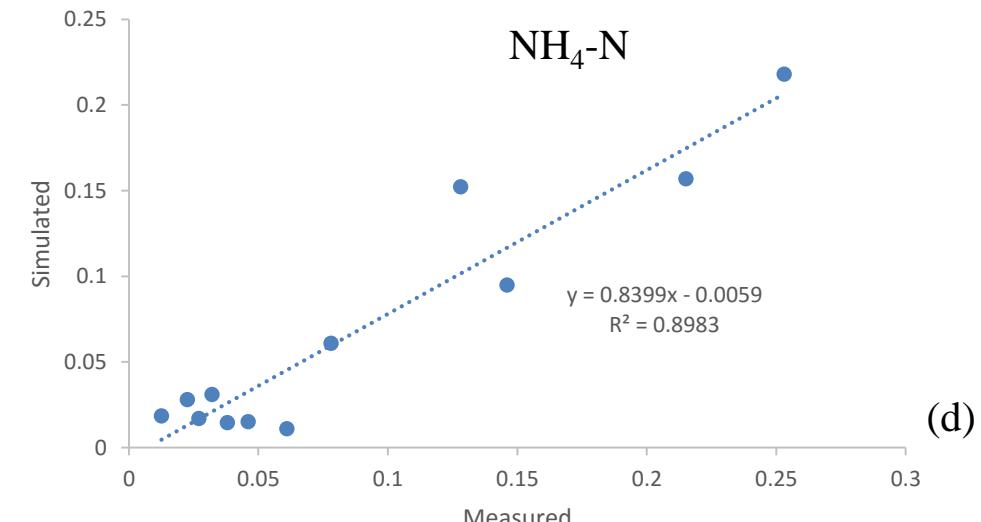
COD



TP



NH<sub>4</sub>-N



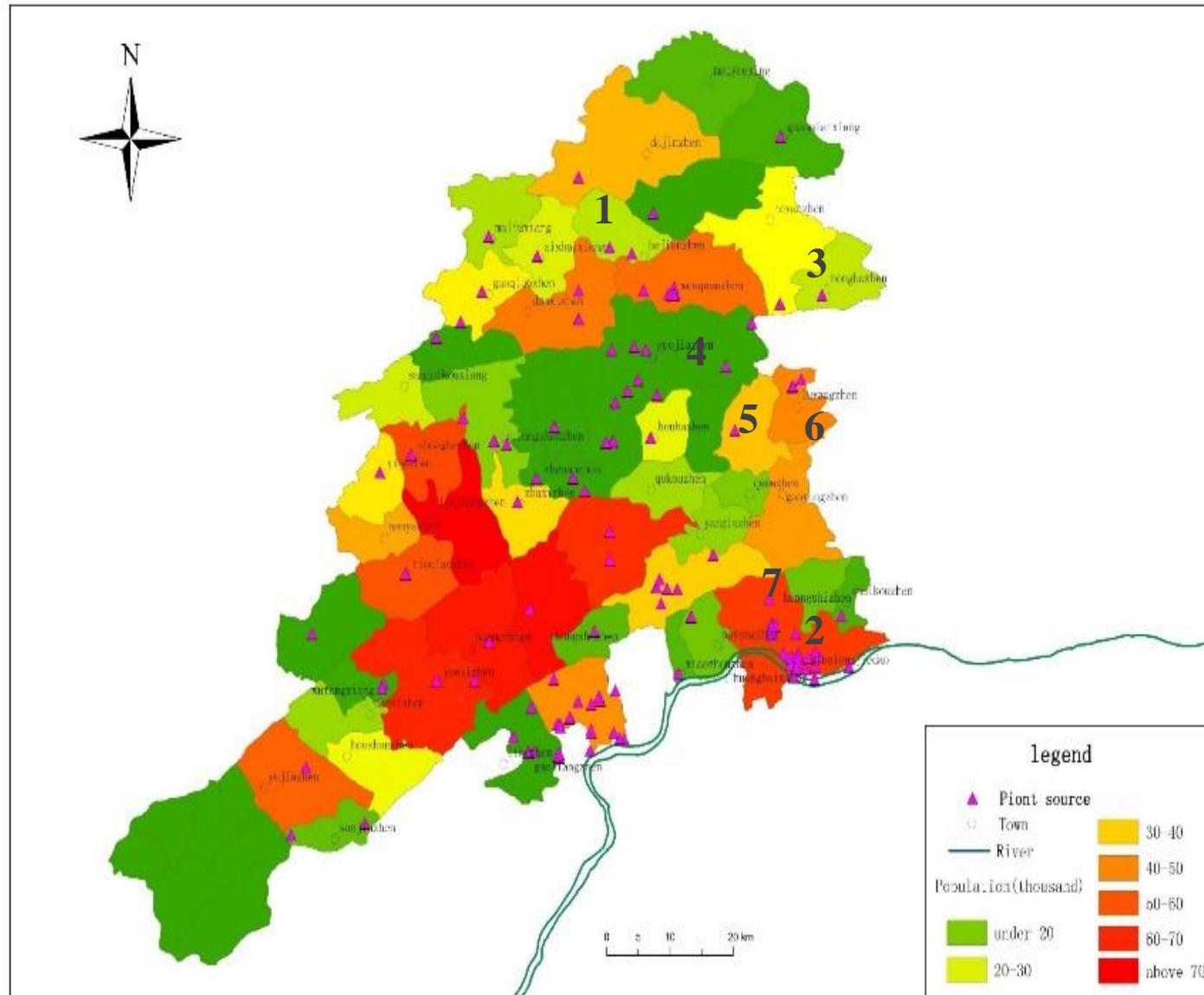
# HRU Analysis Locations

Introduction

Methods

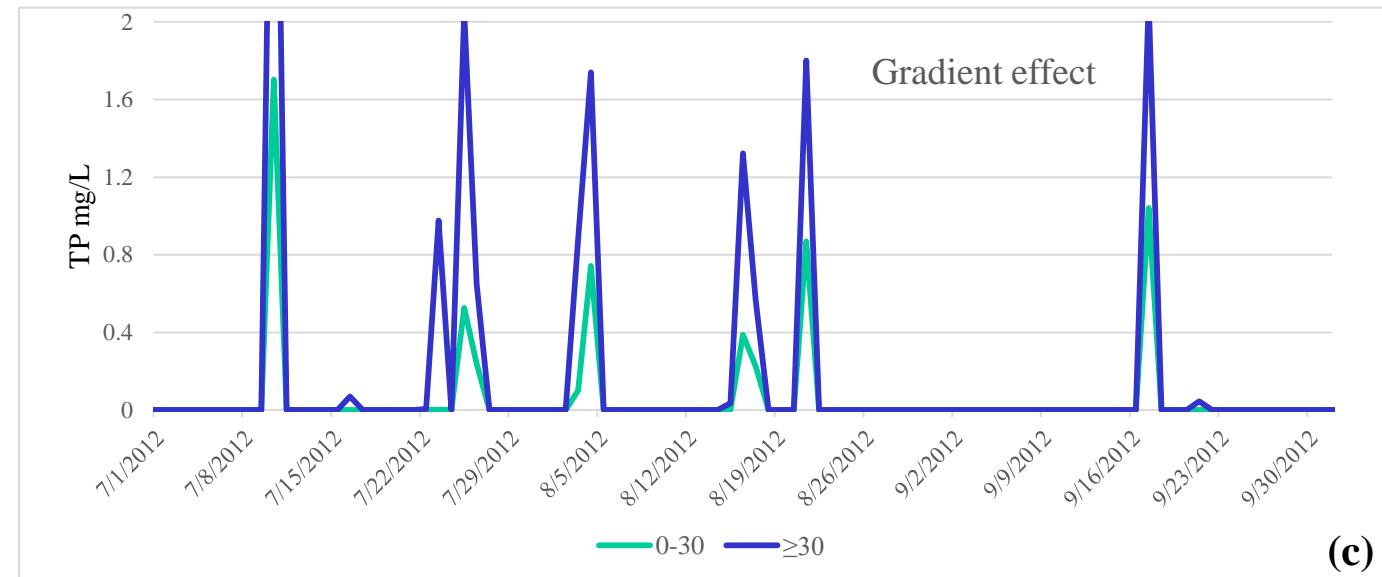
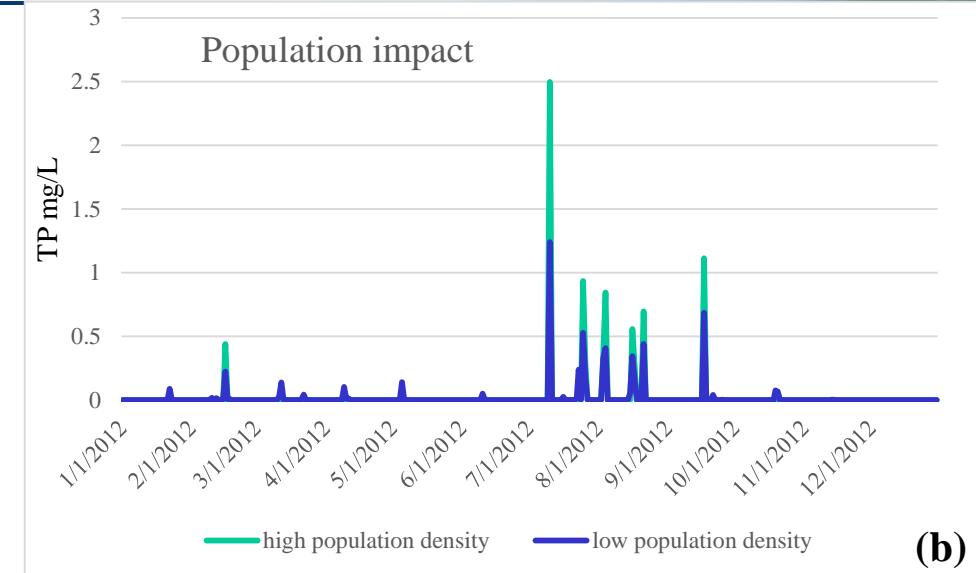
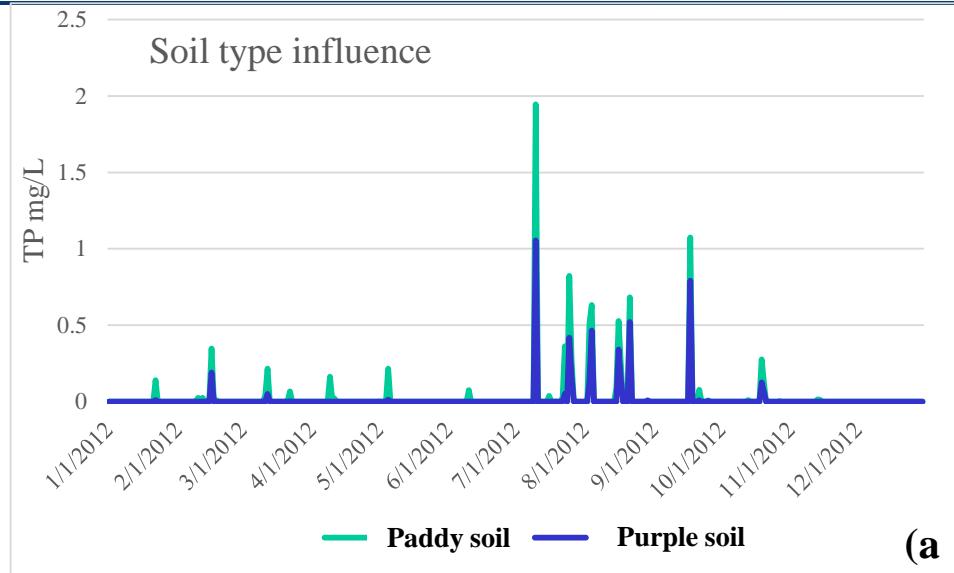
Data

Results



- 1-Low density population
- 2-High density population
- 3-paddy soils
- 4-purplish soils
- 5-slope(0-30)
- 6-slope( $\geq 30$ )
- 7-rocks district

# HRU Analysis



# CONTENTS

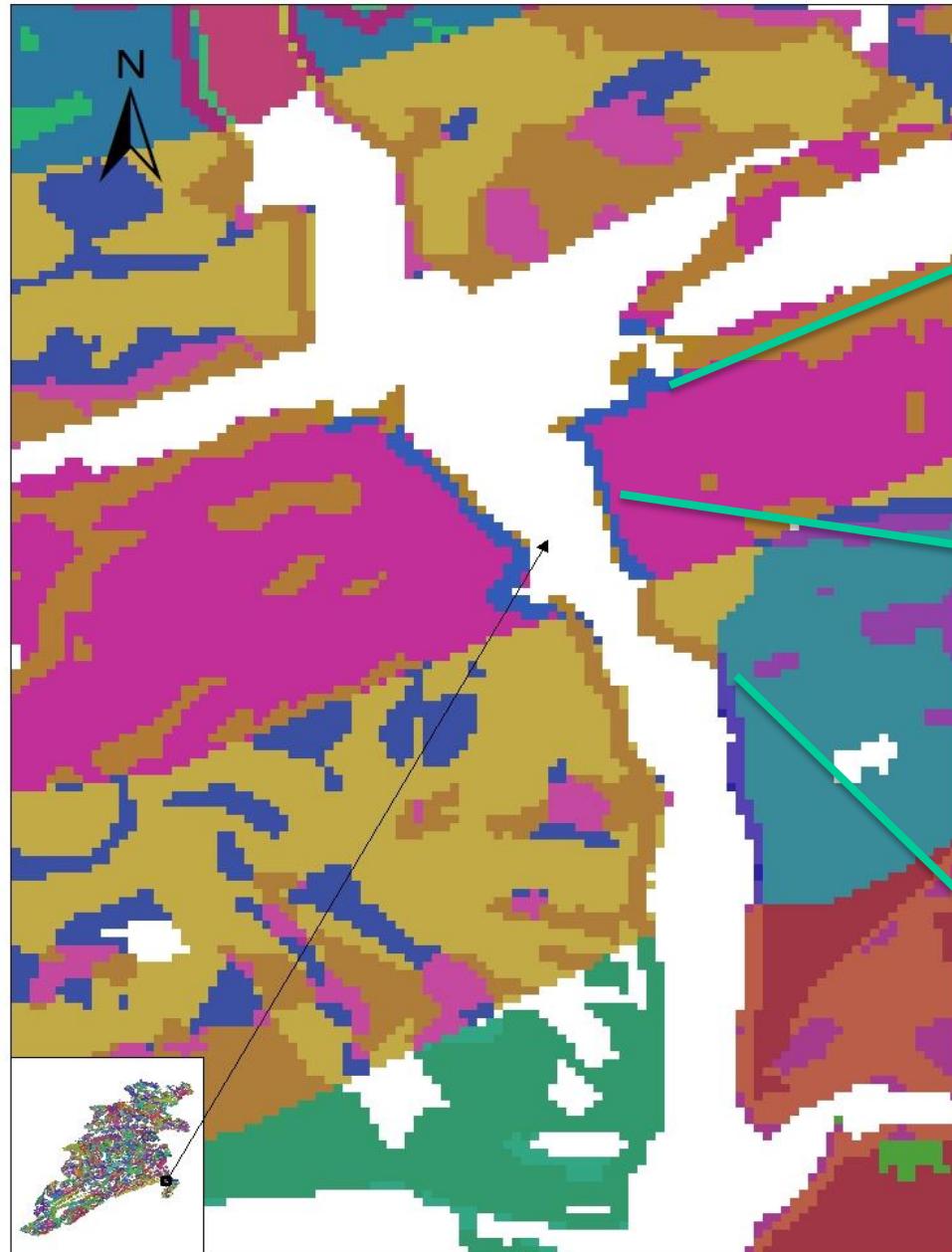
145m

Introduction

Methods

Data

Results



# CONTENTS

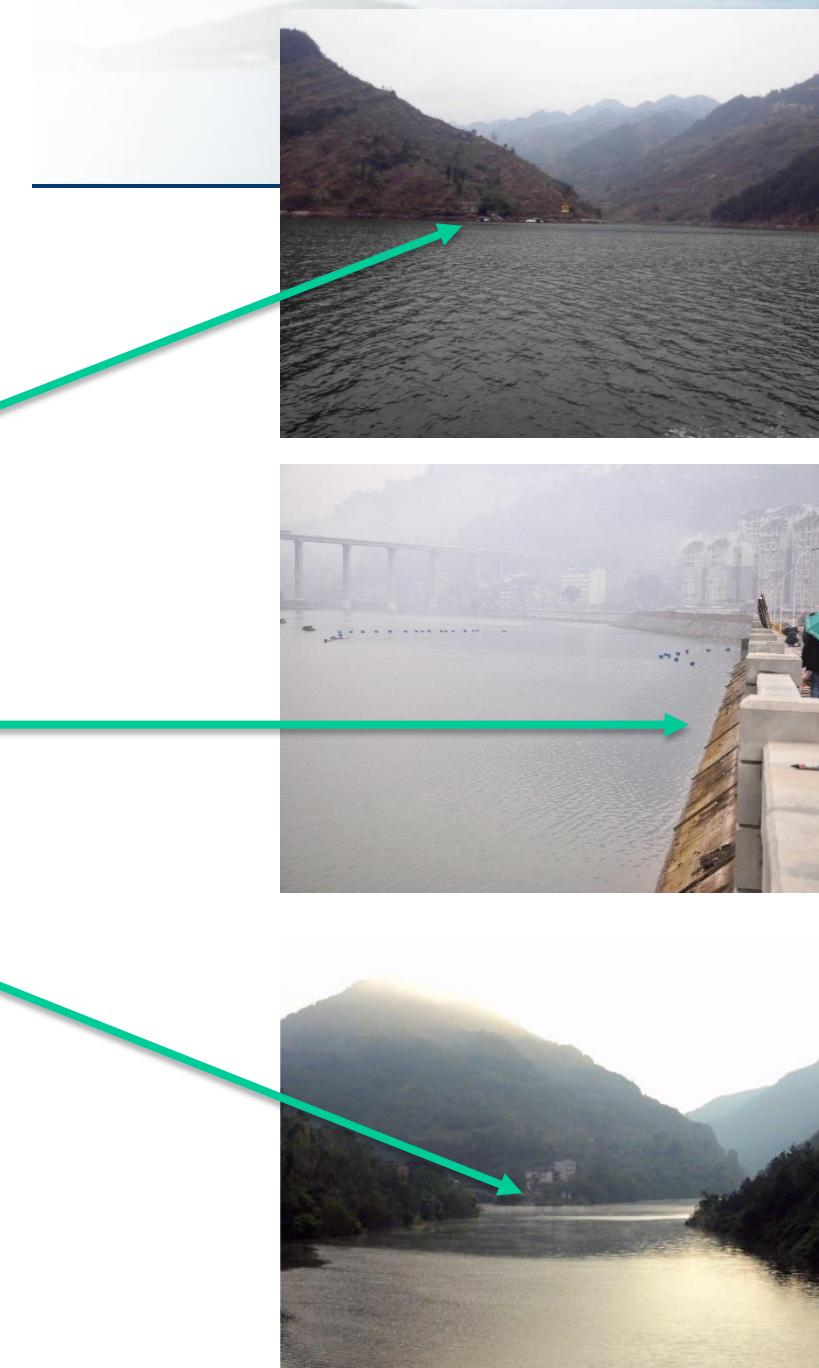
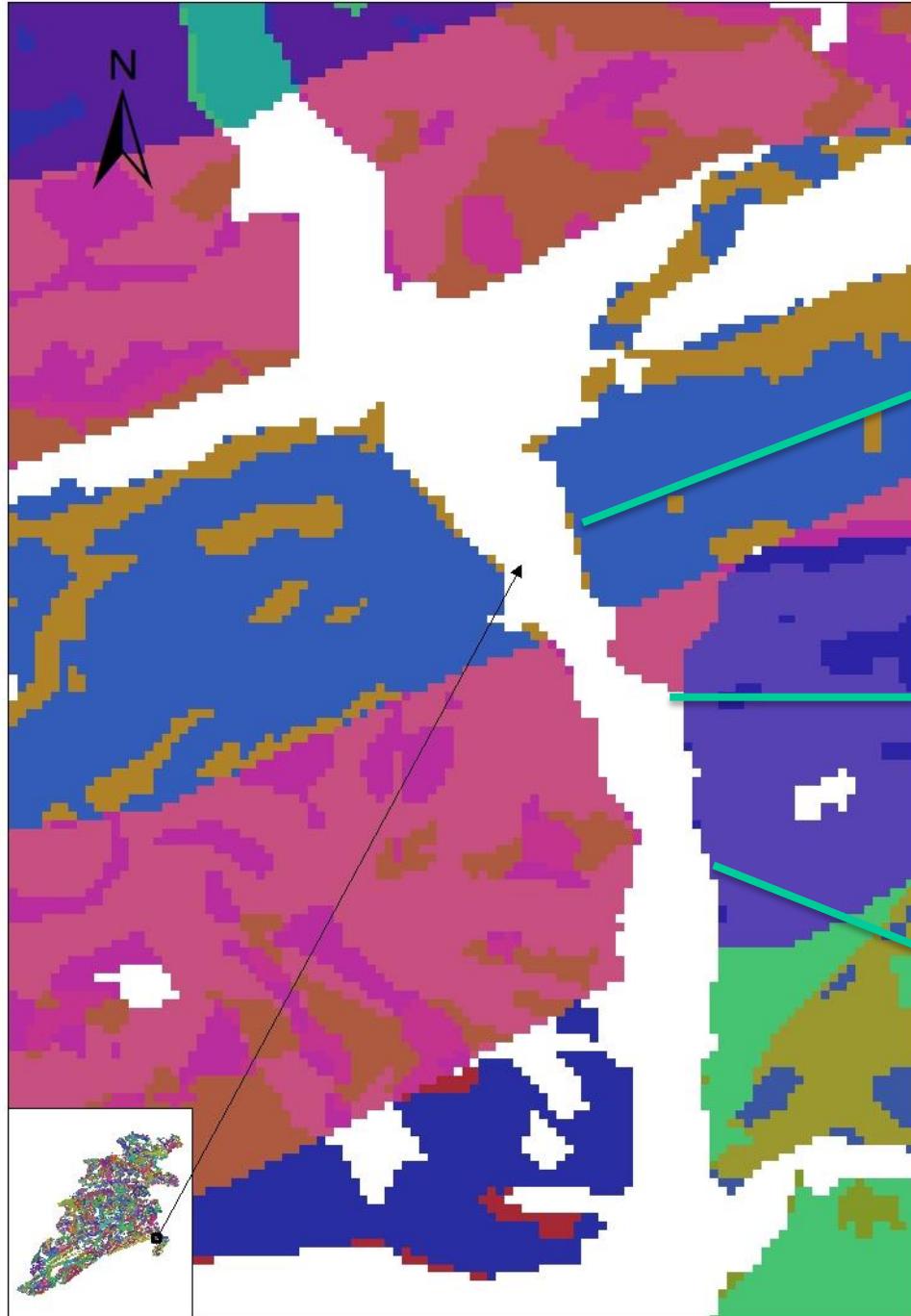
175m

Introduction

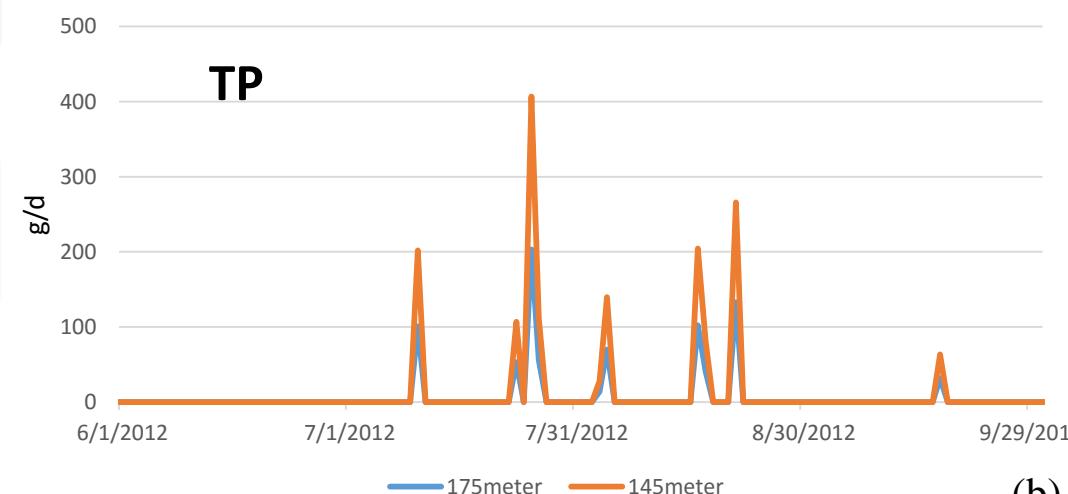
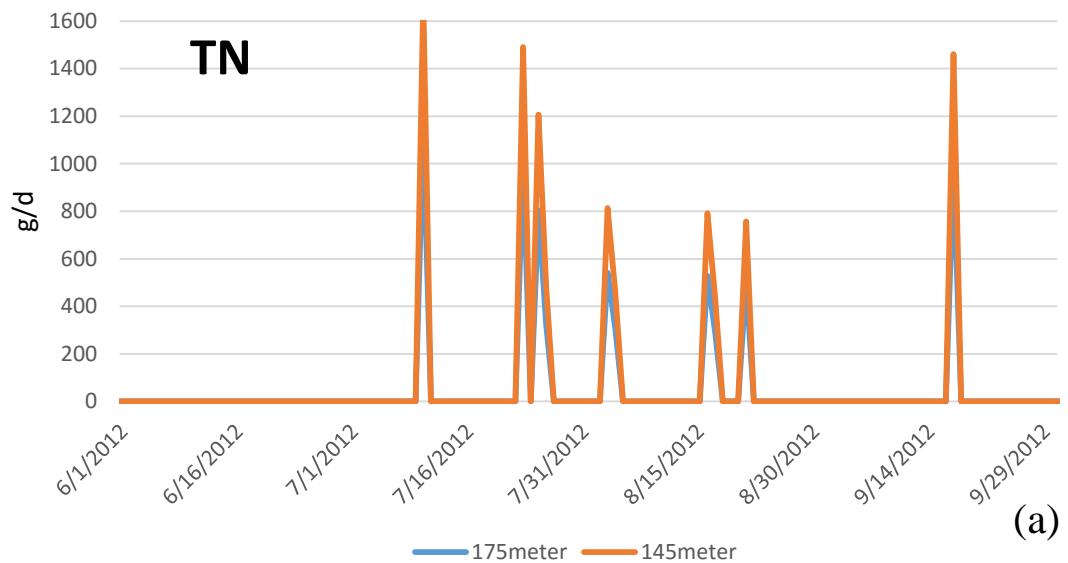
Methods

Data

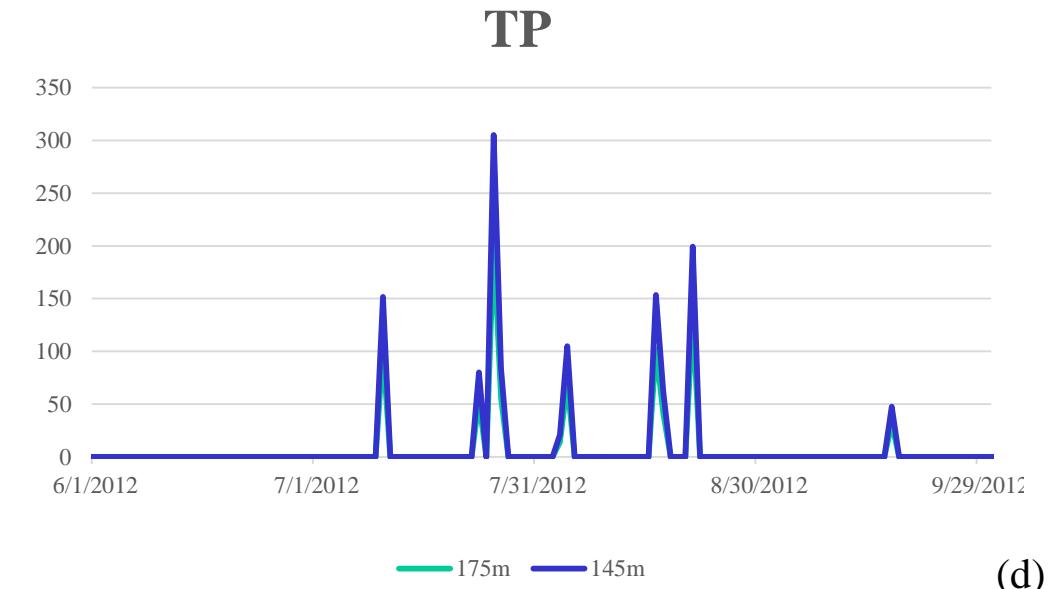
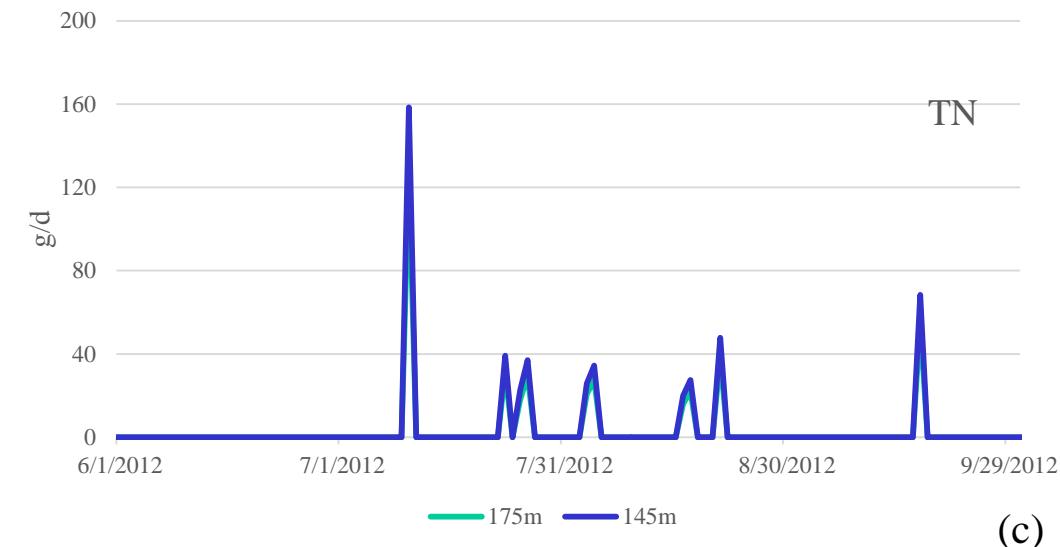
Results



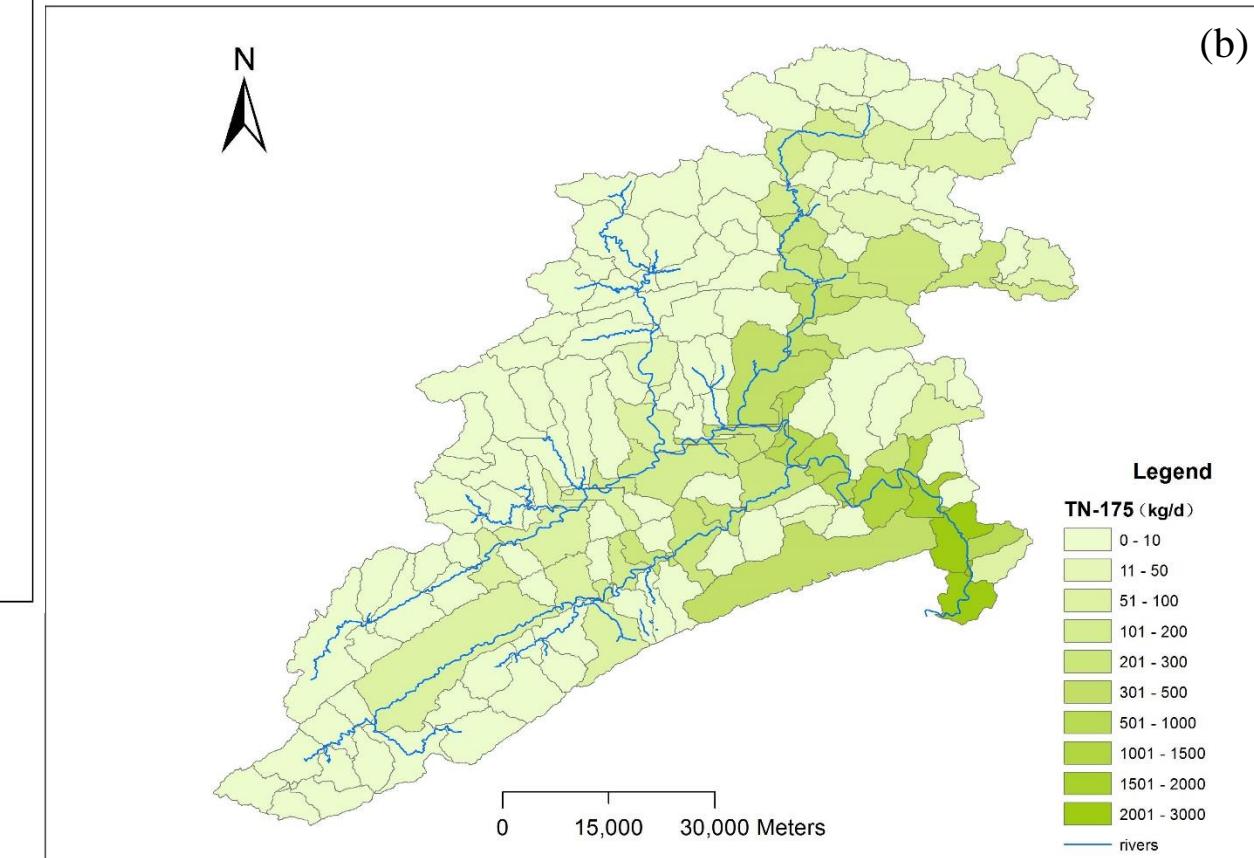
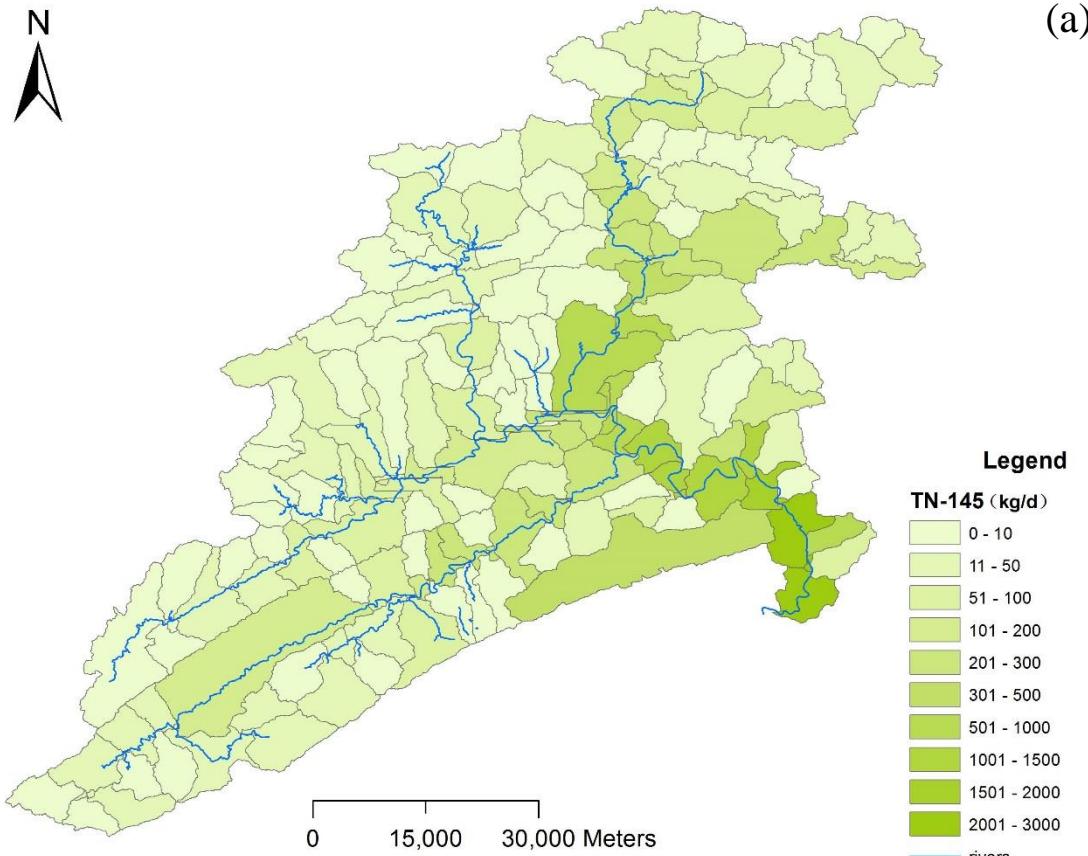
## HRU2-High population density



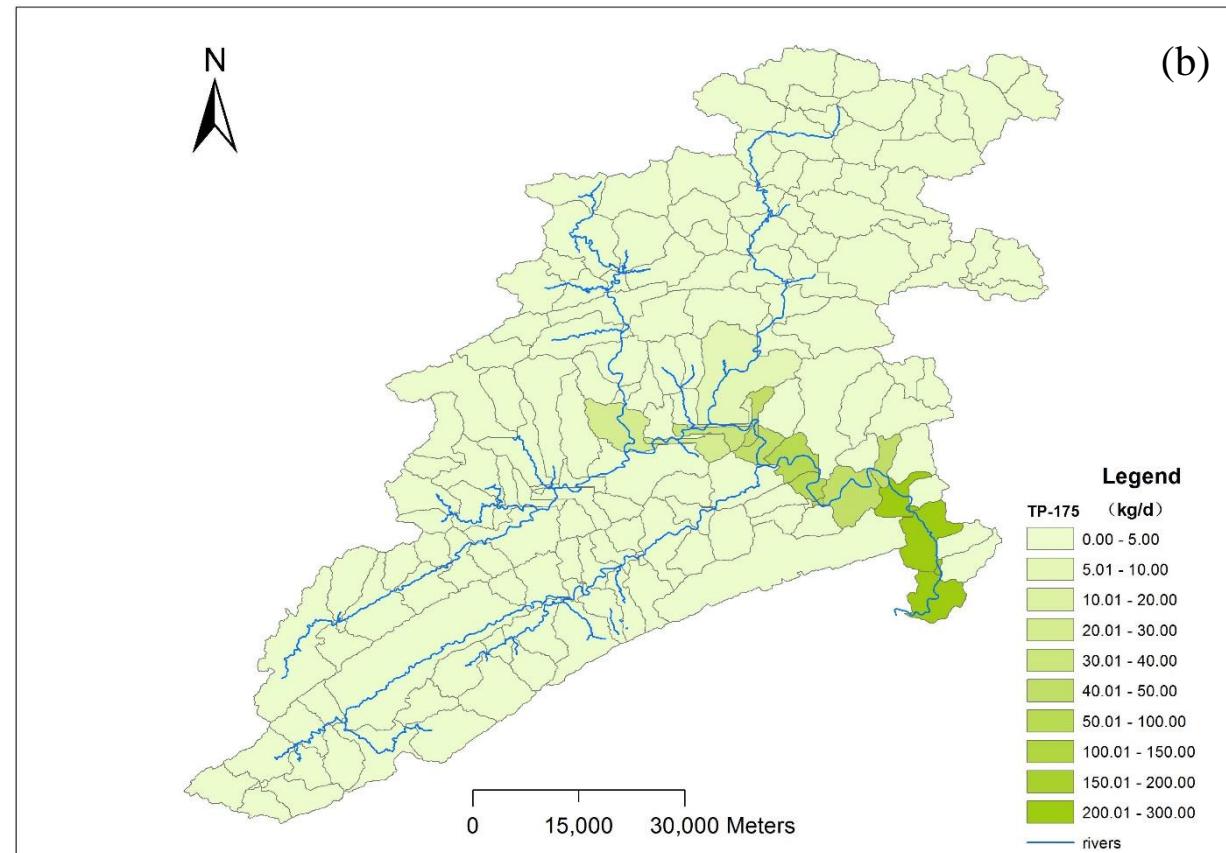
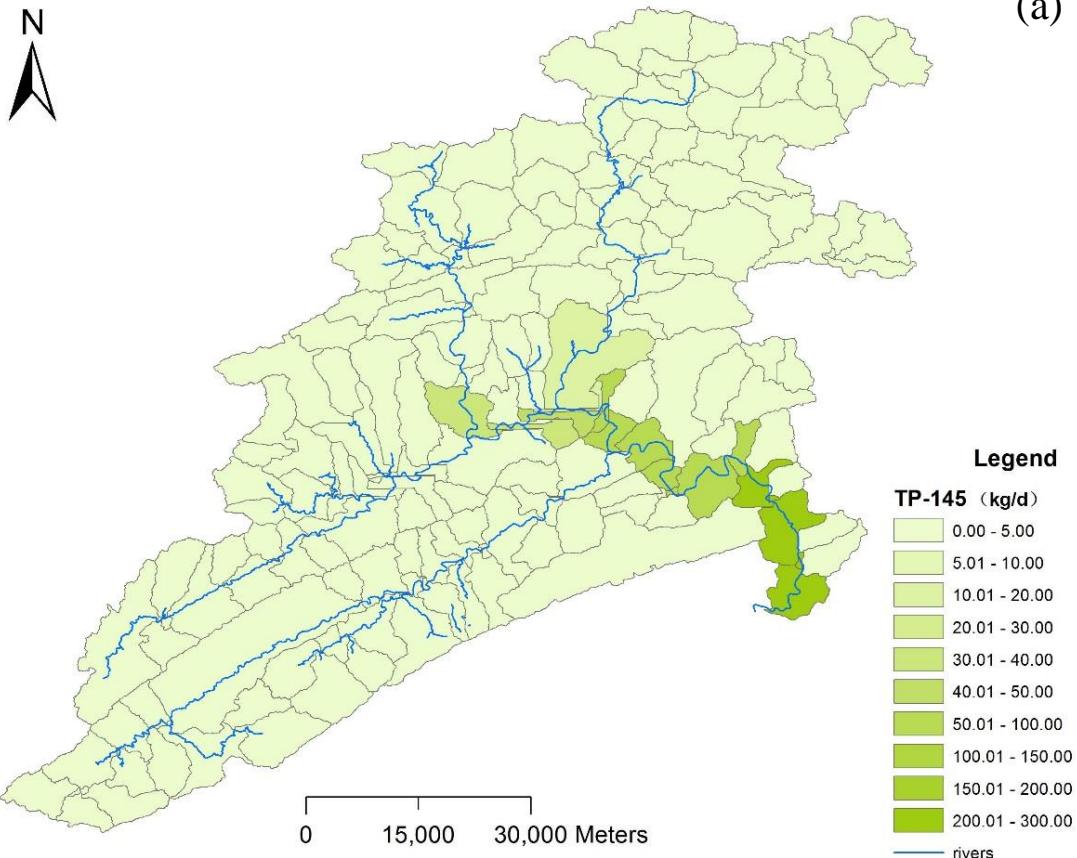
## HRU7-rocks district



# Total nitrogen under 145-meter and 175-meter scenarios



# Total phosphorus under 145-meter and 175-meter scenarios



# Summary

- 1. The overall pollutant loads in Pengxi River basin did not change significantly by comparing 145-meter and 175-meter scenarios, however hru level had been negatively affected by such pollutant inputs locally.**
- 2. Using SWAT to calculate the pollutant loadings in the WLF zone at Pengxi River basin, we provide a reference method of SWAT application in the context of supporting the management and decision-making for the government.**
- 3. Ecological restoration in 30-meter WLF zone is recommended.**

Introduction

Methods

Data

Results

**Thank you for your attention!**

**Questions & Comments?**