

# Evaluation of the nutrient retention effect of bamboo forest in Nantou County based on InVEST



Chun-Wei Chen<sup>1,2</sup>, Mei-Hua Yuan<sup>1</sup>

<sup>1</sup>Research Center for Environmental Change, Academia Sinica, Taipei, Taiwan

<sup>2</sup>Department of Geography, National Taiwan University, Taipei, Taiwan



## Abstract

This study aims to explore the following two questions: (i) Identify the hot-spot of the nutrient export in Nantou County based on InVEST Nutrient Retention Model and relevant geo-information, and (ii) evaluate the monetary value of the nitrogen retention service provided by the ecosystem service. We investigated the Nutrient Retention Effect induced by various land use and land cover in Nantou County, Taiwan. In particular, aiming to provide useful insights and information upon the nutrient retention effect of bamboo forest.

## Study Area

Characterized by the central mountain range and the summit of Mt. Jade, the terrain of Nantou County declines gradually from east to west. Among the overall area of Nantou County (4098.54 km<sup>2</sup>), the area of bamboo forest accounts for approximately 3% (121km<sup>2</sup>).



Figure 2. Map of study area.

## Required Data

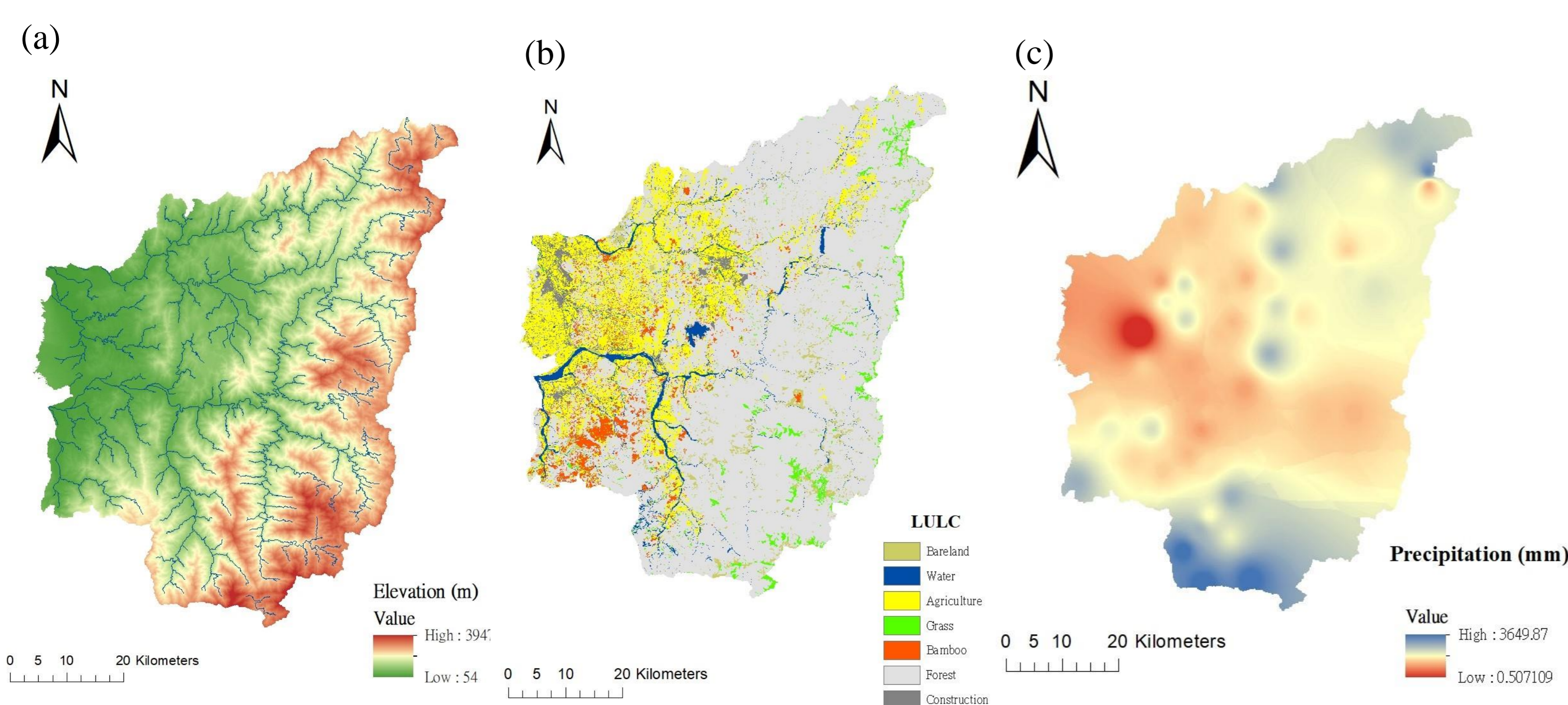


Figure 1. Required data of NDR model, DEM of Nantou County (a), land use and land cover of Nantou County in 2009 (b), and mean annual precipitation (c). The DEM, and land use and land cover are derived from the Ministry of the Interior. The mean annual precipitation data set is derived from Central Weather Bureau.

Table 1. Biophysical table settings

Description	lucode	<sup>a</sup> usle_c	<sup>b</sup> load_p	<sup>c</sup> eff_p	<sup>d</sup> load_n	<sup>e</sup> eff_n	<sup>f</sup> LULC_veg
Construction	1	0.01	5.0	0.00	8.5	0.00	0
Forest	2	0.01	0.2	0.80	3.0	0.80	1
Bamboo	3	0.01	0.2	0.80	3.0	0.80	1
Grass	4	0.15	1.0	0.50	4.0	0.50	1
Agriculture	5	0.10	4.0	0.05	26.0	0.05	1
Water	6	0.00	2.0	0.00	4.0	0.00	0
Bareland	7	1.00	2.0	0.10	4.0	0.10	0

Data sources: (Water Resources Agency, 2006) & (蕭戎雯, 2013)

<sup>a</sup> C factor of USLE.

<sup>b</sup> Phosphorus loading for each land use class (units: kg/ha/yr).

<sup>c</sup> Maximum Phosphorus retention efficiency.

<sup>d</sup> Nitrogen loading for each land use class (units: kg/ha/yr).

<sup>e</sup> Maximum Nitrogen retention efficiency.

<sup>f</sup> Land use type covered by vegetation represent by 1, land use type without covered by vegetation represent by 0.

<sup>\*</sup> P factor of USLE is all constant 1 in our study.

<sup>\*</sup> The distance of each LULC type retains Phosphorus and Nitrogen at its maximum capacity. It is all 150m in our study.

## Concept of NDR model

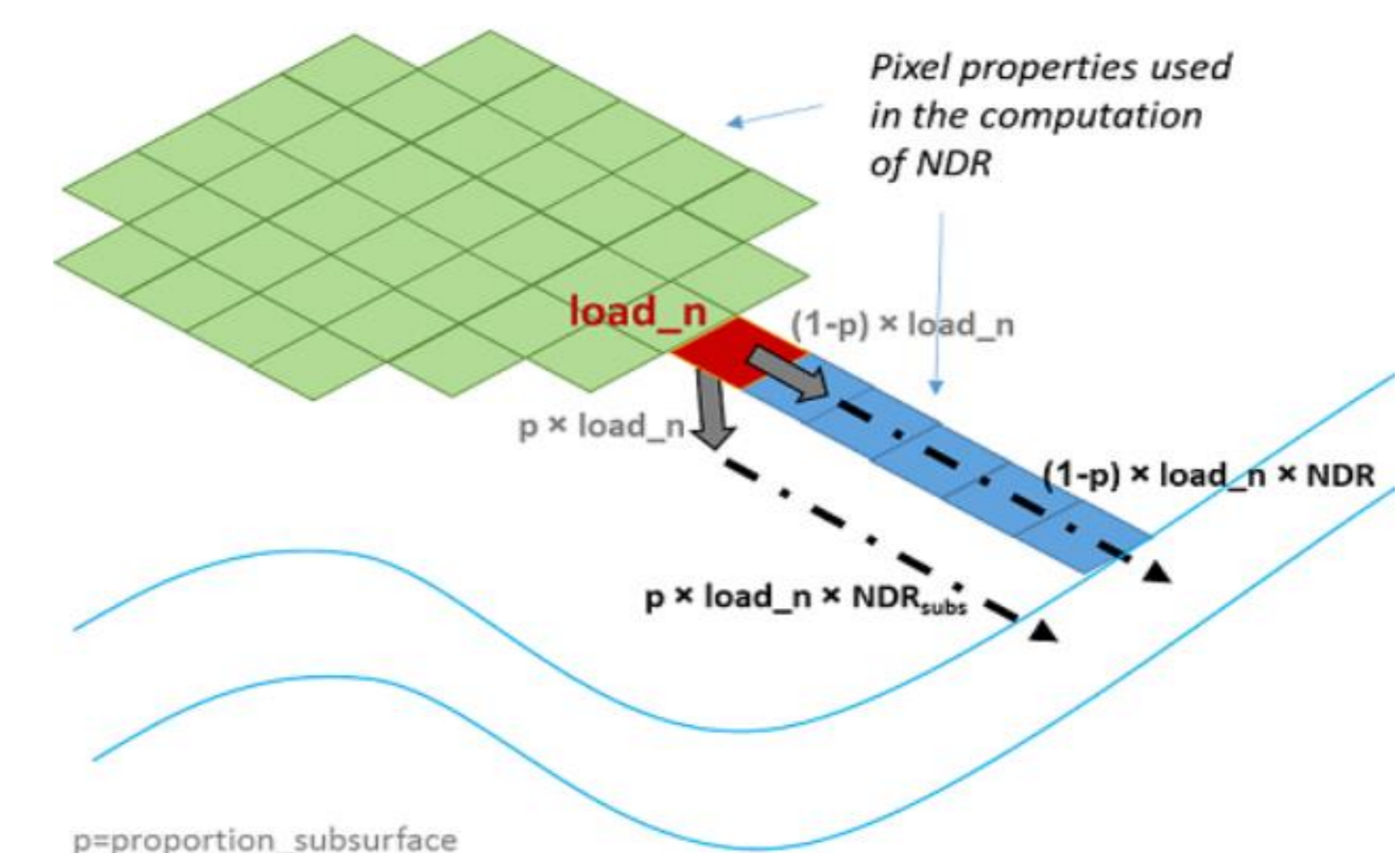


Figure 3. Conceptual representation of nutrient delivery in the model.

## Model Result

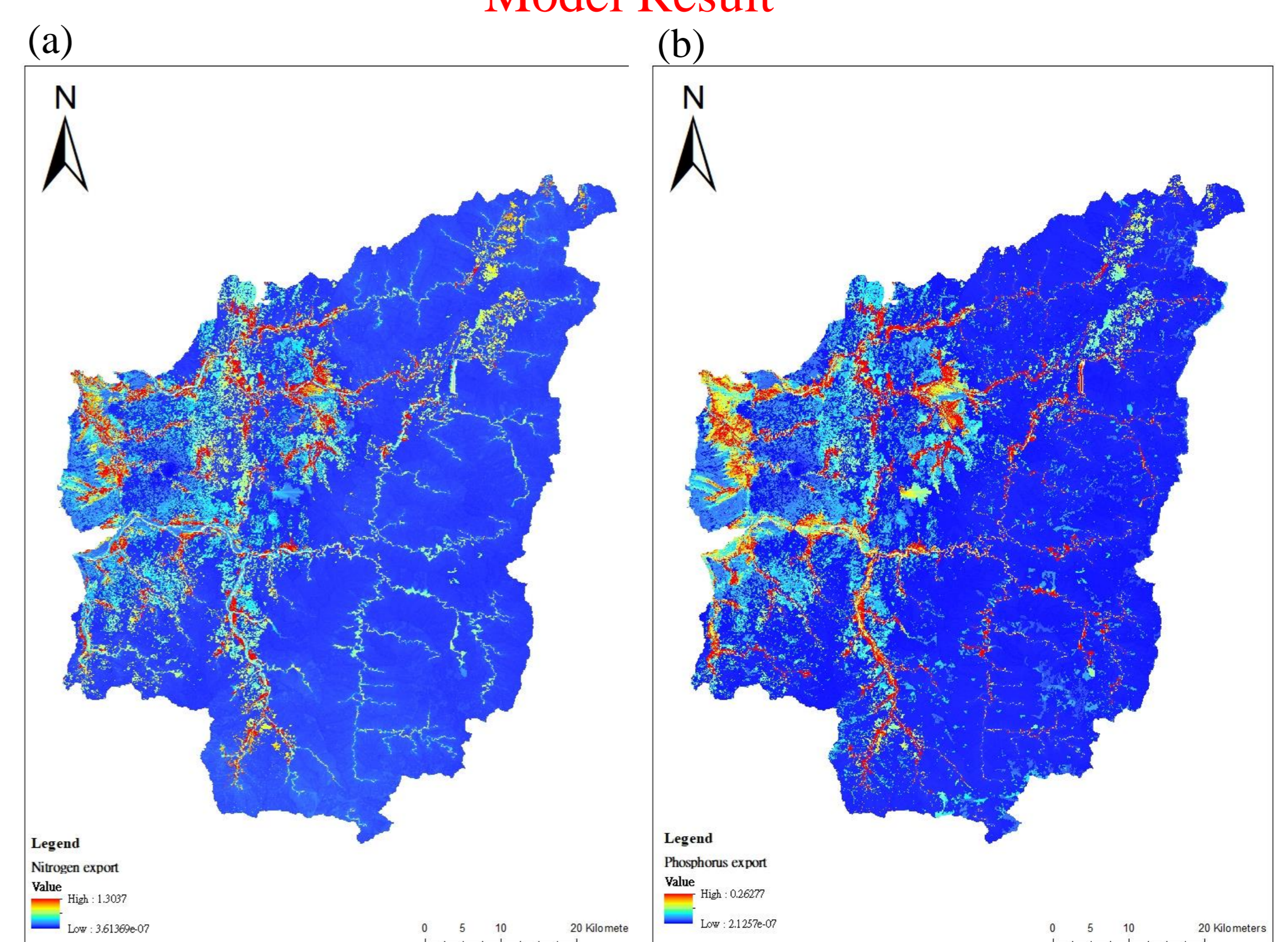


Figure 4. Maps of nitrogen export result (a) and phosphorus export (b).

## Conclusion

- Based on Nitrogen and Phosphorus result, most of high nutrient export sites are distributed along the watercourse and highly anthropogenic active sites, while forest and bamboo forest are the lowest land use type for nutrient export.

<sup>a</sup> Price of urea (40kg/pack)	<sup>b</sup> Total nitrogen load	<sup>b</sup> Total nitrogen export	<sup>b</sup> Total nitrogen retention	<sup>a</sup> Monetary value of retention service
467	2555150.31	347484.42	2207665.89	25774499.27

<sup>a</sup> NTD price in 2009.

<sup>b</sup> units: kg/yr.

## Reference

蕭戎雯(2013), 「不同單元尺度對土地利用及生態系統服務模擬之影響-以大屯溪流域為例」, 國立臺灣大學農學院生物環境系統工程學研究所碩士論文。  
經濟部水利署, <http://www.wra.gov.tw/>.  
農業部農糧署, <https://www.afa.gov.tw/cht/index.php>.