

Evaluating the Soil Retention of Bamboo Forests in Nantou County based on InVEST Sediment Delivery Ratio Model

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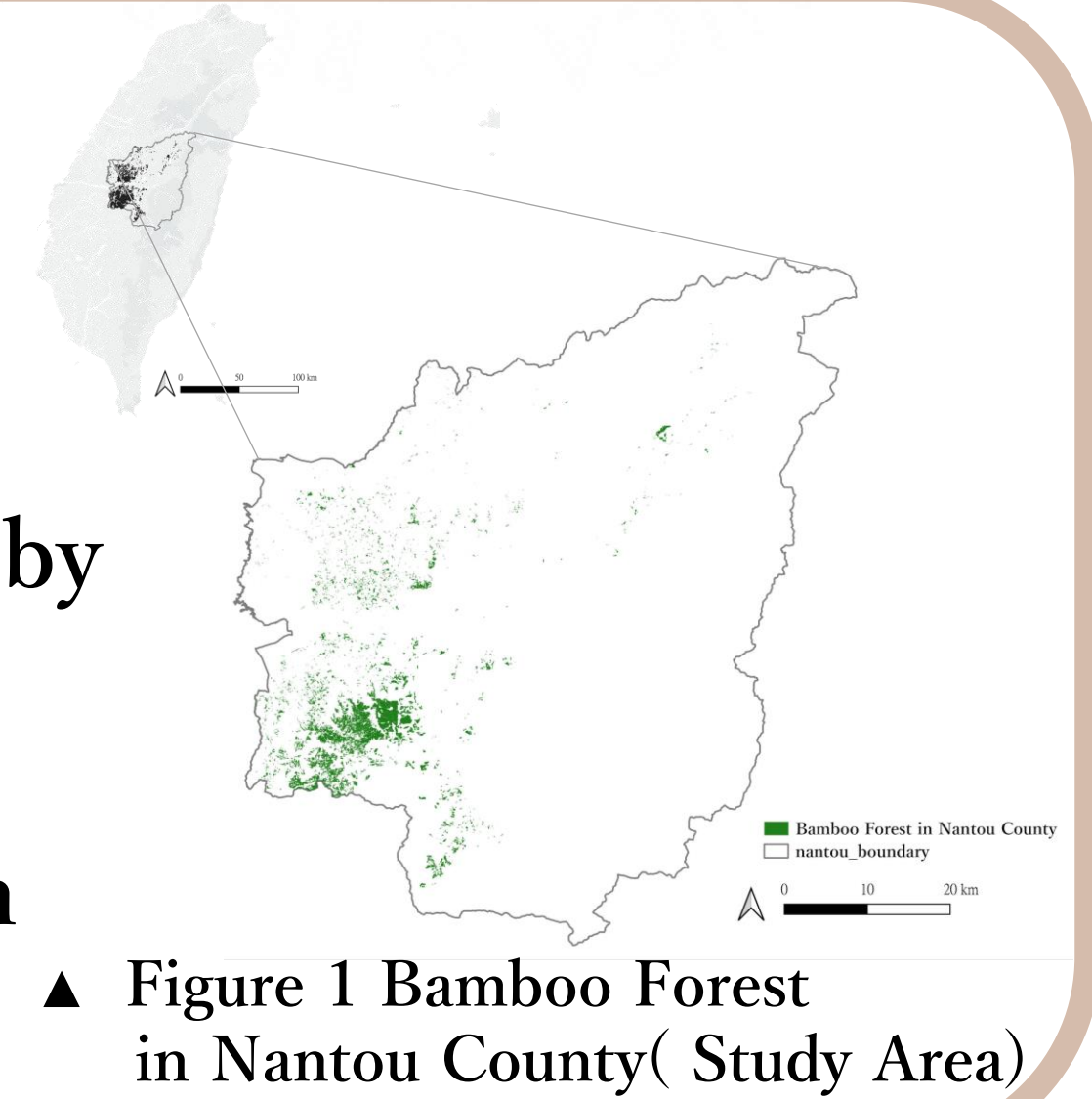
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Abstract

Bamboo forests, an integral part of Taiwan's forest resources, elicit divisive opinions regarding their soil retention capabilities. This study aims to assess the soil retention ability of bamboo forests and provide a reference for future bamboo forest development. The analysis utilizes the InVEST SDR Model, complemented by GeoDa, to examine the correlation between bamboo forests and soil retention quantities. While there is no significant spatial correlation between bamboo forests and soil retention, soil conservation of bamboo forests is still positive. Future developments in bamboo forestry could consider optimal distribution to reduce soil erosion and maximize sediment loss prevention benefits.



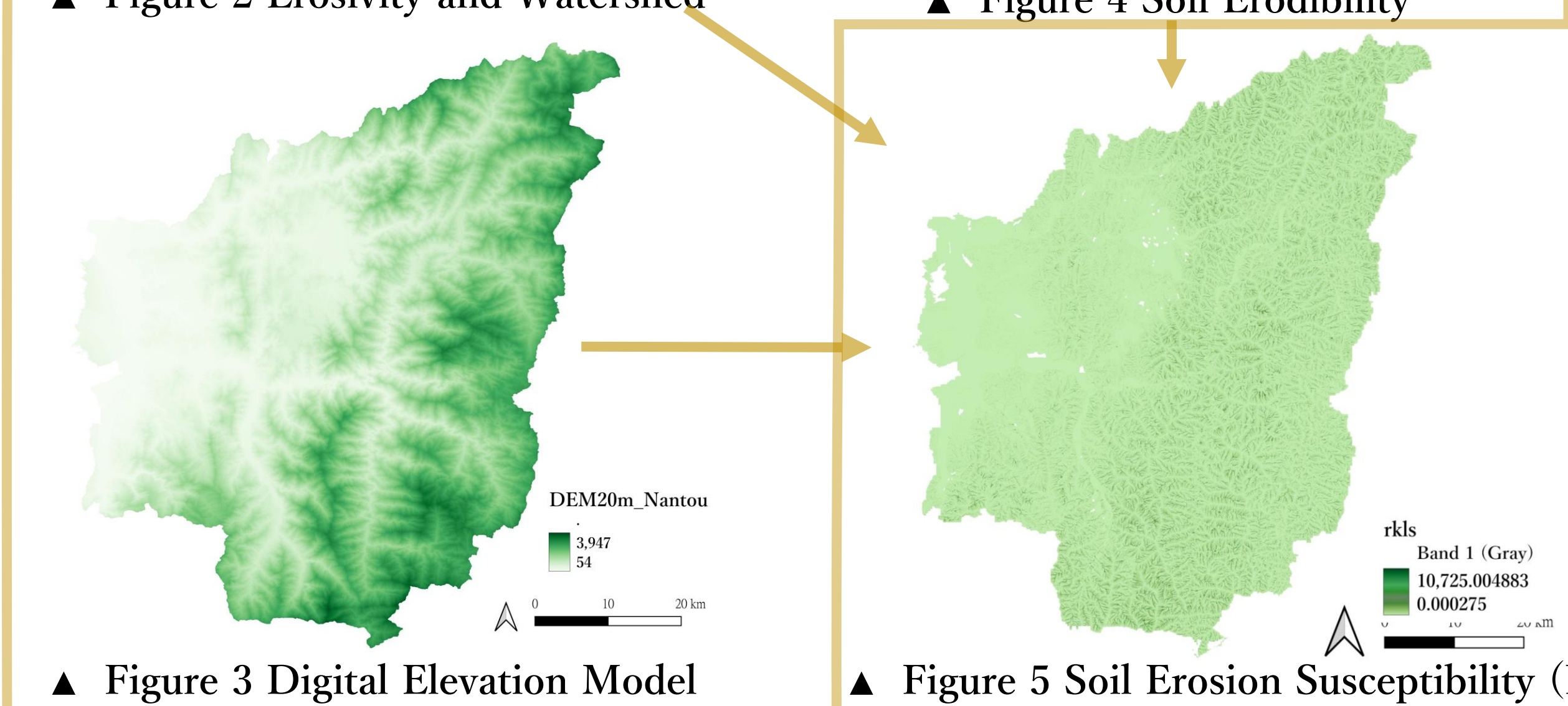
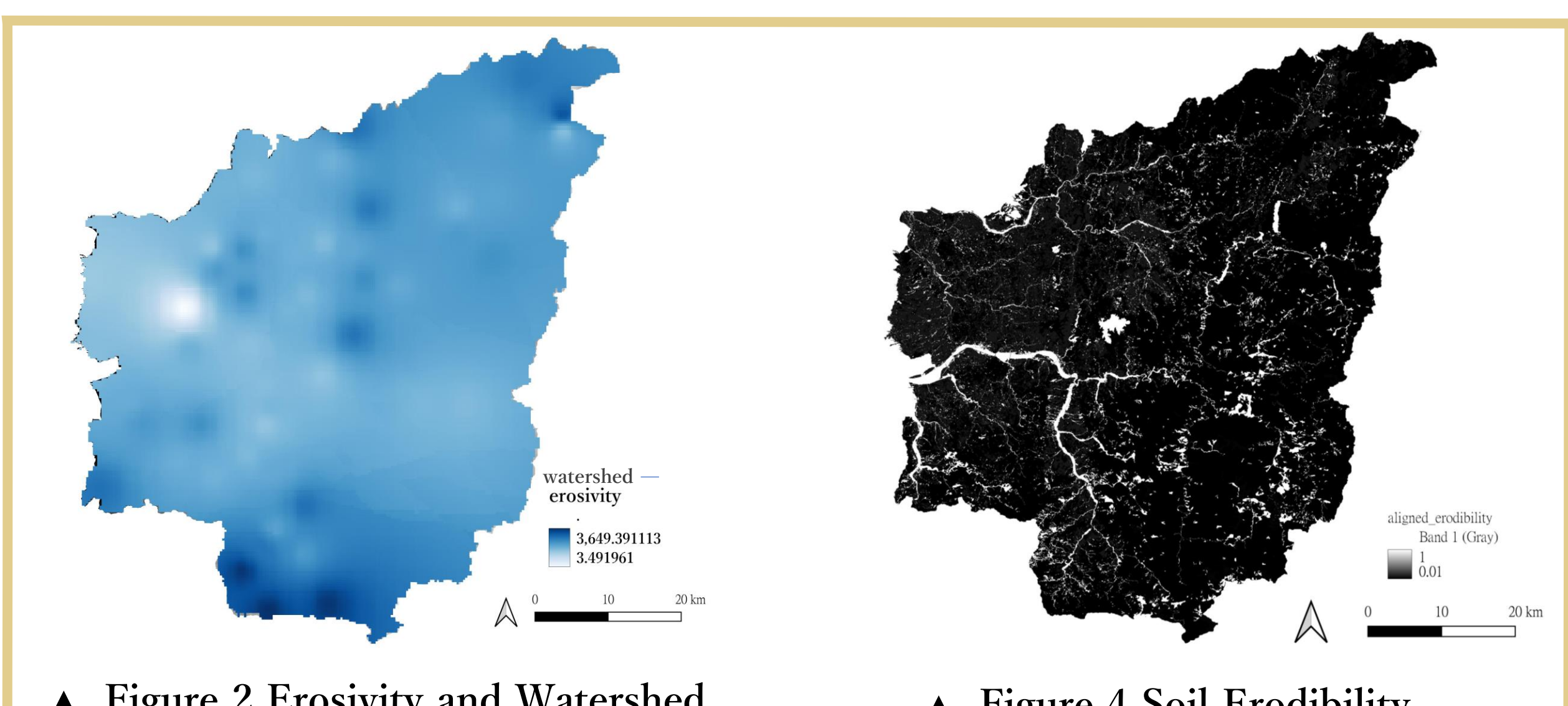
Motivation & Introduction

Bamboo forests, as a poaceae plants, have been questioned for their soil conservation abilities. Yet, bamboo's significance, accentuated by Ministry of Agriculture's recent promotional strategies, lies in its high carbon storage and economic potential. Given its developmental importance, this study seeks to understand its soil retention capabilities, aiming to lay the foundation for bamboo forest advancements in Nantou County.

Methodology

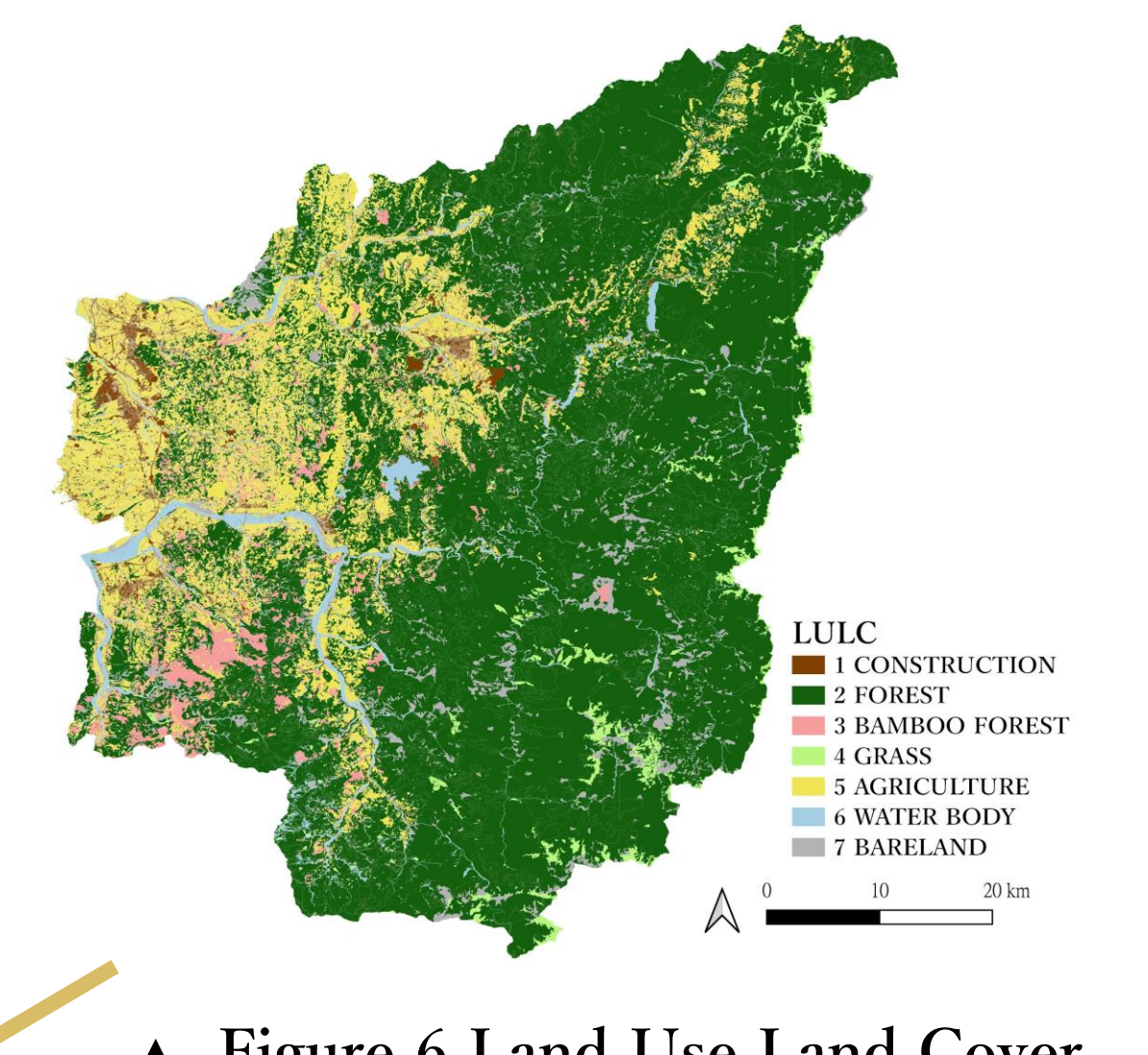
Using the InVEST model v3.13.0, the Sediment Delivery Ratio (SDR) model, based on the Revised Universal Soil Loss Equation (RUSLE), helped derive Soil Erosion Susceptibility (RKLS) and Annual Soil Loss (USLE). The subtracting between these values provided the soil retention amount. Ecosystem service value were assessed using the replacement cost method, and GeoDa was utilized for further correlation analysis, yielding both the significance and LISA Cluster maps.

Datasets

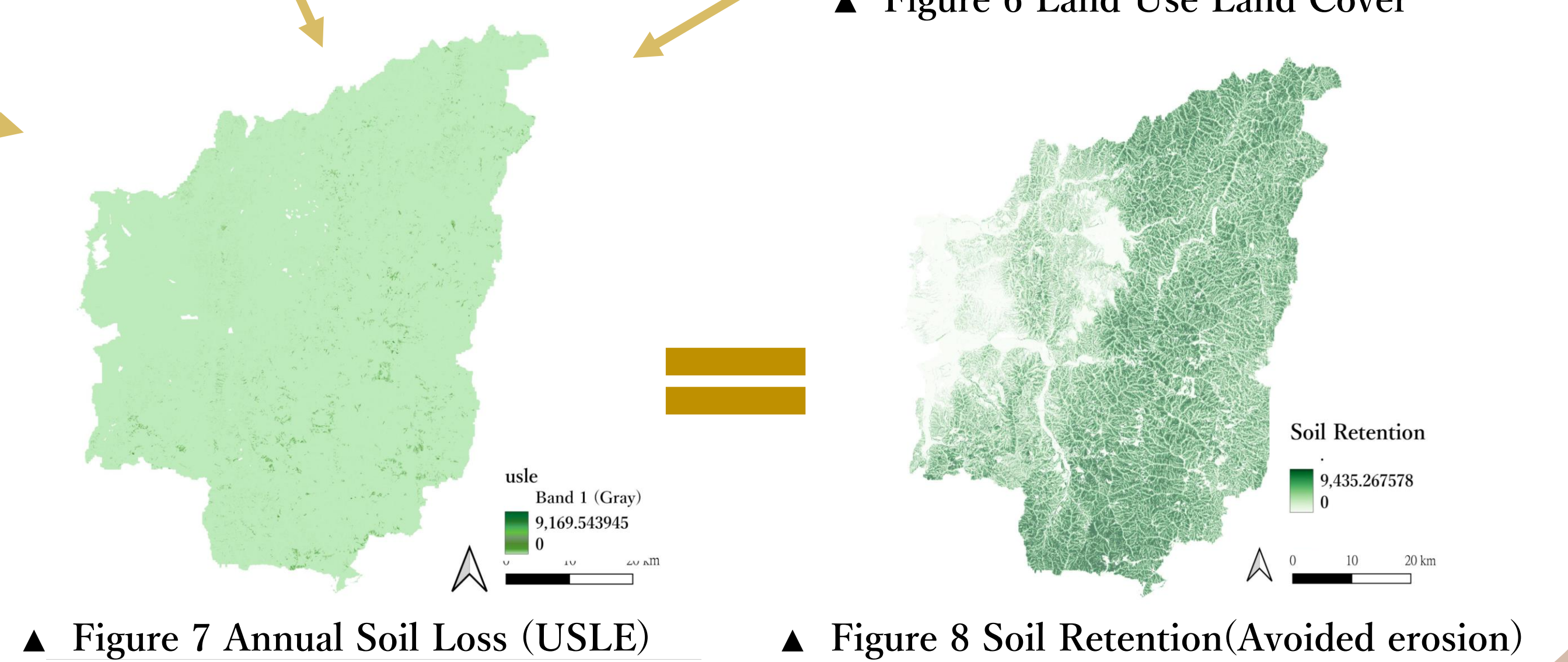


▼ Table 1 Biophysical Table

LULC	Lucode	C (cover)	P (practice)
Construction	1	0.01	1
Forest	2	0.01	1
Bamboo Forest	3	0.005	1
Grass	4	0.01	1
Agriculture	5	0.25	1
Water Body	6	0.025	1
Bareland	7	1	1



Subtract



Results

Replacement Cost Method

Sediment distribution assumes 70% remains in riverbeds and 30% flows into reservoirs. The reservoir's silt reduction benefit is based on the mechanical dredging unit price. The erosion prevention benefit combines both riverbed and reservoir sediment values, calculated as: Total Erosion Prevention × (0.7 * average sand price + 0.3 * reservoir silt removal price).

Value of Ecosystem Service

Nantou county total
 $= (111573489 * 0.7) * 600 + (111573489 * 0.3) * 215$
 $= 54057355421$ (NTD)
 Bamboo Forest in Nantou County
 $= (5549316 * 0.7) * 600 + (5549316 * 0.3) * 215$
 $= 2688643602$ (NTD)

Conclusion

- Bamboo forests indeed have their own ecosystem service value, but there is no significant spatial correlation between their value and land use land cover in Nantou County.
- The relationship between soil property and bamboo forests (land use) has not been considered. This might result in the potential ecosystem service value of bamboo forests not being taken into account.

Future Work

- Find and Increase related surveys to reduce data discrepancies caused by the lack of certain soil data.

Reference

- Please refer to the QR code!



Correlation Analysis

