# Exploring the Carbon Storage Capacity and Economic Value of Bamboo Forests in Nantou County

Peng-Lin, Jiang[1,2], Mei-Hua, Yuan[1]

[1] Research Center for Environmental Change, Academia Sinica, Taipei, Taiwan

[2] Department of Natural Resources and Environmental Studies, National Dong Hwa University, Hualien, Taiwan

## Abstract

In this study, the focus is on exploring the adaptation of ecosystem services and the supply capacity of bamboo forests in Nantou County. The aim is to comprehend the carbon storage levels in bamboo forests, the distribution of bamboo culm accumulations, and variations in bamboo shoot yields. By quantifying these variables in terms of monetary value, the research seeks to assess the ecosystem service capabilities of these bamboo forests. Ultimately, the study aims to propose strategies for the future management and cultivation of bamboo forests in Nantou County.
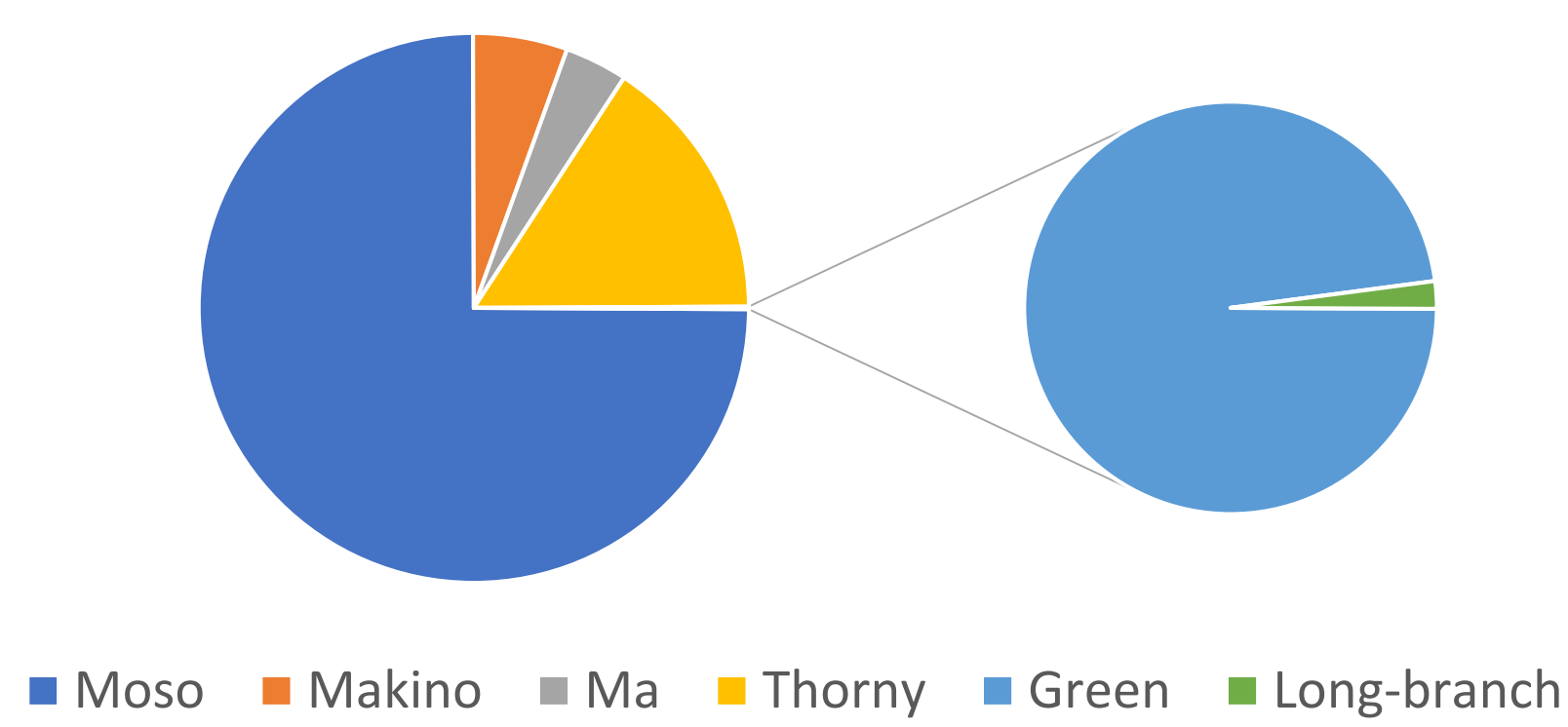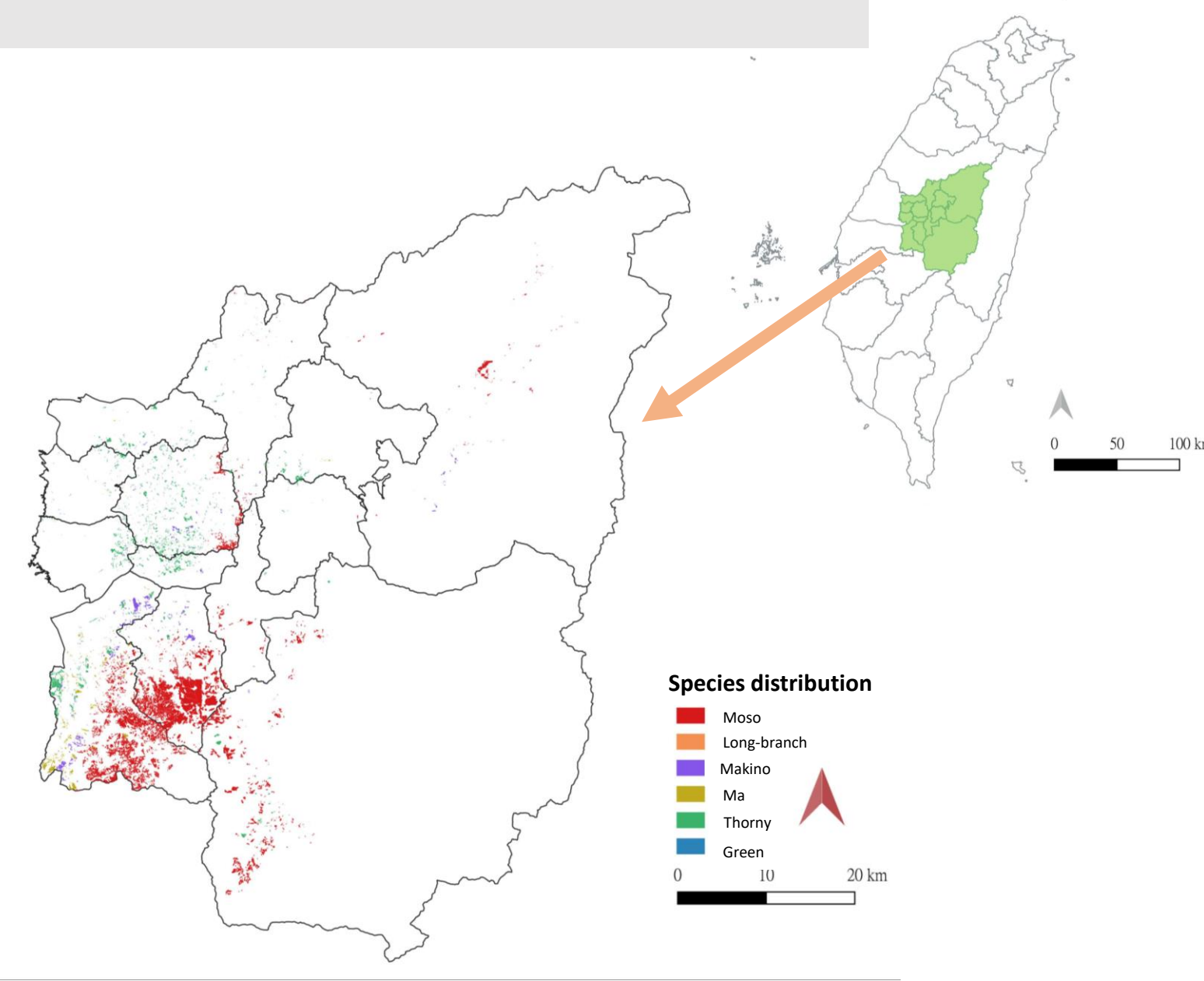
Data Source

## METHOD

### STUDY AREA

Distribution Proportion of Bamboo Species in Nantou



■ Moso ■ Makino ■ Ma ■ Thorny ■ Green ■ Long-branch
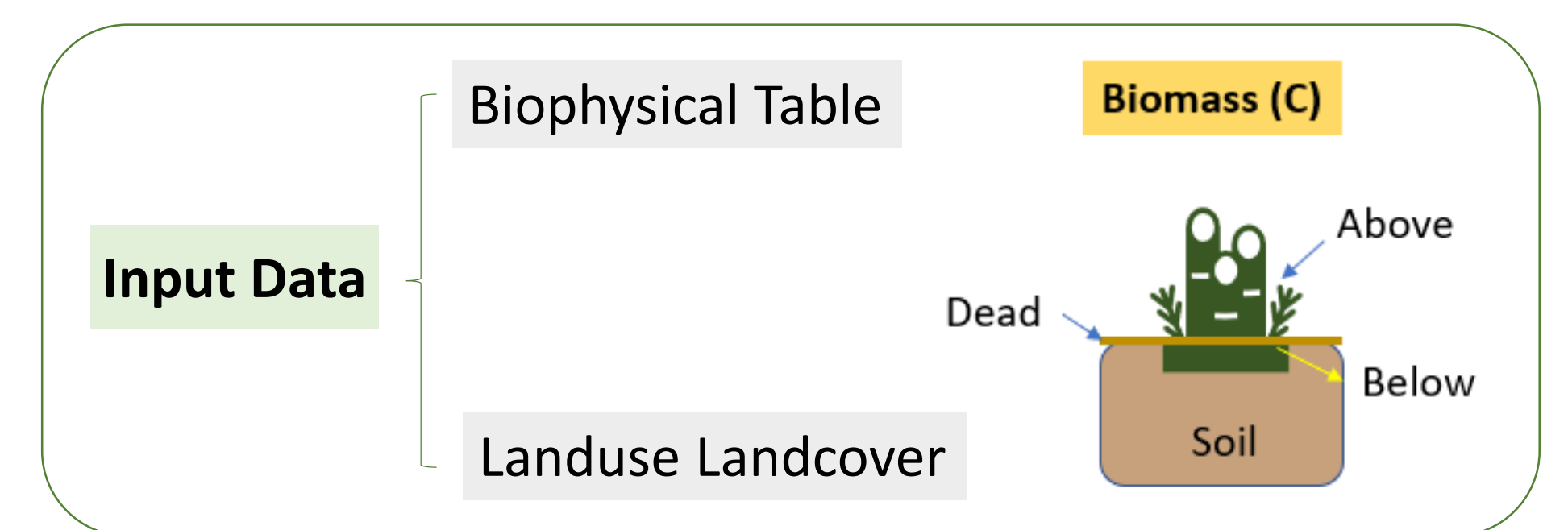
▲ Fig.1 Proportion of bamboo species in Nantou



▲ Fig.2 Distribution of bamboo species in Nantou

### MODEL

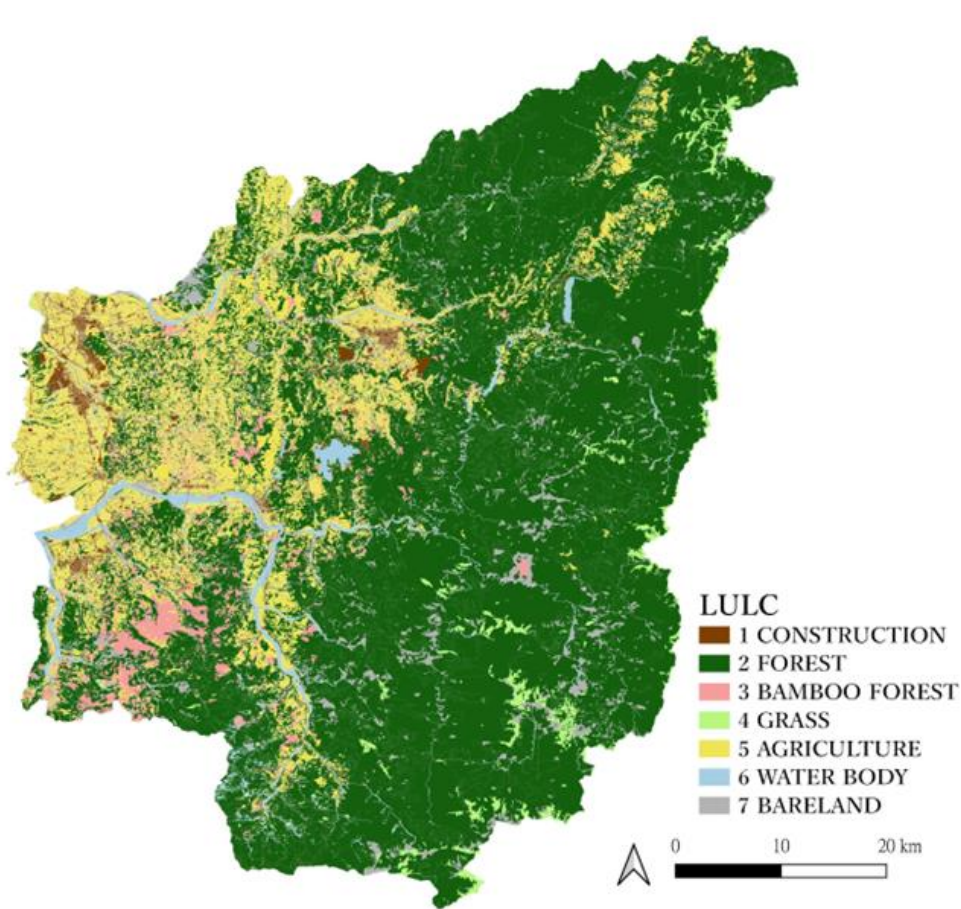【 InVEST - Carbon storage and sequestration 】

This model can calculate the dynamic changes in ecosystem carbon storage and carbon sequestration under land-use transitions. By utilizing biomass data for different land-use types and land-use maps under various scenarios, it can generate carbon stock distribution maps and net carbon sink values for the present, future, and policy change scenarios.
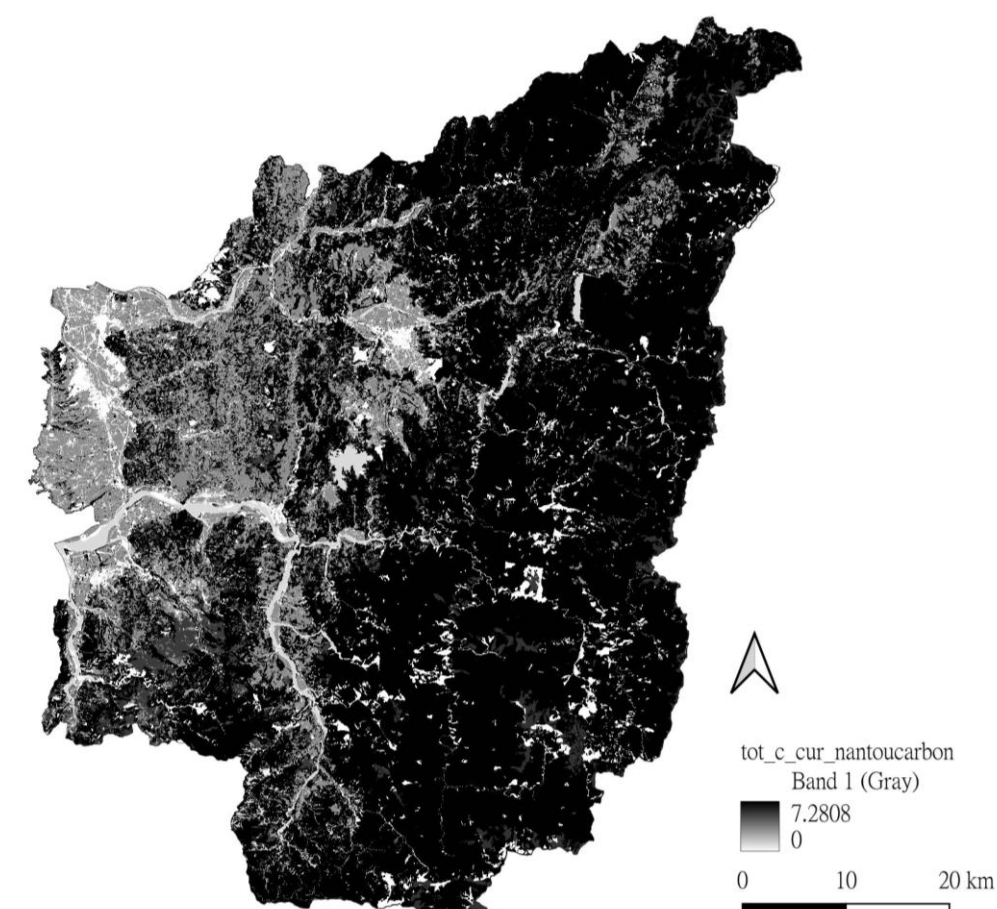
InVEST
Integrated Valuation of Ecosystem Services and Tradeoffs

Input Data — Biophysical Table — Biomass (C) — Above, Dead, Below, Soil — Landuse Landcover

## RESULT

### CARBON STORAGE

#### Nantou County



▲ Fig.3 Nantou county land use landcover



▲ Fig.4 Nantou county Carbon Storage Distribution

#### Bamboo Forest

▼ Table.1 Bamboo Carbon Content

**Bamboo Forest Biophysical Table**

| LULC_Name | C_above | C_below | C_soil | C_dead | C_total |
|---|---|---|---|---|---|
| Makino | 26.31 | 41.11 | 38 | 9.8 | 115.22 |
| Moso | 27.66 | 55.06 | 38 | 9.8 | 130.54 |
| Ma | 29.09 | 39.85 | 38 | 9.8 | 116.74 |
| Green | 25.48 | 28.54 | 38 | 9.8 | 101.84 |
| Thorny | 69.01 | 143.41 | 38 | 9.8 | 260.3 |
| Long-branch | 36.5 | 50.1 | 38 | 9.8 | 134.44 |
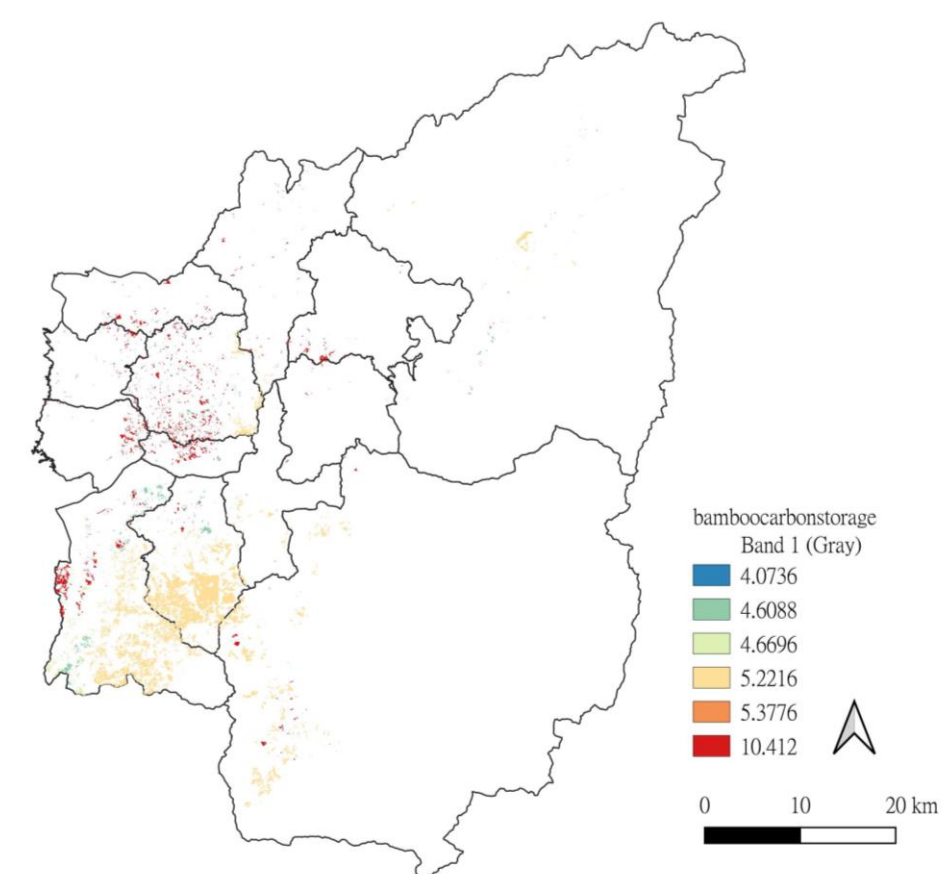


▲ Fig.5 Bamboo Forest CS Distribution

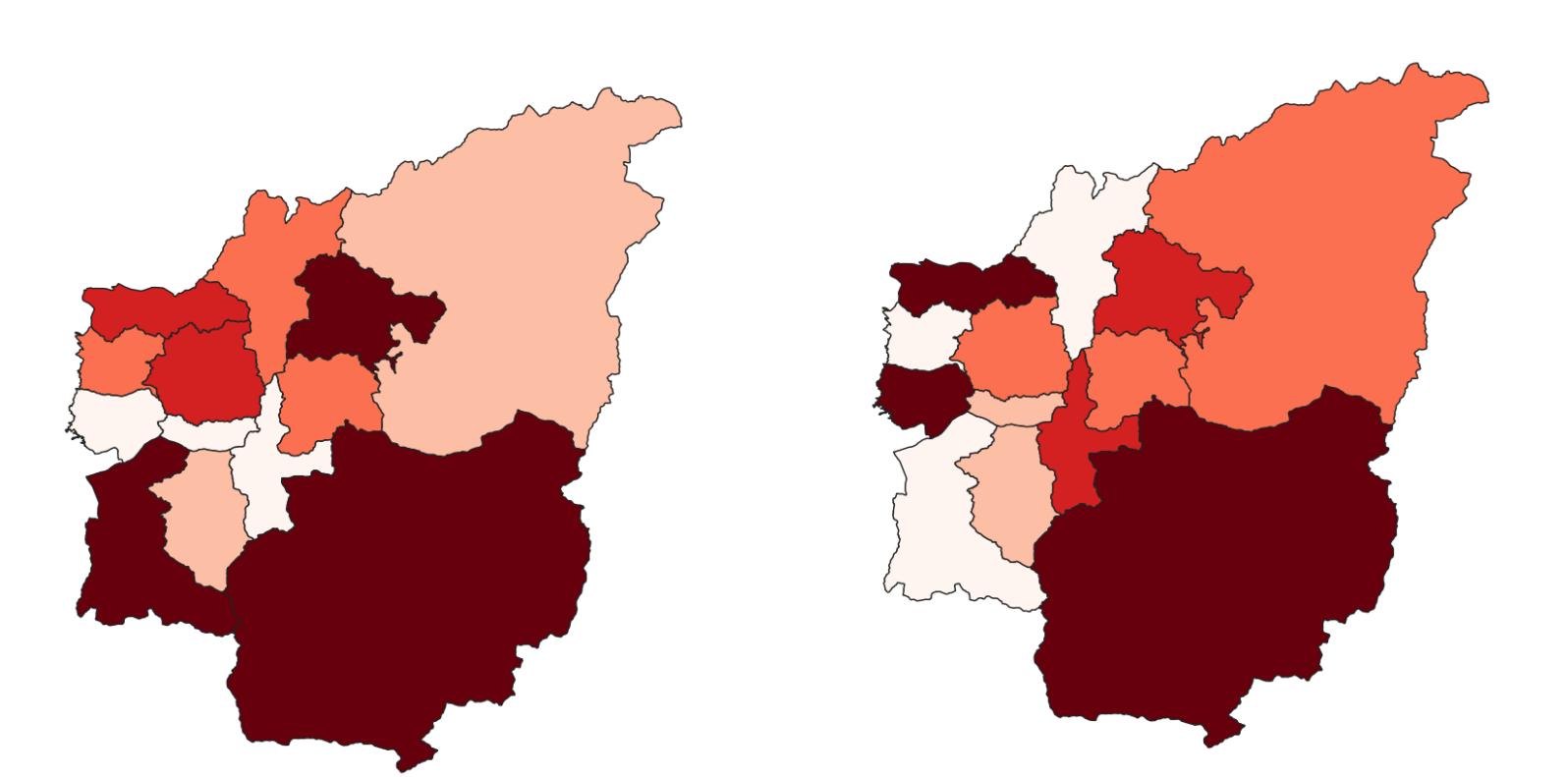#### Carbon Storage Total

▼ Table.2 Carbon Storage total

| Item | Amount (ton) | Portion |
|---|---|---|
| Bamboo Forest | 1,444,807 | $\frac{Bamboo\ Forest}{Nantou\ County} = 0.02$ |
| Nantou County | 60,042,436 | |

### BAMBOO PRODUCT

#### BAMBOO SHOOT YIELD
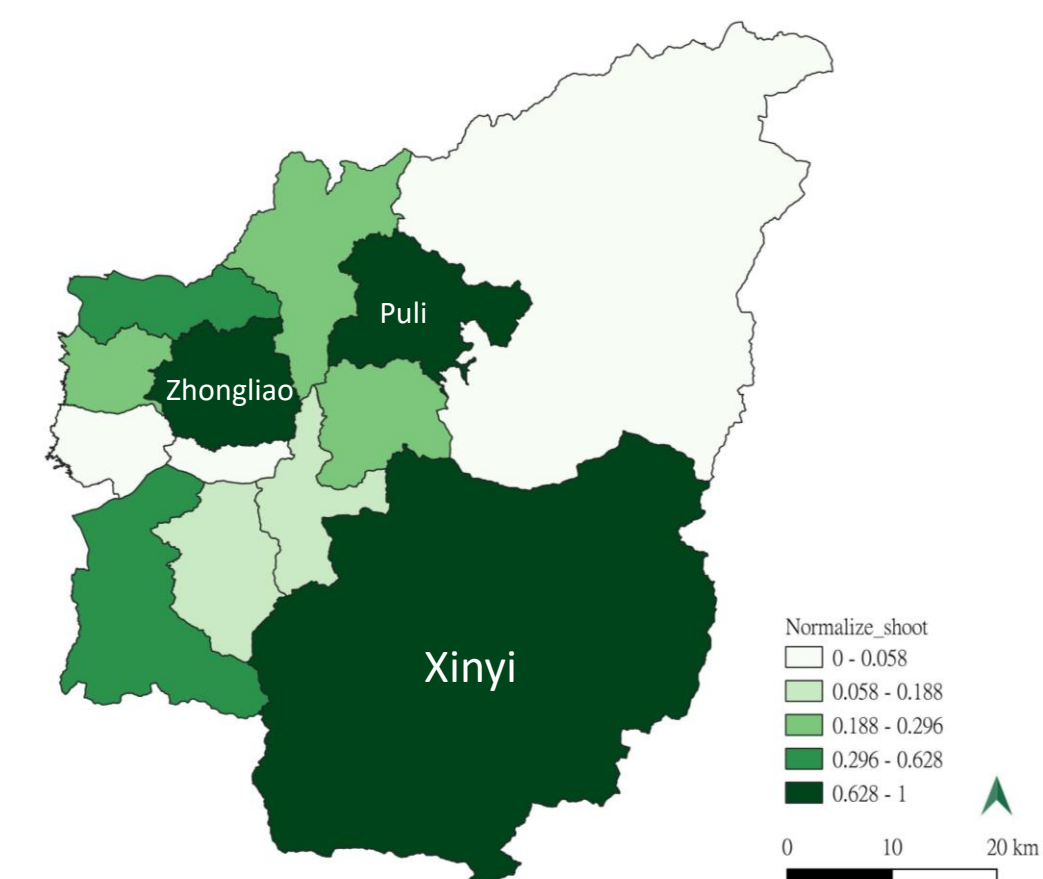


▲ Fig.6 Bamboo shoot yield distribution (2016)



All township yield were declined

▲ Fig.7 2009-2016 Yield DIFF



Dark area yield still declined

▲ Fig.8 2016-2022 Yield DIFF

T3. Reaching its lowest point in 2016 year can be inferred to have been influenced by the impact of the compensation measures for logging prohibition on indigenous reserves, resulting in a decline in the production values of many bamboo forests.

▼ Table.3 Bamboo shoot yield trend graph

Nantuo bamboo shoot proudct yield and cultivate area



#### Bamboo culm accumulation
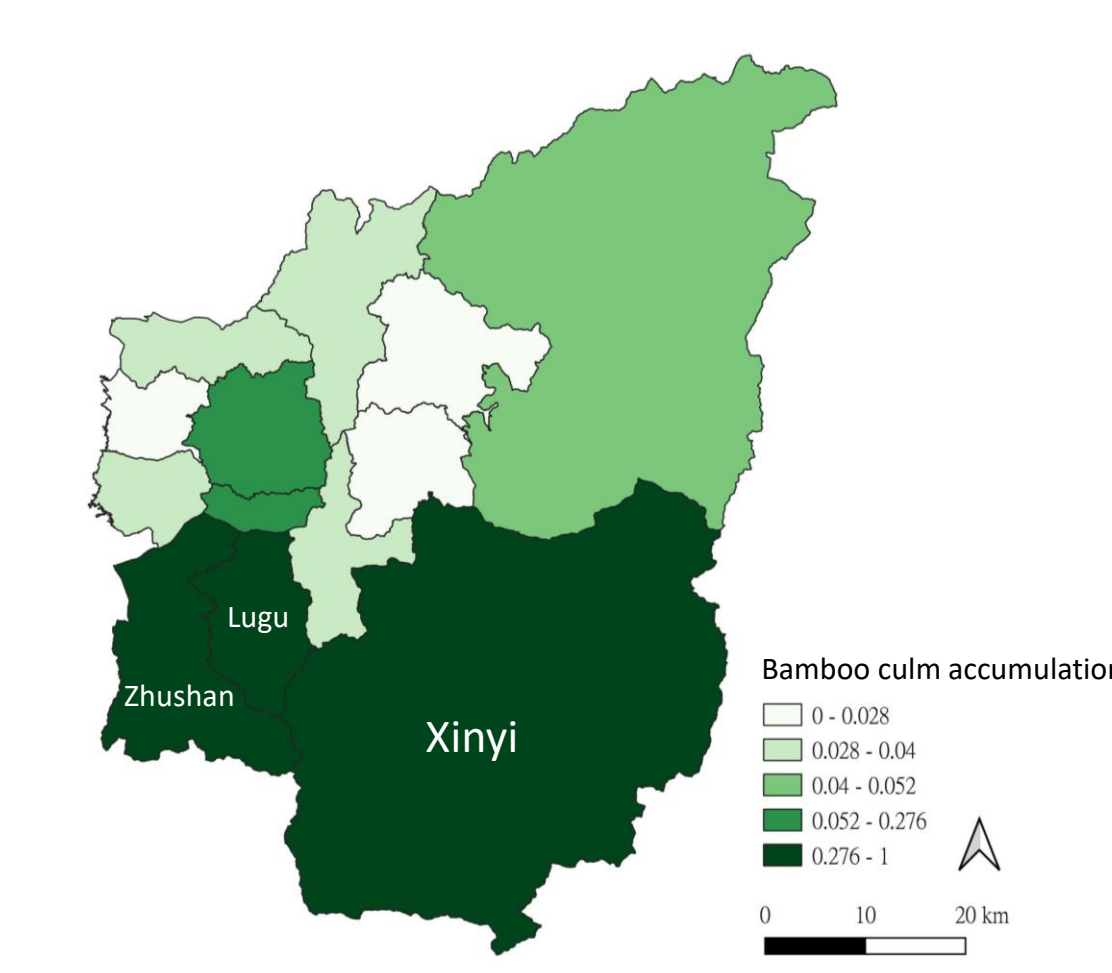


▲ Fig.9 Nantou bamboo culm accumulation

▼ Table.4 Accumulation culm of bamboo forest

| Item | Average (culm/ha) | Accumulation of bamboo | Production Value |
|---|---|---|---|
| Makino | 14000 | 55,765,992 | 2,205,686,173 |
| Moso | 7000 | 15,107,440 | 2,007,575,711 |
| Thorny | 10708 | 18,461,973 | 1,467,957,908 |
| Long-branch | 13233 | 2,239 | 179,169 |

Nantou County has a bamboo reserve of up to 80 million culms, with a total potential production value of 5.6 billion.

## Conclusion

### Carbon Storage

- The biomass of sympodial rhizome bamboo is slightly higher than that of monopodial bamboo species.
- Bamboo forests in Nantou County have a carbon sequestration capacity of 66,651 metric tons . After undergoing value transformation, bamboo forest can lead to a reduction in carbon emission costs by 1,446,326.

### Bamboo Shoot

- Converting the production values into economic values ,the reduced production during the period from 2009 to 2016 amounts to 10,280,267 kg. This translates to a decrease in economic value of approximately $293,090,412 , which accounts for about 40% of the 2009 production value.

## Policy Suggestion

- To enhance bamboo forest management ratios, conduct regular forest harvesting and renewal, reduce accumulation of old and waste bamboo material, and strengthen the carbon sequestration capacity of bamboo forests.
- Provide integrated carbon sink credit project plans for small-scale bamboo forest production areas.
- Simplify the application process for forest carbon offsets project and lower the application threshold.
- Emphasize the circular economic value of bamboo, as bamboo material can substitute for non-biological materials and can be utilized as energy and construction materials, at the same time, its products have carbon storage capacity. In the future more detailed economic value calculations can be done.