Food and Agriculture Organization
of the United Nations

July 2025

Bamboo Resource Assessment in
Myanmar

A methodological approach using:

Collect Earth Online

SEPAL

Google Earth Engine

Importance of Bamboo

A Key Resource for Sustainable Development

Nature's Most Versatile Sustainable Resource

Bamboo is revolutionizing how we think about sustainable development,
offering solutions to climate change while supporting economic growth worldwide.

1600 +
Species Globally

35M
Hectares Covered

10,000 +
Commercial Uses

Environmental Benefits

- ▷ Climate change mitigation and adaptation
- ▷ High carbon storage and sequestration potential
- ▷ Sustainable harvesting, rapid regrowth
- ▷ Land restoration and soil conservation

Socioeconomic Benefits

- ▷ Low-cost, accessible income source
- ▷ Builds on traditional skills
- ▷ High-value products potential
- ▷ Create rural employment
- ▷ Empowers women entrepreneurs
- ▷ Cultural significance preservation

Objectives of the Bamboo Mapping Initiative

Mapping Bamboo for a Sustainable Future

Our initiative aims to create a comprehensive bamboo distribution database in Southeast Asia, leveraging cutting-edge technology to support conservation, sustainable management, and economic development.

Create Comprehensive Distribution Map

▷ Develop an accurate, up-to-date, and accessible bamboo distribution map for targeted countries in Asia

▷ Overlay bamboo distribution map with topographic and environmental factors to understand the suitability of bamboo

Build on Scientific Research Foundation

▷ Build on INBAR's and other scientific research by simplifying bamboo mapping in Asia

Leverage Advanced Technology Platforms

▷ Utilize cutting-edge satellite imagery and user-friendly platforms to ensure accurate, accessible, and real-time bamboo mapping.

▷ Sepal, Google Earth Engine, Collect Earth Online

Enable Informed Management Decisions

▷ Disseminate actionable information to stakeholders for effective bamboo conservation, sustainable harvesting, and economic development

Knowledge Gaps & Data Limitation

A Key Resource for Sustainable Development

Critical Data Gaps

Only **23 countries** with bamboo resources have reported comprehensive data, creating a massive knowledge gap affecting global sustainable management efforts

FRA 2020 Reporting Status

23
Countries reported bamboo data

35M
Hectares in Reporting Countries

24.9 M
Hectares in Asia countries

71.1 %
Asia's share of global bamboo

Key Data Limitation

Global Coverage Gap

Only 23 countries provided bamboo data, leaving significant gaps in the understanding of global bamboo distribution and resources

Asia Concertation

71.1% of reported bamboo area is in Asia, highlighting the regional importance of both bamboo resources and reporting

Data Categorization

Global and national datasets often group bamboo under forests or grasslands, causing mis-representation of the actual bamboo extent

Global Datasets

Lack of global and regional bamboo datasets posing challenges to data validation and understanding of actual bamboo distribution

Literature Review: Key Studies in Bamboo Mapping

Modern Remote Sensing Studies

2018	Bamboo Forest Mapping in China Using the Dense Landsat 8 Image Archive and Google Earth Engine. Remote Sensing
2018	A Comparison of Pixel Based and Object Based Image Classification for Cropland Area Estimation. International Journal of Remote Sensing
2020	Mapping Natural Distribution Using Google Earth Engine, Phenological Behavior, Landsat 8, and Sentinel-2
2020	Mapping bamboo forest expansion by coupling vegetation phenology and C-band SAR with Sentinel-1 and Sentinel-2
2023	Mapping bamboo forest bright and shadow areas using optical and SAR satellite data in Google Earth Engine
2023	Mapping Large-Scale Bamboo Forest Based on **Phenology and Morphology Features**
2024	Bamboo classification based on GEDI, time-series Sentinel-2 images and whale-optimized, dual-channel DenseNet

Historical Approaches

- ▷ Relied on traditional field surveys with limited coverage
- ▷ Challenged by accessibility constraints and time limitations in remote areas
- ▷ Used single-date satellite imagery, missing temporal variations in vegetation dynamics

Technological Evolution in Bamboo Mapping

Field Survey ▶ **Single Date Satellite Imagery Mapping** ▶ **Cloud Computing + Time Series** ▶ **SAR + Optimal Integration Time Series** ▶ **LIDAR + Deep Learning**

Challenges & Recommendations

From Literature Review

Key Challenges

- ▷ **Spectral similarities** between bamboo and other vegetation
- ▷ **Complex landscapes and terrain hinder** accurate classification
- ▷ **Limited Ground Truth Data**
- ▷ **Cloud Cover Issues** in tropical and subtropical regions
- ▷ High Computation Demand **for large-scale mapping**

Best Practices

- ▷ Integration of **multi-sensor data** (optical & radar)
- ▷ Analyze **Time-series satellite**
- ▷ Use **spectral, textural, topographic, and phenological** features
- ▷ Apply **Indices** (NDVI, EVI, GCVI, MTCI, LSWI,etc)
- ▷ Incorporate **wall-to-wall tree height data**

Research Trend

The research is moving towards integrated approaches combining AI/ML techniques, multi-sensor fusion, and cloud computing platforms like Sepal and Google Earth Engine for large-scale, accurate bamboo mapping.

Myanmar Study Area

A Critical Bamboo Resource Region in Southeast Asia

Global Ranking

3rd Largest

Bamboo Areas Globally (after China and India)

Species Diversity

8% Of world's bamboo species grow naturally

Natural Bamboo Forest Species

1.78M ha

In Bago, Tanintharyi & Rakhine

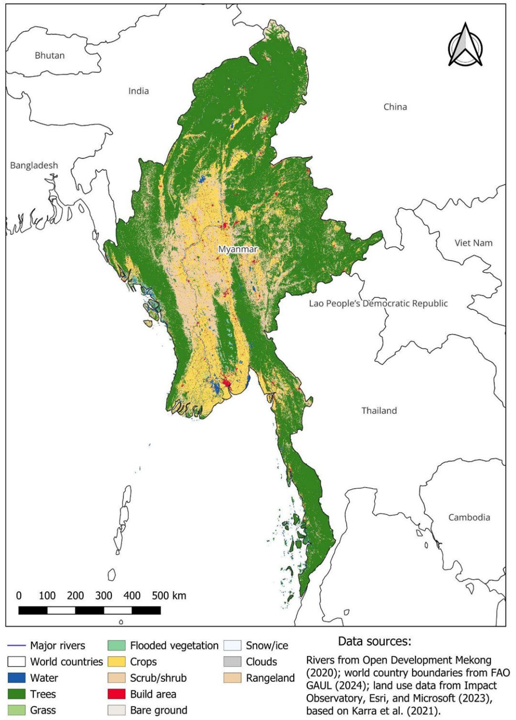
Source: Ministry of Environmental Conservation and Natural Resources data

Data Challenges

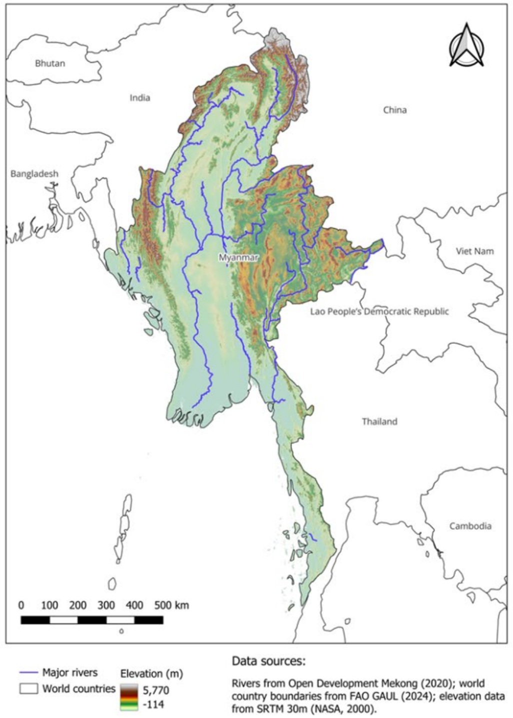
No bamboo data in **FRA 2020** Report Limited information about bamboo areas

Need for comprehensive mapping initiative

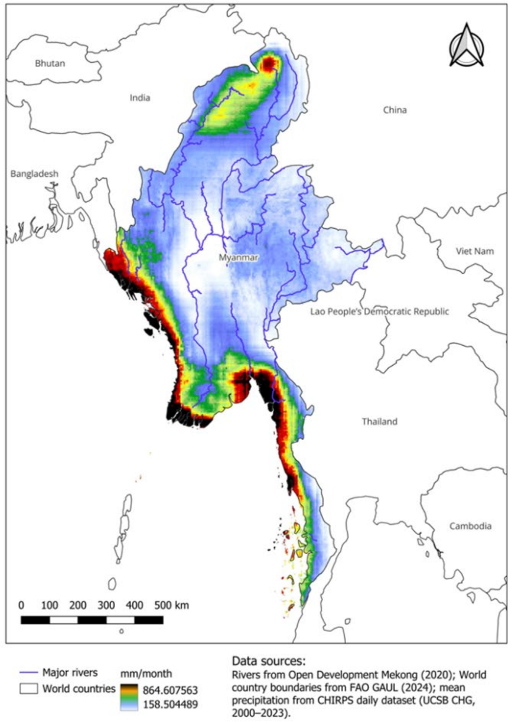
Geographic Content, Precipitation & Land Cover



Data sources:
Rivers from Open Development Mekong (2020); world country boundaries from FAO GAUL (2024); land use data from Impact Observatory, Esri, and Microsoft (2023), based on Karra et al. (2021).



Data sources:
Rivers from Open Development Mekong (2020); world country boundaries from FAO GAUL (2024); elevation data from SRTM 30m (NASA, 2000).



Data sources:
Rivers from Open Development Mekong (2020); World country boundaries from FAO GAUL (2024); mean precipitation from CHIRPS daily dataset (UCSB CHG, 2000–2023).

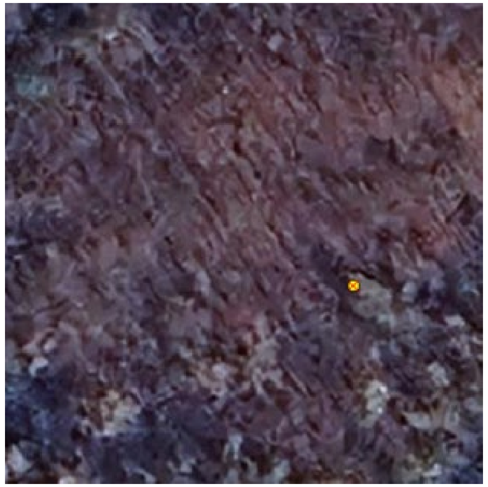
Historical Bamboo Resources

(Source: INBAR and FAO estimates)

261,000 ha	895,000 ha	859,000 ha
1990	2000	2005

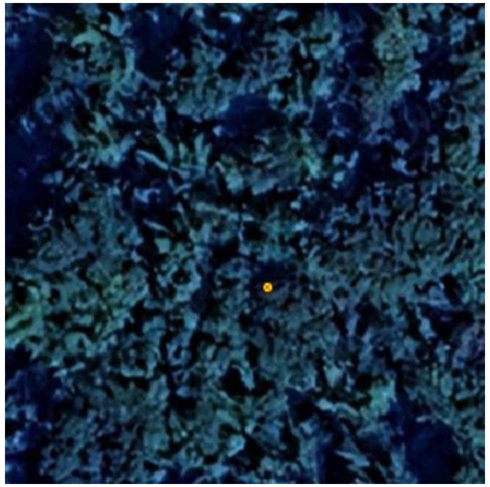
Major Bamboo Species in Myanmar

Melocanna baccifera

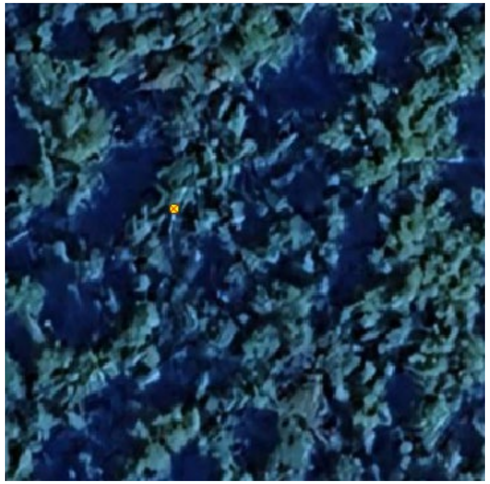


Dendrocalamus strictus

Bambusa polymorpha



Cephalostachyum pergracile

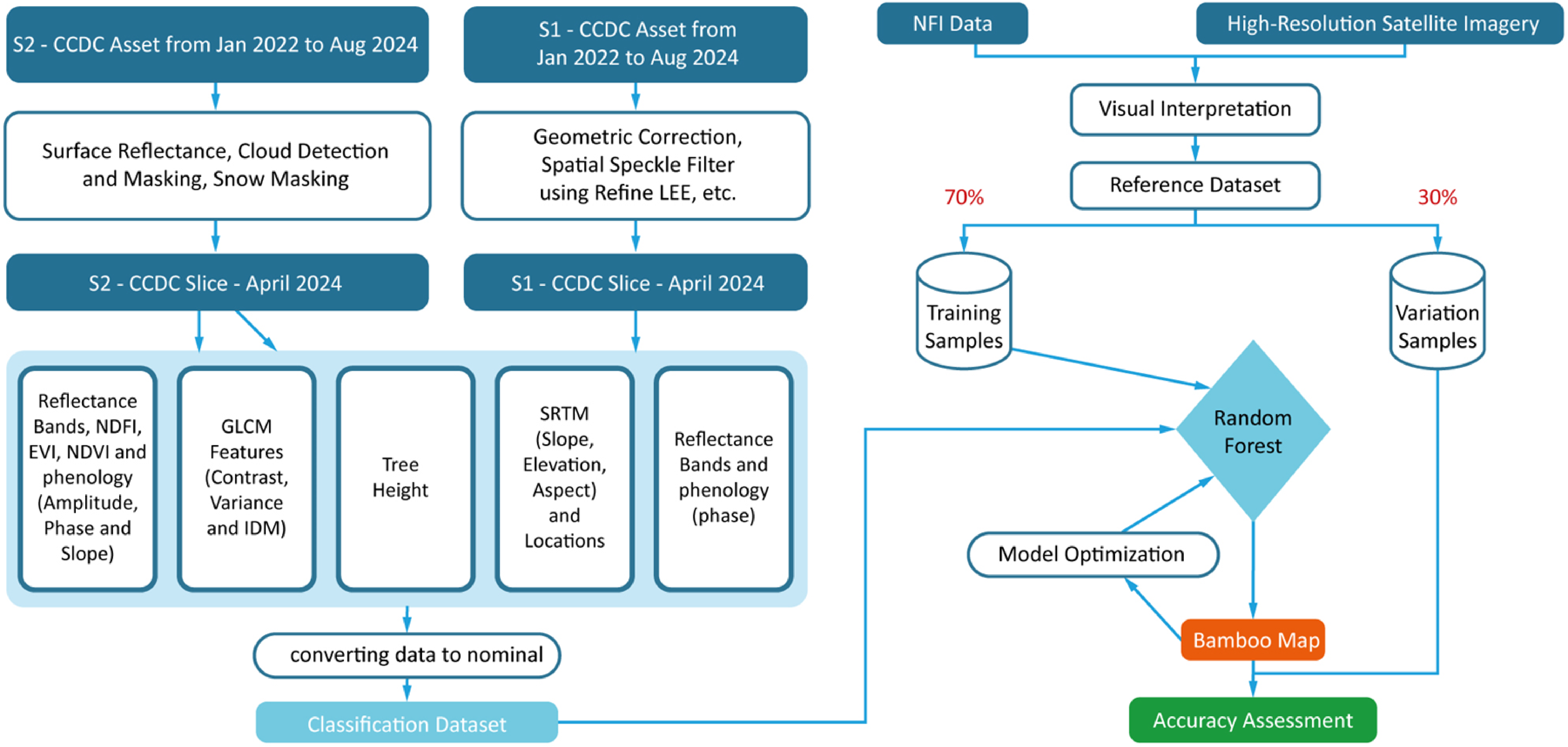


Bambusa tulda

- ▷ **Dendrocalamus membranaceus**:Wapyu
- ▷ **Thyrsostachys oliveri**: Thana-wa
- ▷ **Dendrocalamus hamiltonii**: Wabo-myet-san-gye
- ▷ **Oxytenanthera nigrociliata**: Waya
- ▷ **Dendrocalamus brandisii**: Wabo

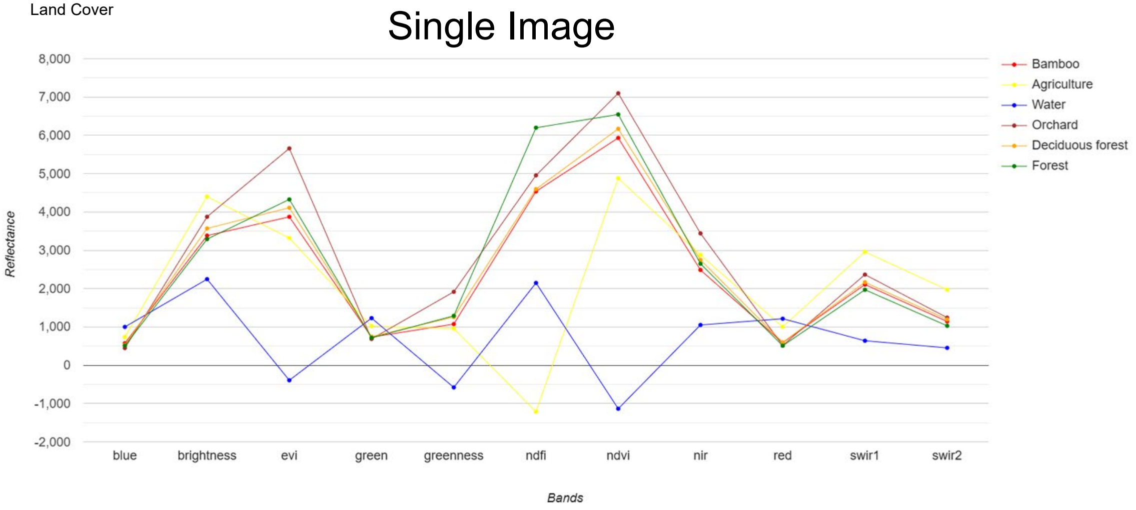
Based on the ground truth of NFI Data

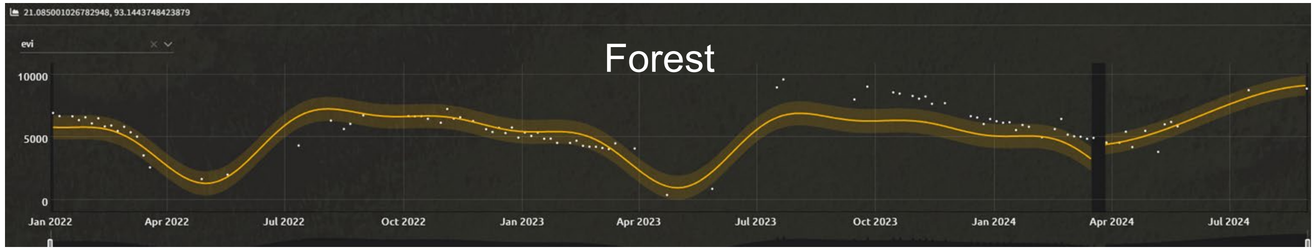
Methodology for the Bamboo Extent Mapping

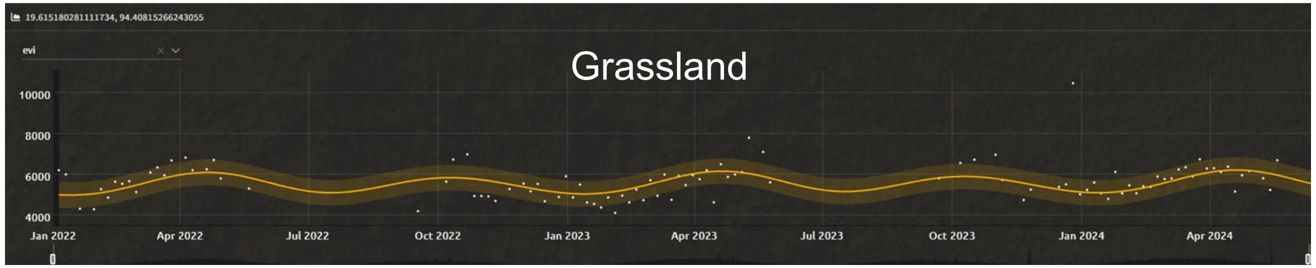


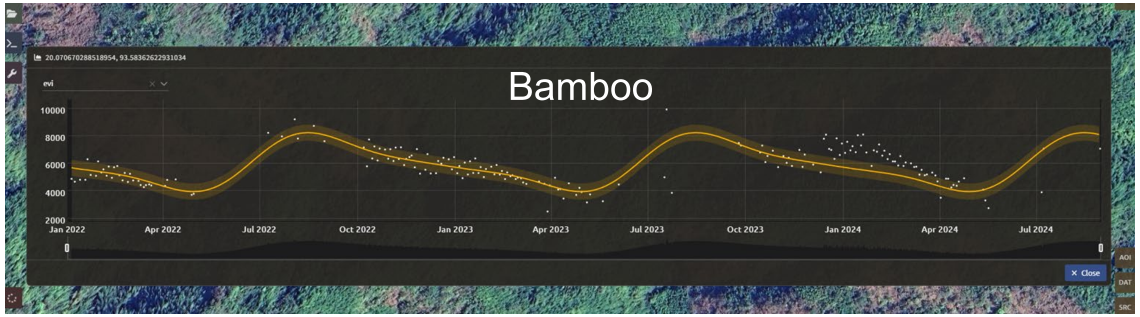
Phenology Profiles of Major Land Use in Myanmar

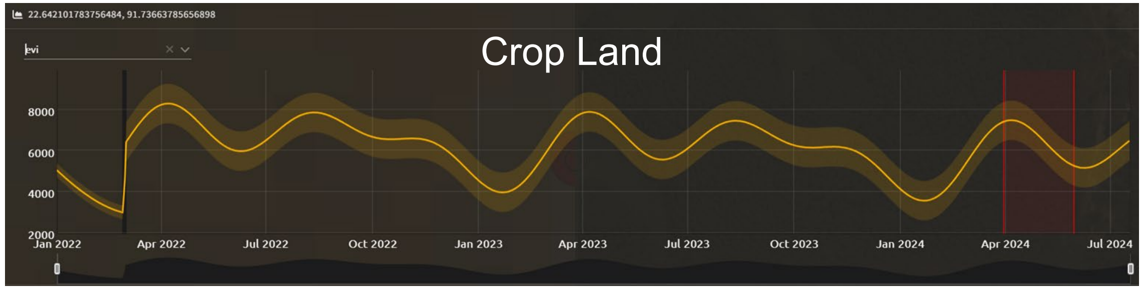
Average Spectral Signature Values of Land Cover



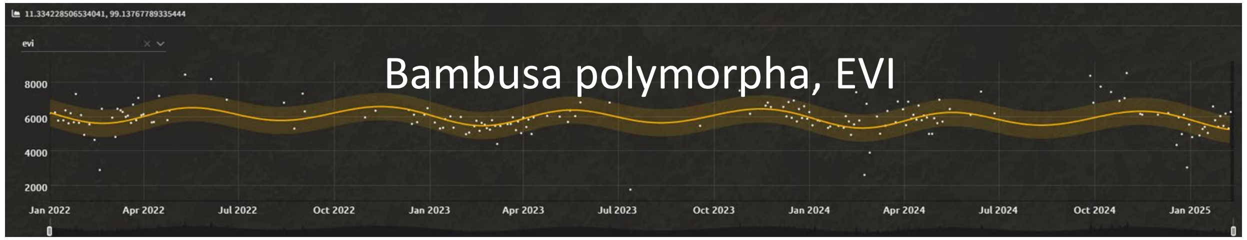


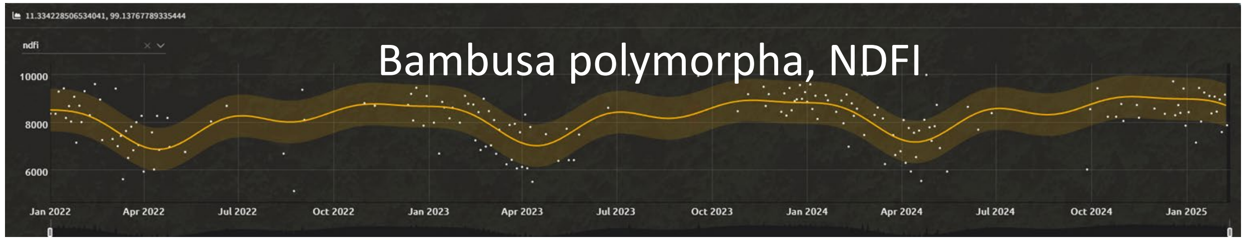


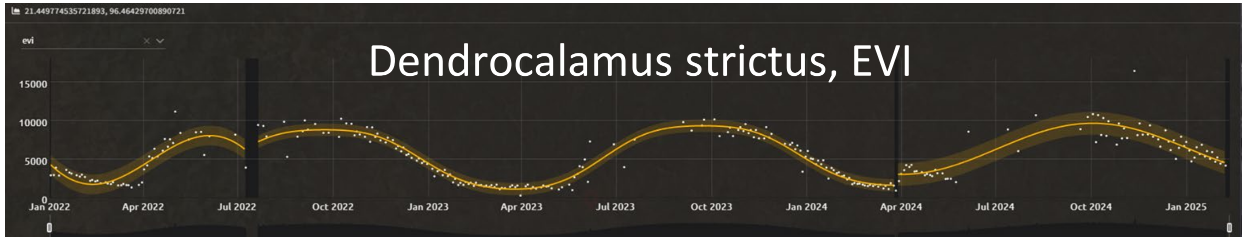


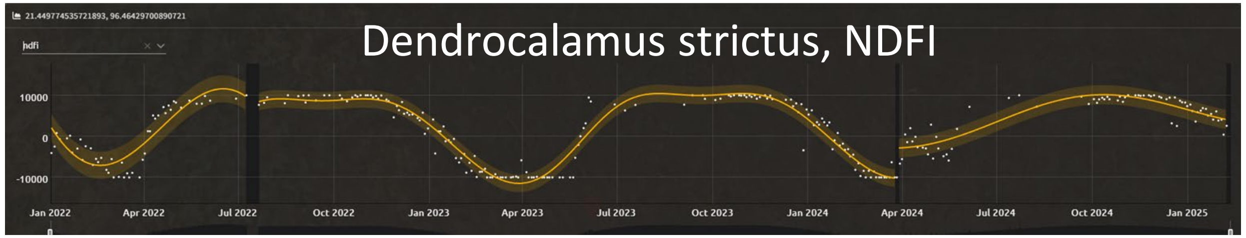


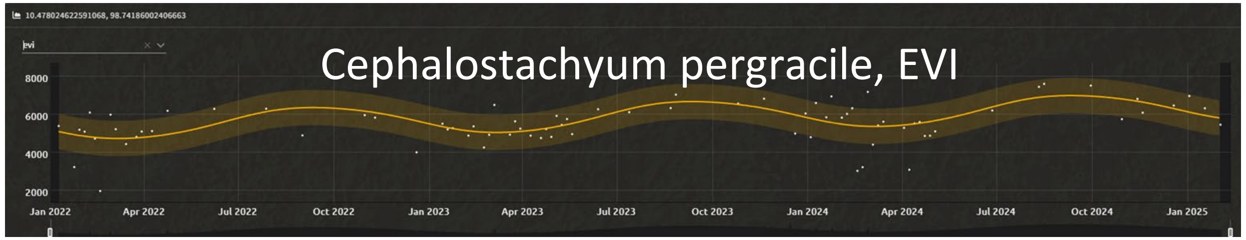
Phenology Profiles of Major Bamboo Species in Myanmar

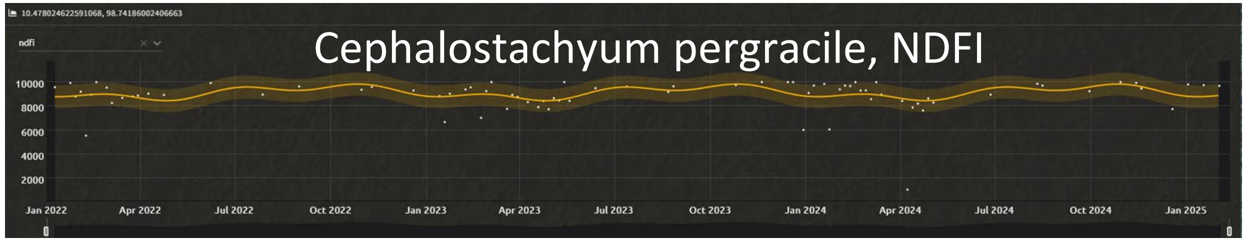


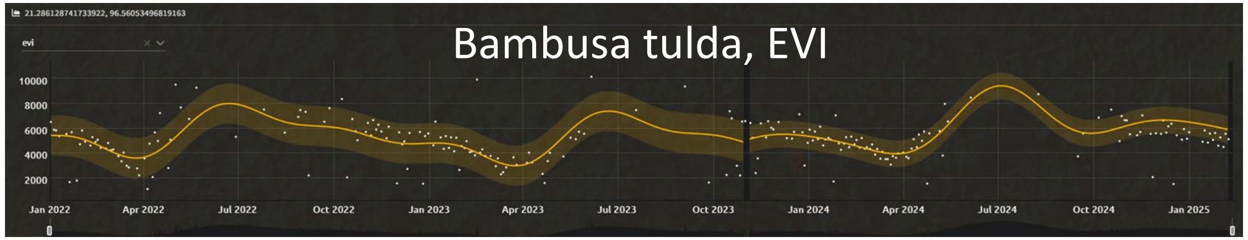


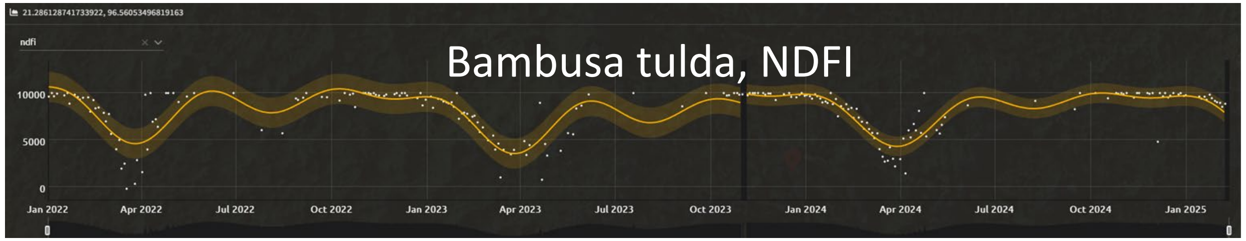


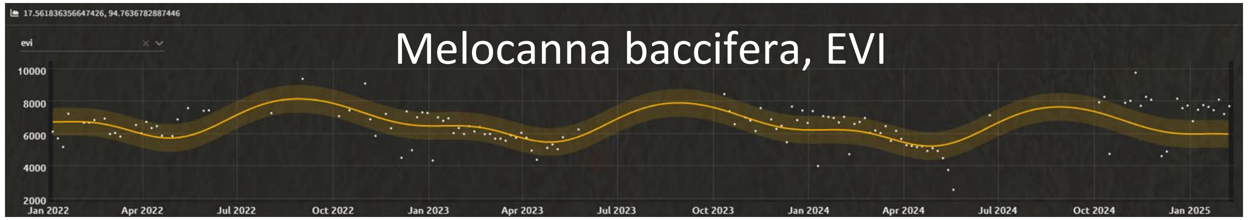


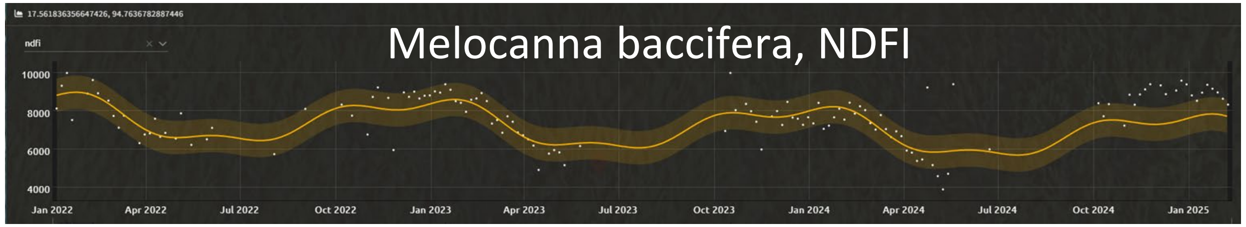












Classification Accuracy Metris

Model Performance Overview

Overall Accuracy: 94.49 %
Validation Split

70 %
Training Data

30 %
Validation Data

Accuracy Metrics

0.878

Kappa Coefficient

Confusion Matrix

Predicted	**Actual**	
	Non-Bamboo	Bamboo
Non-Bamboo	3,085	90
Bamboo	181	1,566

Producer's Accuracy

Non-Bamboo: 97.16%

Bamboo: 89.63%

User's Accuracy

Non-Bamboo: 94.45%

Bamboo: 94.56%

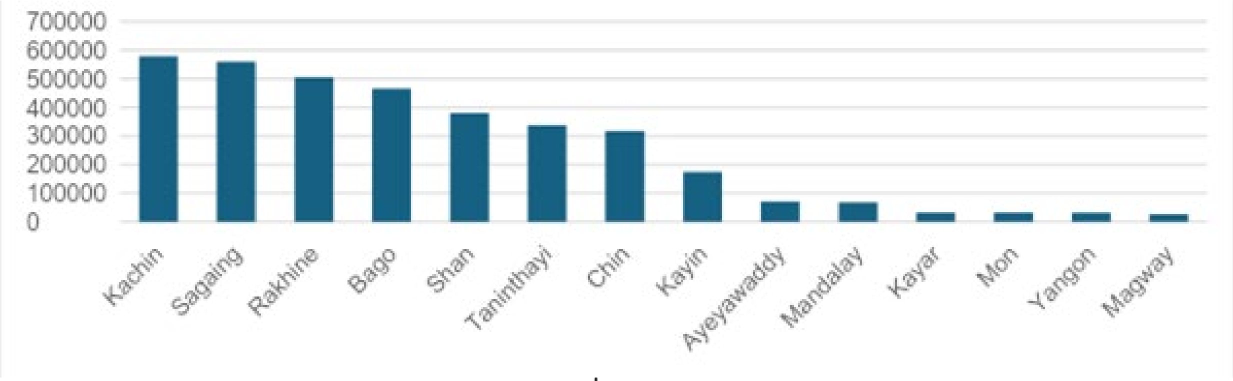
Interpretation Levels

Almost Perfect Agreement	0.81 - 0.99
Almost Perfect Agreement	0.61 - 0.80
Almost Perfect Agreement	0.41 - 0.60
Fair Agreement	0.21 - 0.40
Almost Perfect Agreement	0.00 - 0.20

Bamboo Distribution Results

Large-Scale Mapping Findings for Myanmar

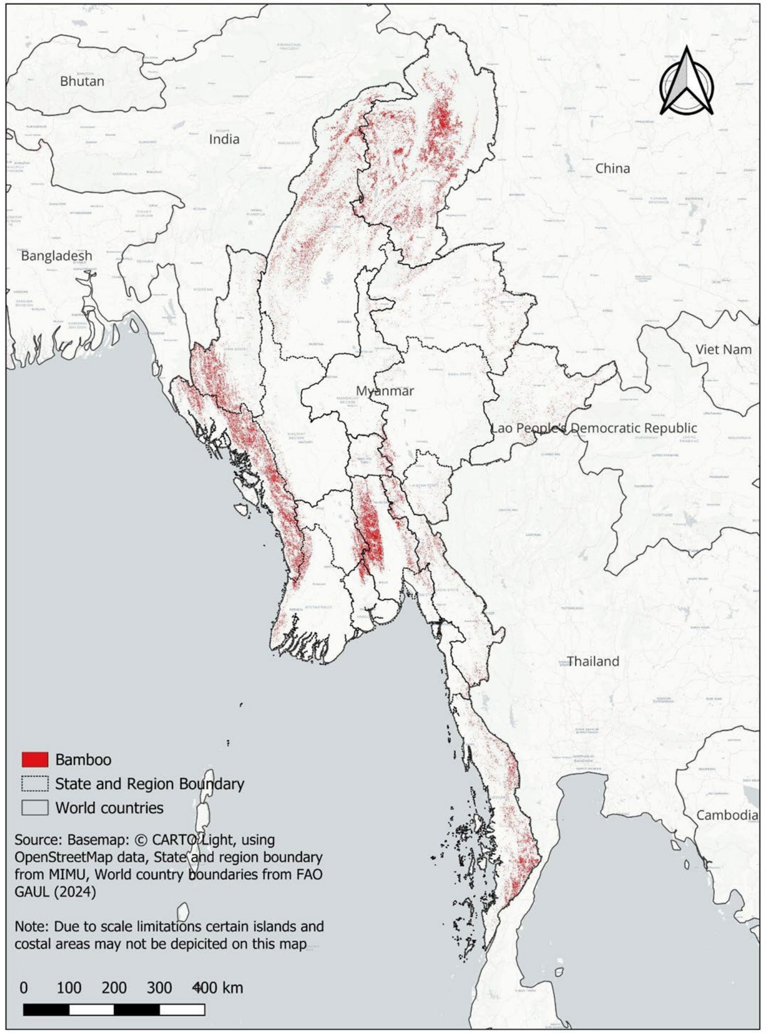
Regional Distribution of Bamboo Areas (HA)



3.56 million ha bamboo

Total Bamboo Distribution in Myanmar

Bamboo Distribution Map 2024, Myanmar



Key Findings

Border Region Concentration

The highest concentrations of bamboo are found in border states (Kachin, Sagaing, Rakhine, Bago)

Topographic Influence

Mountainous and hilly regions in northern and western states show higher bamboo concentrations compared to central plains

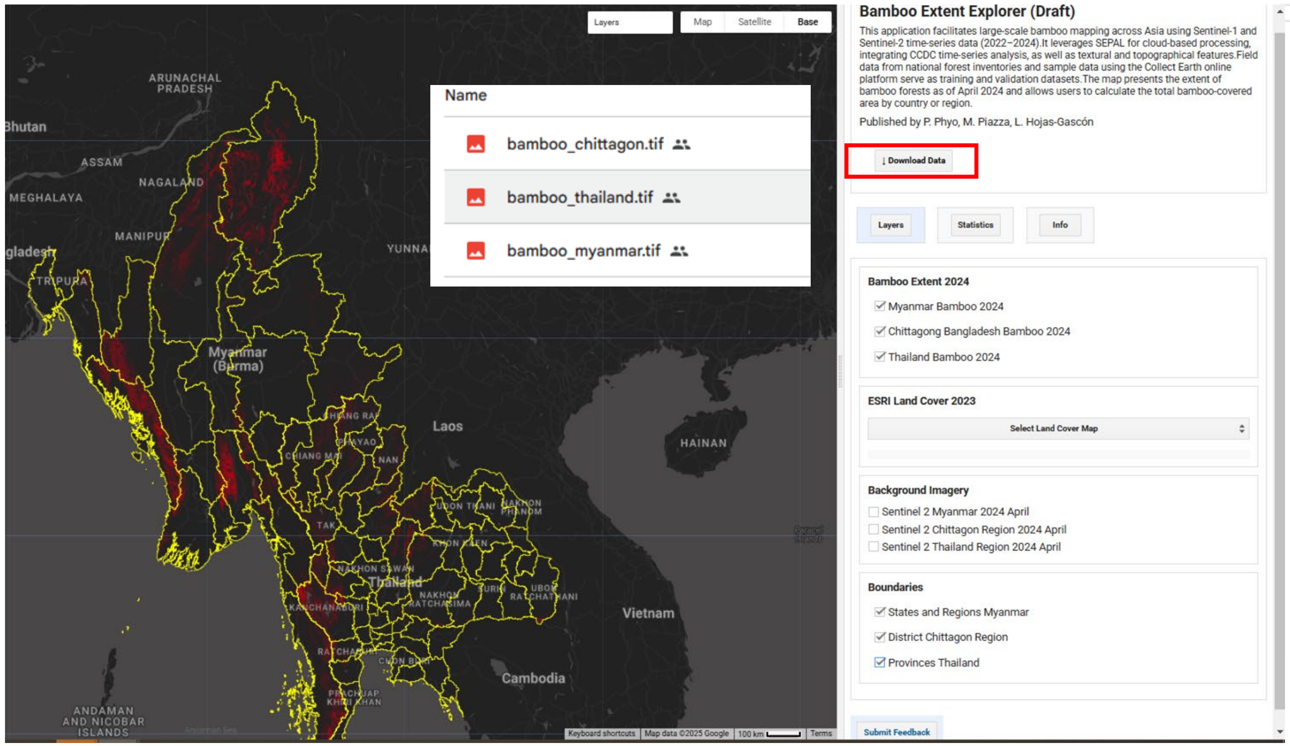
Mapping Accuracy

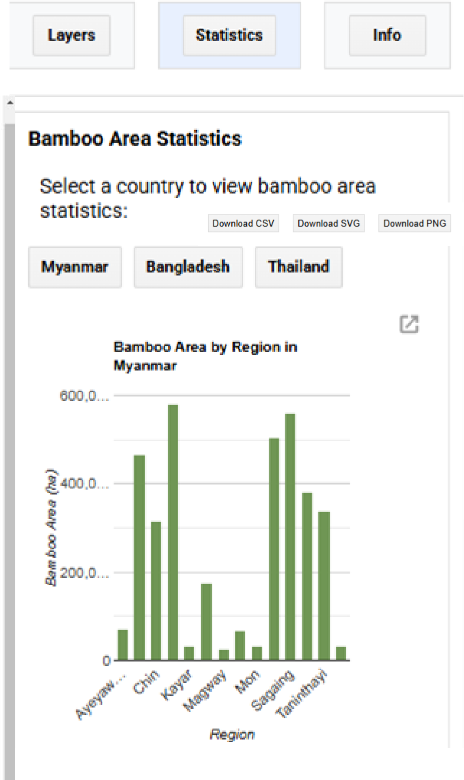
High-resolution satellite imagery analysis enabled precise identification of bamboo forests with 94.49% overall accuracy

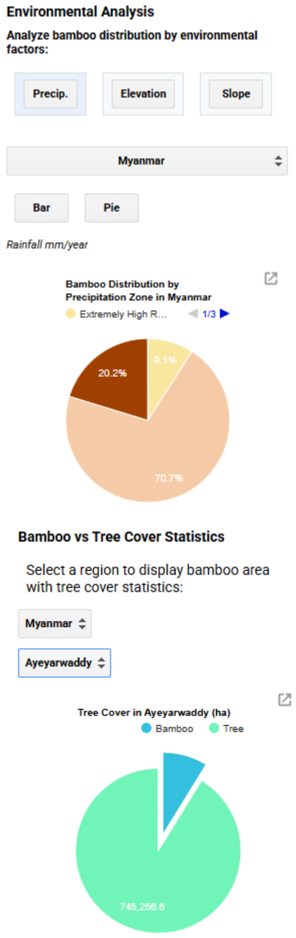
Uneven Distribution

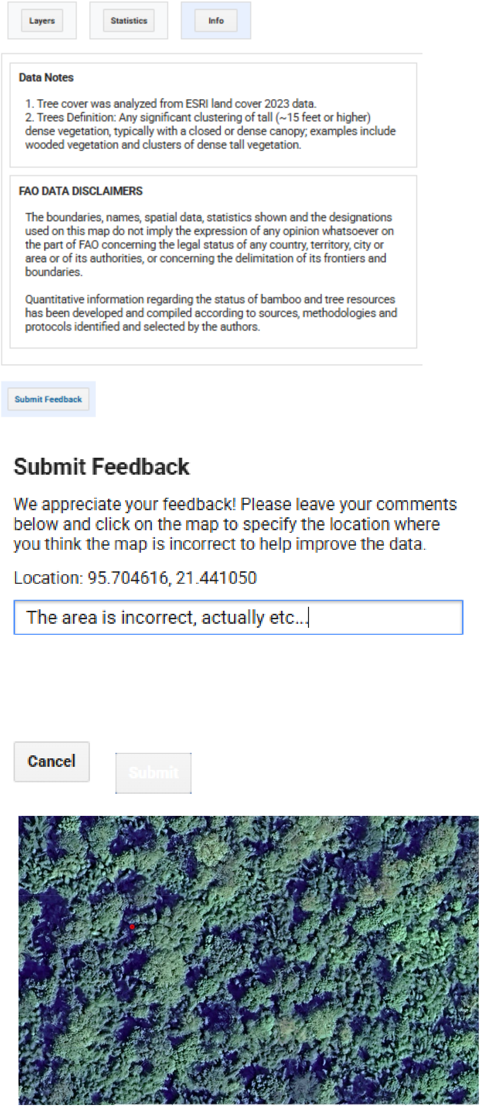
Top 5 states account for approximately 65% of total bamboo areas, showing significant regional concentration of resource

Bamboo Web Application







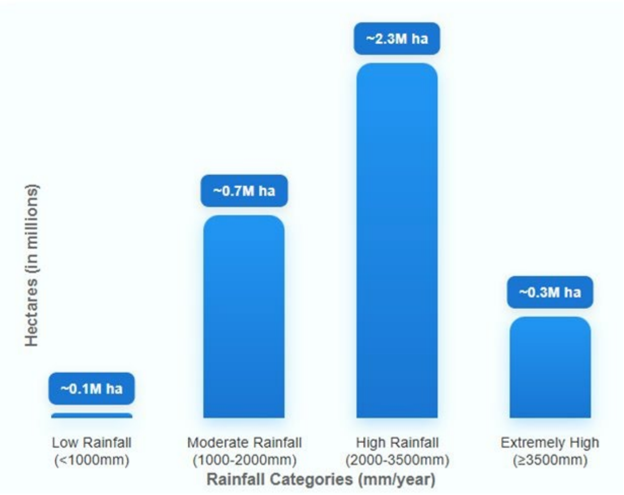


https://ee-bamboo.projects.earthengine.app/view/bamboo-extent-explorer

Bamboo Area Distribution by Rainfall Intensity

Climate-Vegetation Analysis

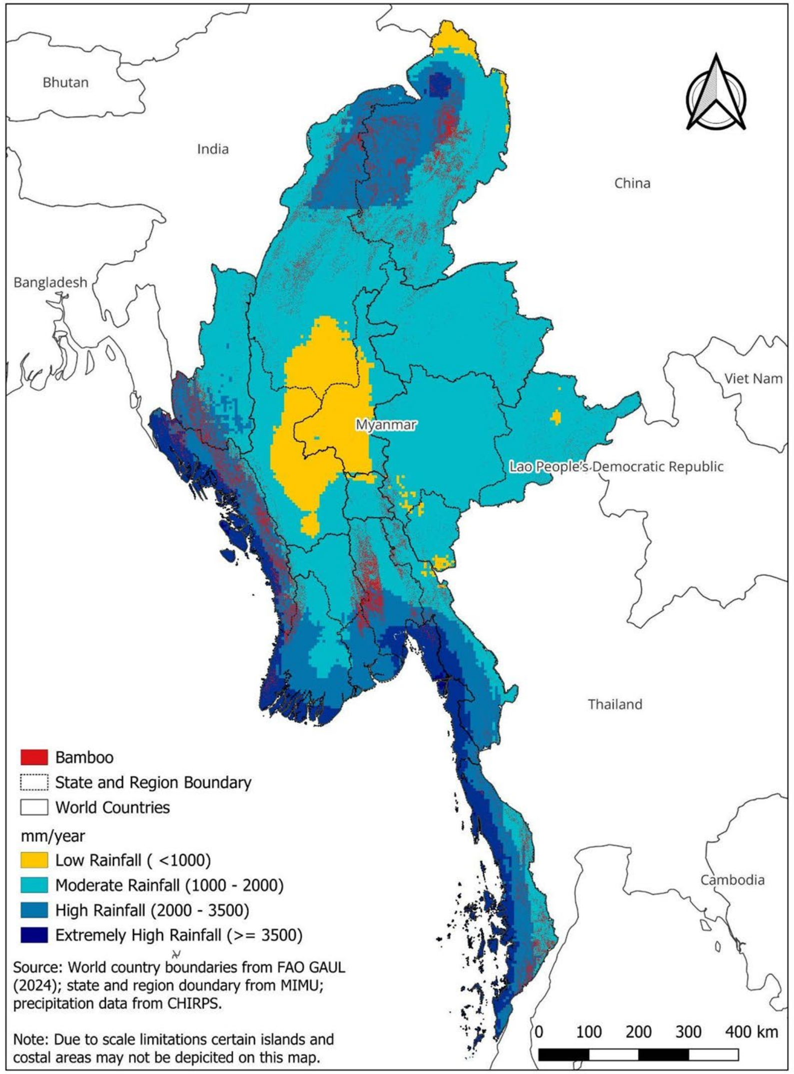
Bamboo Area Distribution Across Rainfall Zones



Optimal Zone

67% of bamboo thrives in high rainfall areas (2000-3500 mm).

Bamboo Area Distribution by Rainfall Intensity, Myanmar



Key Rainfall Insights

Rainfall Dependency

Bamboo shows strong correlation with rainfall, with 87% of total area found in areas receiving >1000mm annually.

Limited Drought Tolerance

only 3% of bamboo exists in low rainfall zones (<1000mm), indicating limited adaptation to arid conditions in Myanmar.

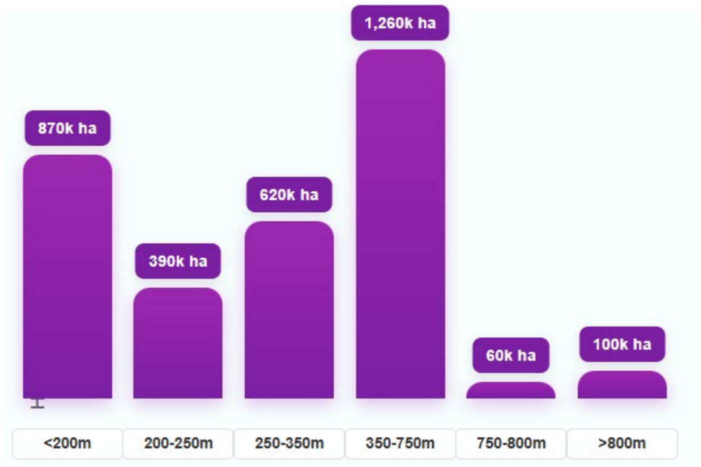
High Rainfall Dependency

Bamboo area decreases in extremely high rainfall zones (≥3500mm), suggesting sensitivity to excessive moisture.

Bamboo Area Distribution by Elevation Class

Altitudinal Preferences and Distribution Patterns

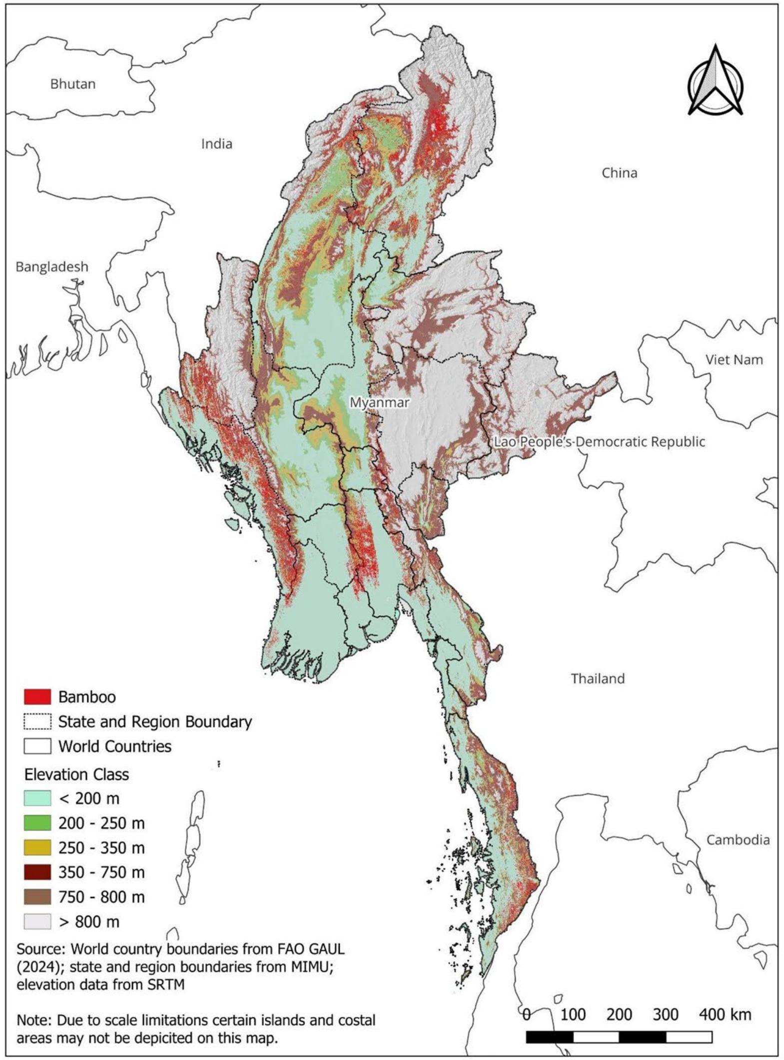
Bamboo Distribution Across Elevation Zones



Optimal Zone

Bamboo shows distinct preference for mid-elevation zones (350-750m), where optimal growing conditions combine favorable temperature, moisture, and soil characteristics.

Bamboo Area Distribution by Elevation, Myanmar



Key Elevation Insights

Mid – Elevation Preference

The peak concentration (36.7%) occurs at mid-elevations (350-750m) where temperature and moisture conditions are optimal for bamboo growth.

High Altitude Adaptation

Only 4.6% of bamboo exists above 750m, indicating limited adaptation to high altitude conditions and temperature constraints.

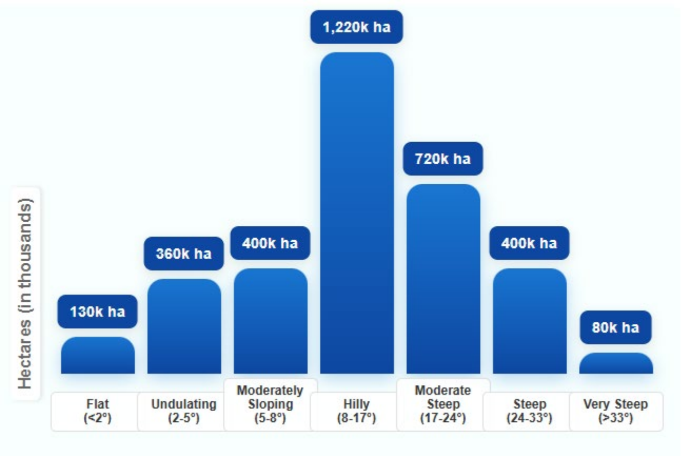
Low Elevation Presence

54.6% of bamboo is found below 350m elevation, showing significant adaptation to lowland and transitional zones.

Bamboo Area Distribution by Slope Class

Altitudinal Preferences and Distribution Patterns

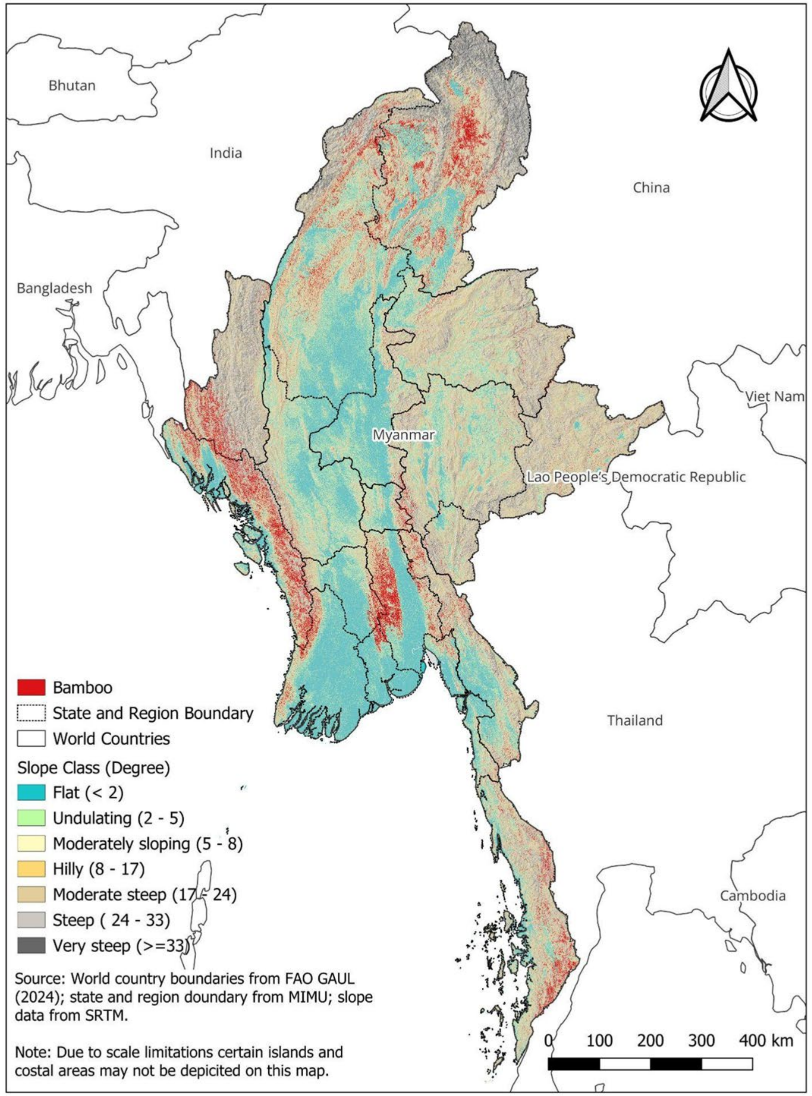
Bamboo Distribution Across Slope Class



Optimal Zone

58.2% of bamboo (1.94Mha) on moderate to steep slopes (8-24°).

Bamboo Area Distribution by Slope, Myanmar



Key Slope Insights

Hilly Terrain Preference

33% of bamboo grows on moderate steep slopes (17-24°), indicating preference for well-drained hillside conditions.

Extreme Slope Avoidance

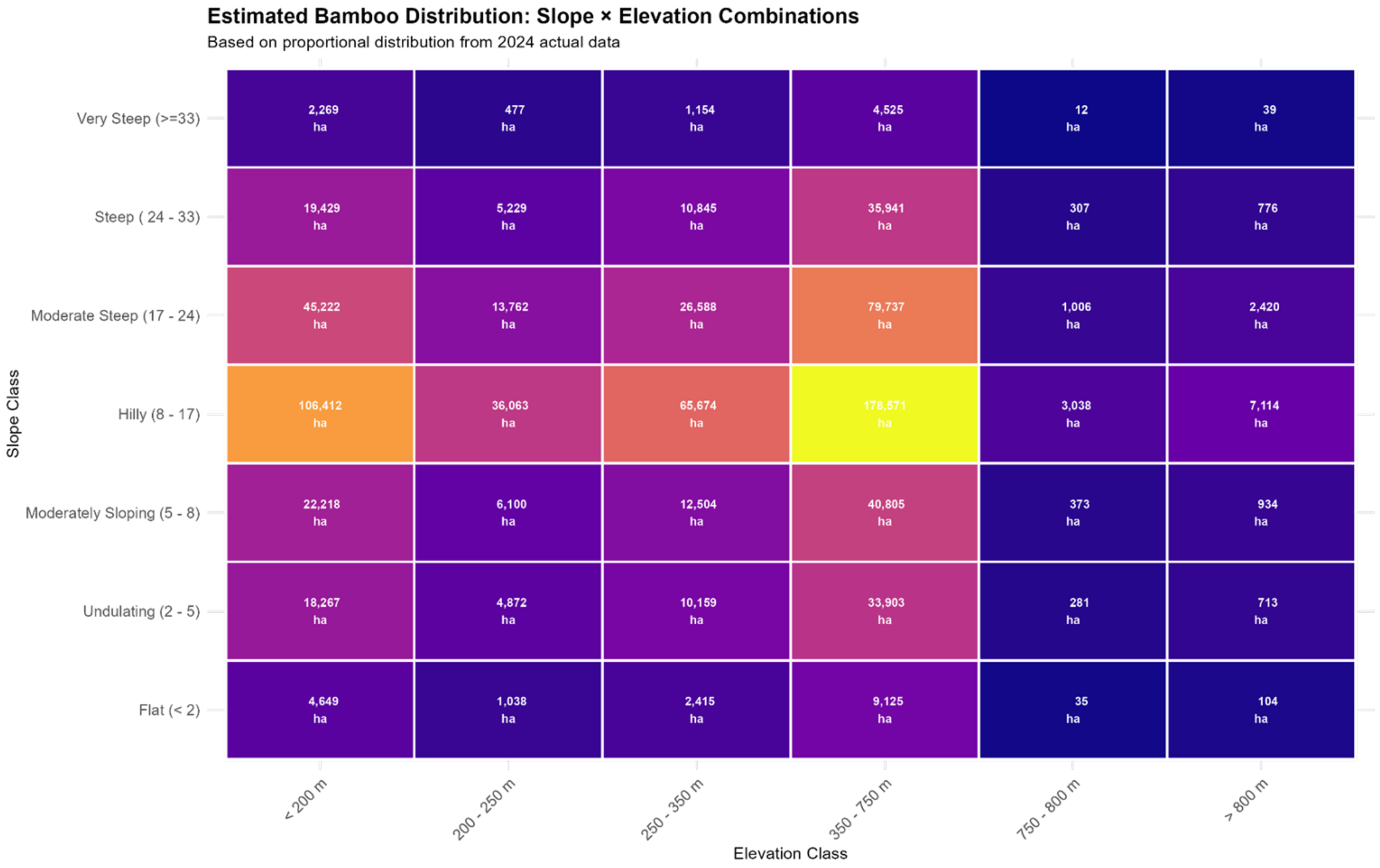
Significant distribution across hilly (28%) and steep (26%) slopes shows bamboo's versatile slope tolerance.

Moderate Conditions

Combined moderate to hilly slopes (5-17°) contain 48.6% of bamboo, indicating preference for intermediate terrain conditions.

Bamboo Area Distribution

Slope and Elevation Combination

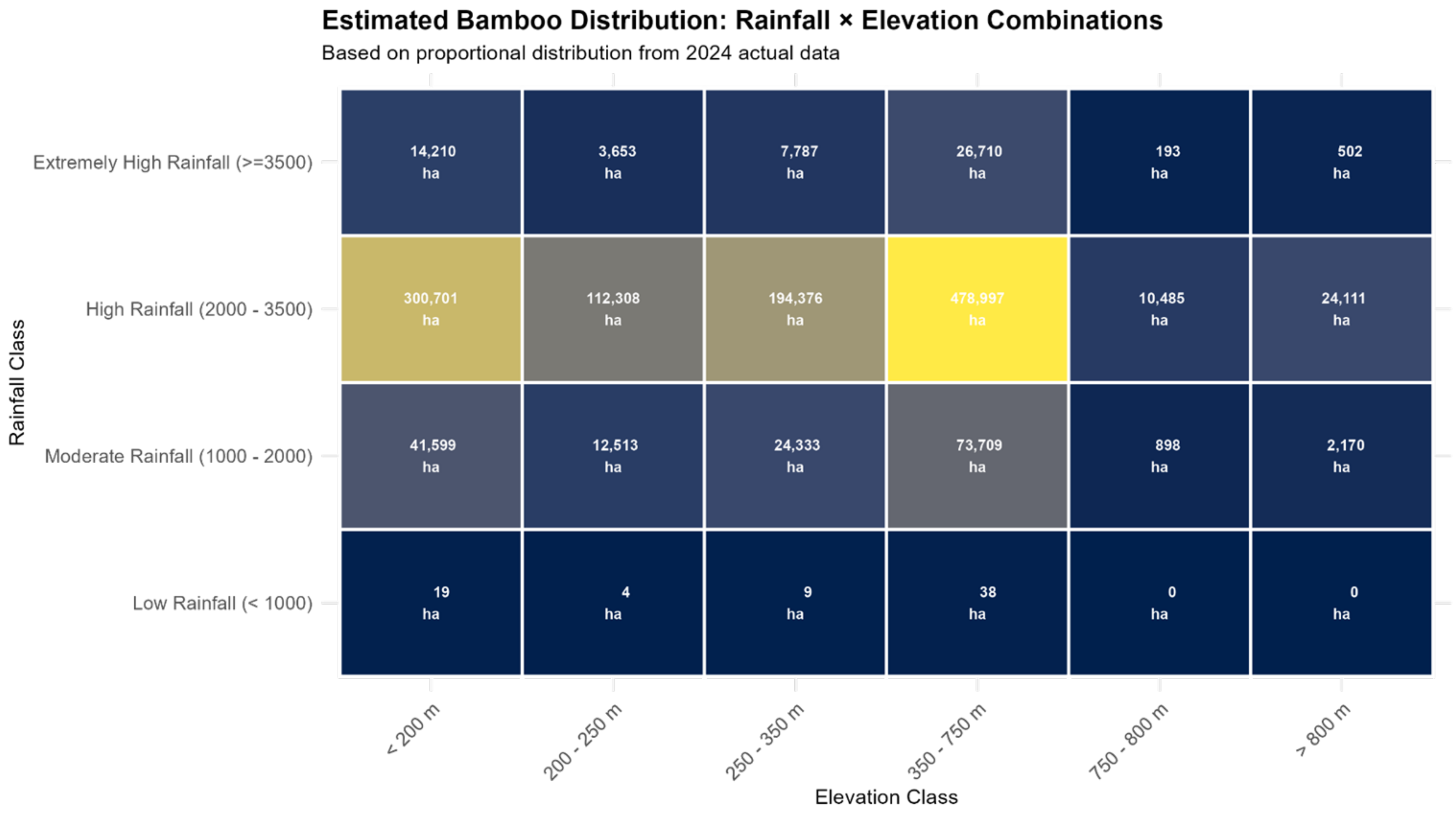


Bamboo Area Distribution

Slope and Rainfall Combination

Bamboo Area Distribution

Elevation and Rainfall Combination



Bamboo Correlation with Rainfall, Slope and Elevation

Major Findings

Optimal Rainfall Pattern:

2000 – 3500mm Annual

▷ High rainfall dominance (70.7%)

▷ Monsoon-dependent cultivation

Favorable Sope Range:

Hilly Terrain (8 - 17°)

▷ Hilly slopes optimal (37.8%)
▷ Moderate steep secondary (21.5%)
▷ Diverse slope utilization
▷ Excellent drainage conditions

Favorable Elevation Spot:

Mid – Elevation (350 – 750m)

▷ Mid-elevation dominance (38.3%)
▷ Low elevation secondary (26.8%)
▷ Temperature optimization
▷ Mountain foothill advantage

Conditions to Avoid

▷ Low rainfall zones (<1000mm)
▷ Very steep slopes (>33°)
▷ High elevations (750-800m+)
▷ Flat terrain in dry areas
▷ Extreme elevation zones
▷ These appear in 90% of poor combinations

Economic Growth Potential

Feasible

▷ **70% of Myanmar's bamboo** falls within accessible slopes (5-17°), making it viable for harvesting

▷ Bamboo industries should focus on **mid-elevation, moderate-sloped and high rainfall regions** to maximize yield while ensuring sustainability

Key Recommendations:

Hilly Terrain Priority

Target hilly areas (8-17°) first, leveraging the 37.8% bamboo concentration. Focus on natural drainage and slope stability for optimal growth.

High Rainfall Optimization

Prioritize high rainfall zones (2000-3500 mm) representing 70.7% of bamboo areas. Develop monsoon management systems.

Mid Elevation Opportunity

Target 350-750m elevation zones for best results. Utilize mountain foothill advantages and temperature optimization.

Diverse Terrain Strategy

Leverage Myanmar's balanced slope distribution. Combine hilly terrain with moderate steep areas for maximum coverage.

Limitation & Future Work

Challenges and Opportunities

Current Limitations

Data Availability

Lack of existing data for bamboo at the national, regional and global level hampers comprehensive analysis and comparison

Training Samples

Insufficient training sample data from NFI for different bamboo species affects species-level classification accuracy

Species Identification

Challenges in species-level identification due to spectral similarities between different bamboo varieties

Ground Validation

Need for more extensive ground truth validation to improve model accuracy and reliability

Future Work

Geographic Expansion

Expand bamboo mapping to other regions and countries across Southeast Asia and beyond

Suitability Mapping

Develop comprehensive bamboo suitability maps for different applications (conservation, harvesting, restoration)

Final Thought

Strategic Resources for Myanmar’s Future

Our mapping reveals that Myanmar's 3.56 million hectares of bamboo represents a strategic resource with high potential for sustainable development, climate action, and economic growth.

More than a Forest Resource

Bamboo transcends traditional forestry - it's a multifunctional ecosystem that provides materials, food, shelter, and environmental services while regenerating rapidly.

A Climate Solution

Carbon absorption, rapid regeneration, bamboo fights deforestation and stabilizes landscapes across Myanmar's diverse terrain.

An Economic Driver

Supporting rural communities and sustainable industries, bamboo creates employment opportunities while promoting environmentally responsible economic growth.

A Resilience Booster

Improving soil and water retention while enhancing ecosystem health, bamboo strengthens Myanmar's resilience against environmental challenges.

Strategic Partnership

Managing bamboo strategically can transform Myanmar's future, creating synergies between conservation, economic development, and climate resilience.

The Path Forward

Myanmar stands at a unique crossroads to protect the environment and grow its economy through strategic bamboo management.

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