Improving Secondary Forest Above-ground Biomass Estimates using GIS-based Model

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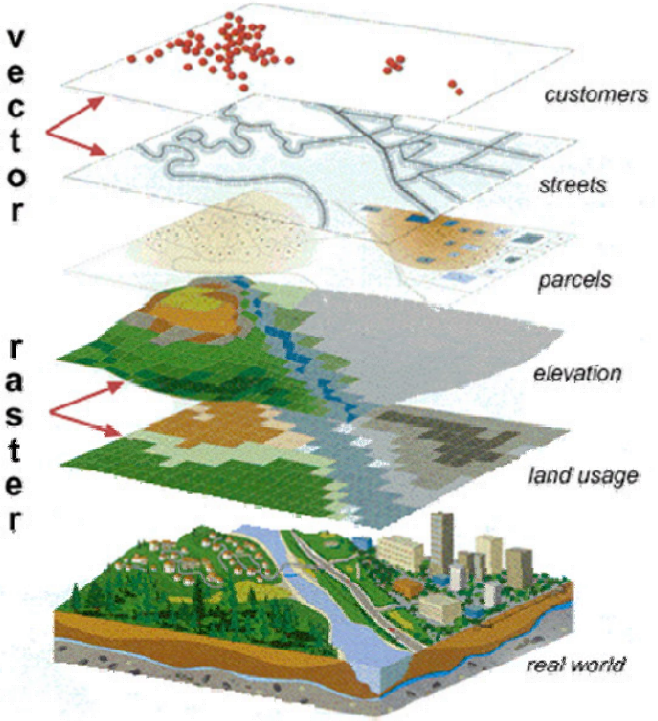
INTRODUCTION

- Secondary forests in the Philippines are scattered across the country, with an estimated forest cover of 2.7 M ha
- These forest areas comprise the largest remaining natural forest type in the country
  - Under severe pressure from human activities
  - Main source of wood and other forest-based resources

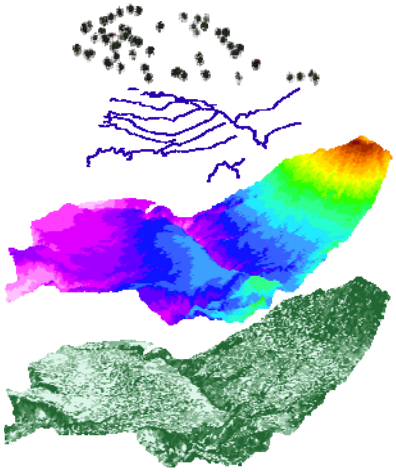
INTRODUCTION

- Data reporting aboveground biomass density of secondary forests has been poor and insufficient to extrapolate biomass estimates to areas where data are lacking.
- GIS technology can provide a means to estimate biomass density for regions with little data because consistent patterns of biomass density frequently result from similar biophysical characteristics in the study area.



OBJECTIVE

Develop a GIS-based model that can be used to predict estimates of aboveground biomass of secondary forests at different locations and environmental conditions in the Philippines.



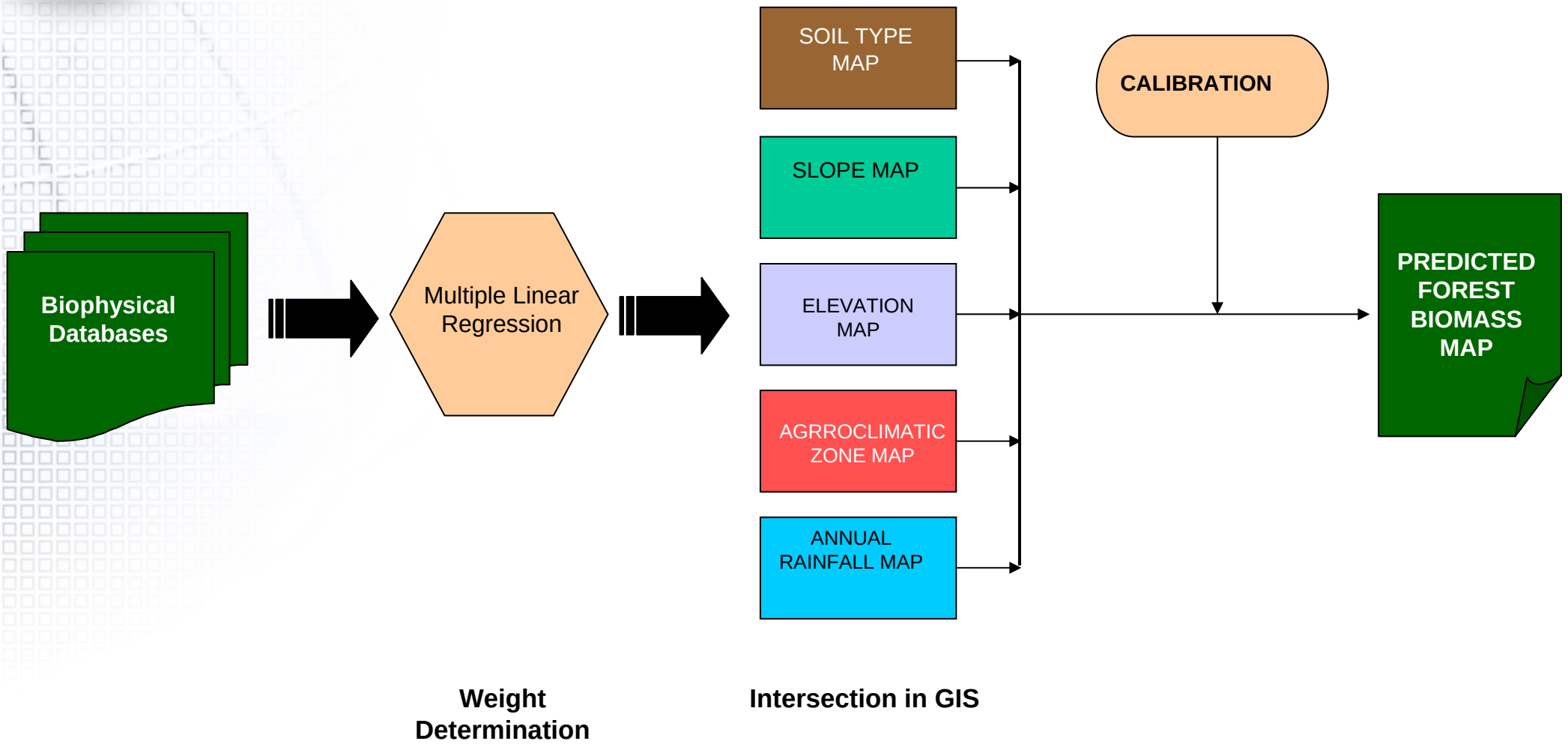
METHODOLOGY

Study area

- Main types of forest vegetation are dipterocarp, mangrove, pine and mossy forests

Philippines

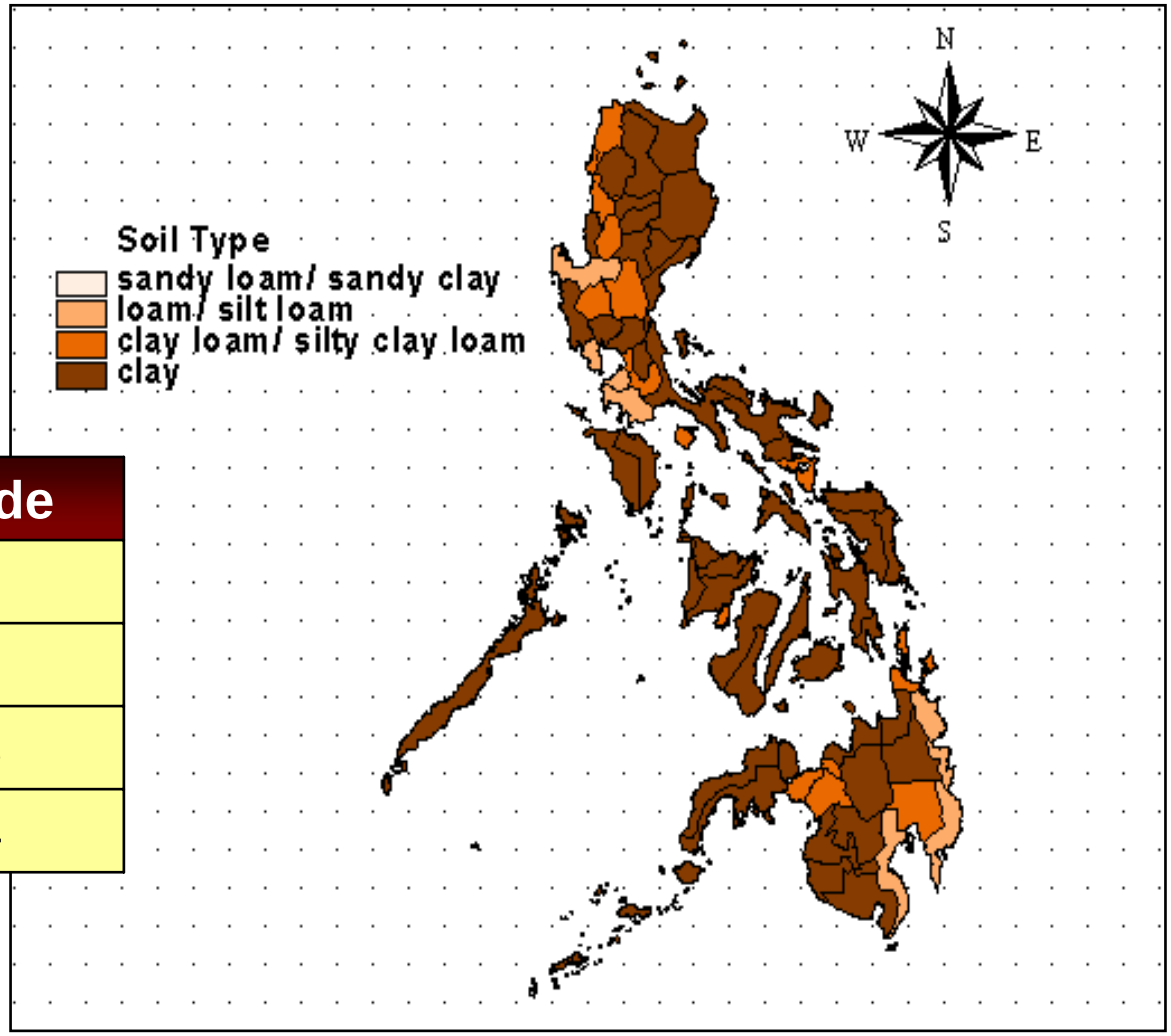
Flow diagram of GIS-modeling approach



RESULTS

Major soil types of remaining secondary forests

Clay (70.7%)
Clay loam and silty clay loam (17.3%)
Loam and silty loam (9.3%)
Sandy loam to sandy clay (2.7%)



Soil type	Code
Sandy loam/ sandy clay	1
Loam/ silt loam	2
Clay loam/ silty clay loam	3
Clay	4

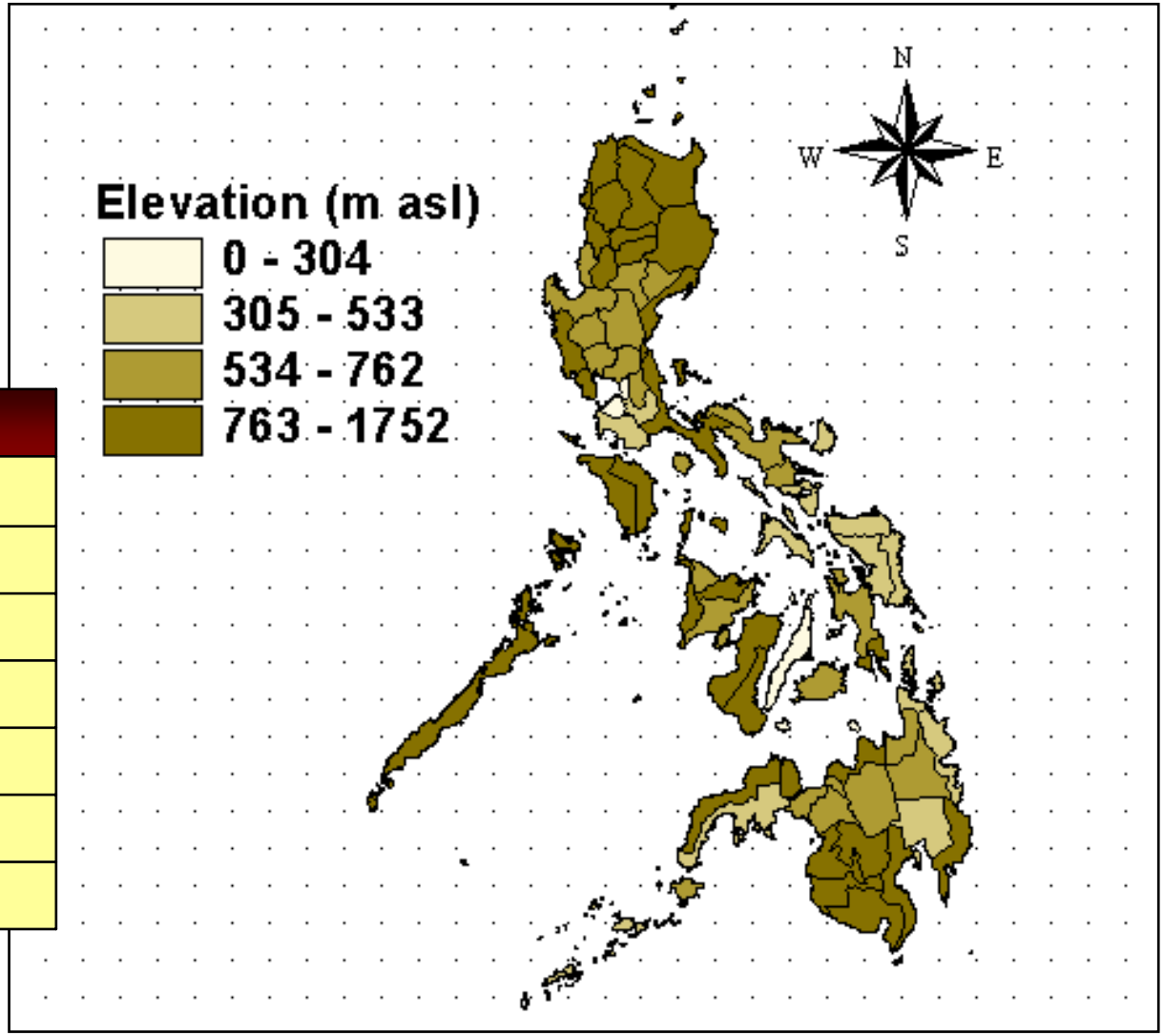
Fernandez and Clar de Jesus, 1980

Major elevation ranges

Majority of forests are in the 700-1100 m asl and few are found in 300-600 m asl and greater than 1500 m asl elevation classes.

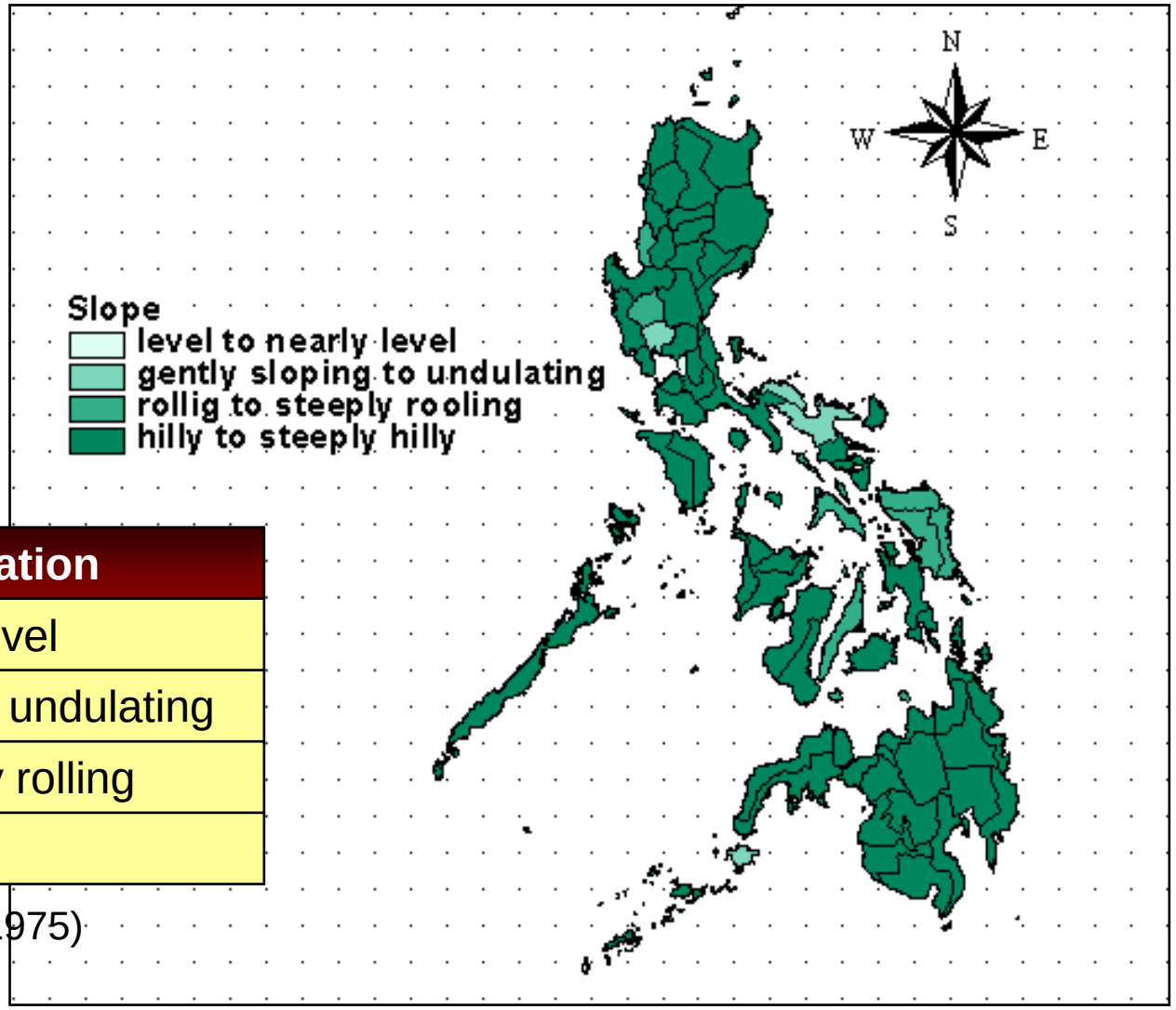
Elevation (meters)	Elevation (feet)
0-151	0-499
152-456	500-1499
457-1066	1500-3499
1067-1523	3500-4999
1524-1980	5000-6499
1981-2437	6500-8000
2438+	8000+

National Mapping and Resource Information Authority (1995)



Major slope distribution

- Fifty-seven percent of the remaining secondary forest areas are found in the 60-65% slope class.
- The remaining 43% is unevenly distributed the 0 to 25% and 45 to 50% slope classes.

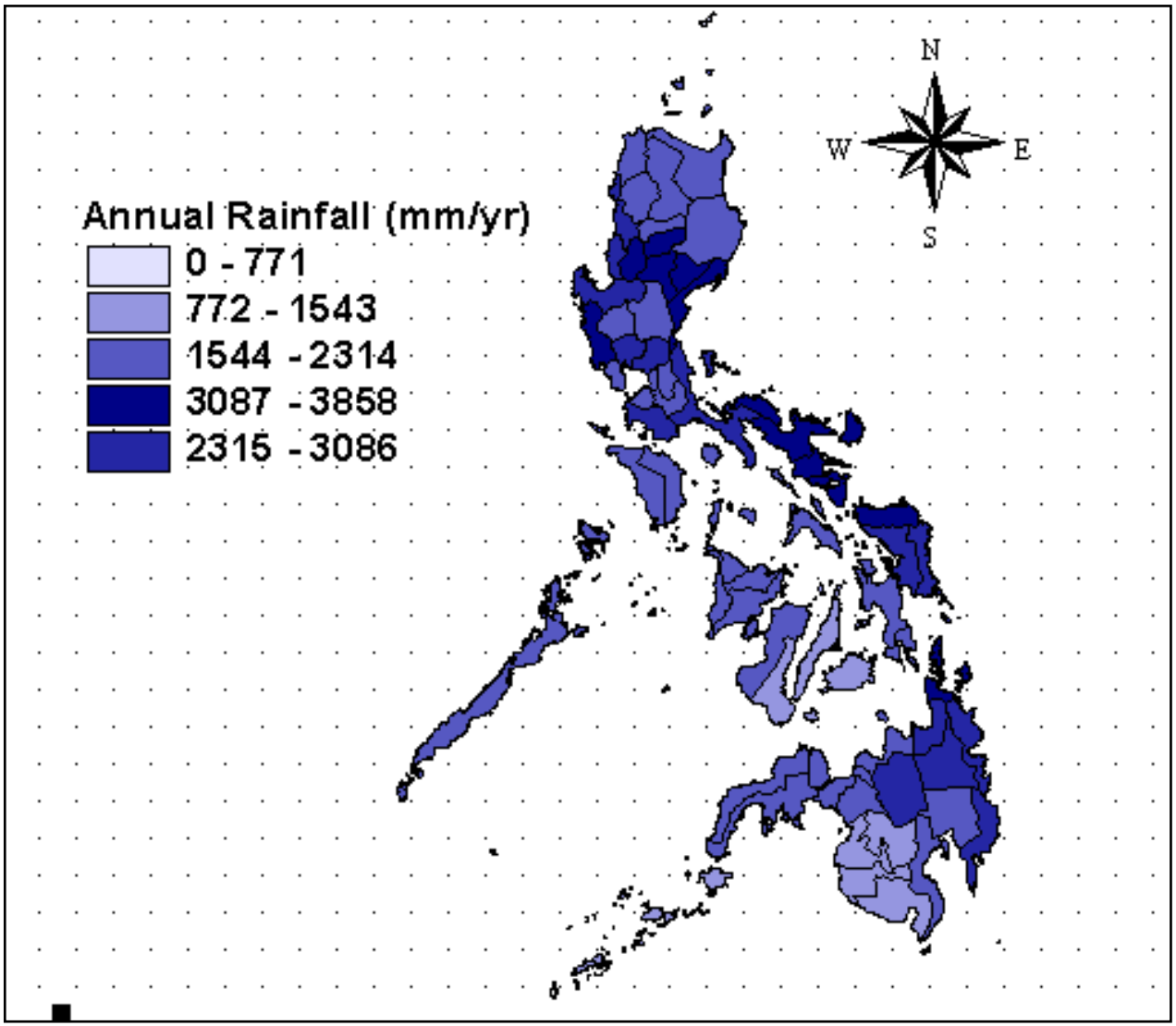


Slope range (%)	Classification
0-3	Level to nearly level
3-15	Gently sloping to undulating
15-30	Rolling to steeply rolling
30-65+	Steeply hilly

Bureau of Soil and Water Management (1975)

Major annual rainfall distribution

Thirty-seven percent of the secondary forests have 2000-2500 mm/yr precipitation, and the remaining proportion are unevenly distributed to greater than 1000 and 4000 mm/yr precipitation values.



Data source: Climatological normals from the Philippine Atmospheric, Geophysical and Astronomical Services Administration (1961-1995)

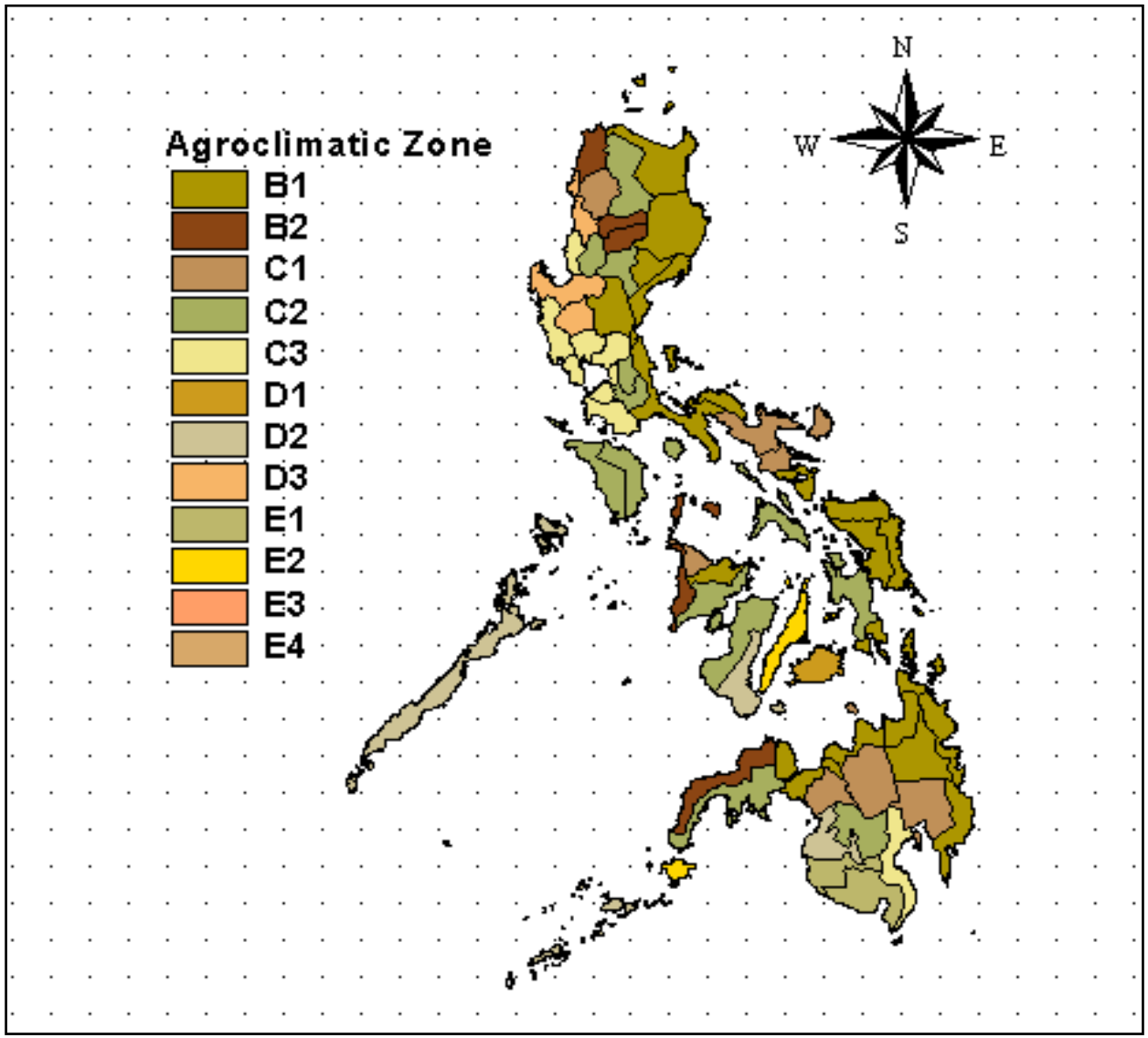
Major agroclimate distribution

Majority of forest areas are under

Climate type B1(less than 2 dry months, 7-9 wet months)

Climate type C2 (2-4 dry months, 5-6 wet months)

Climate type C3 (5-6 wet and dry months)



Data Source: Philippine Atmospheric, Geophysical and Astronomical Services Administration (1990)

Potential biomass

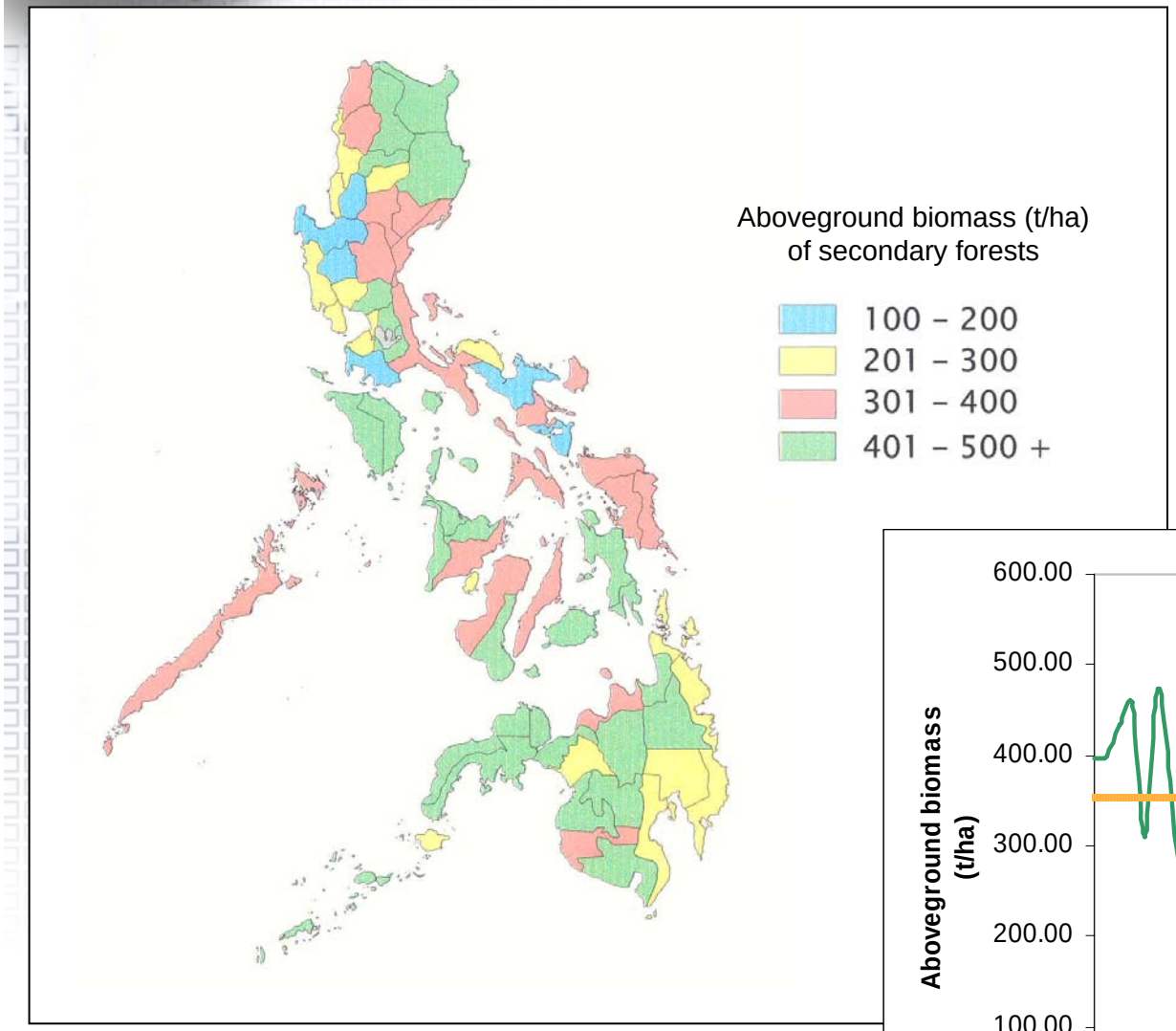
Potential biomass (t/ha) =

Physical factor 1* Weight 1 + Physical factor n…* Weight n…

Physical factor	Weight
Annual rainfall	-0.1033
Climate	17.1668
Elevation	-0.1621
Slope	3.66446
Soil type	108.244

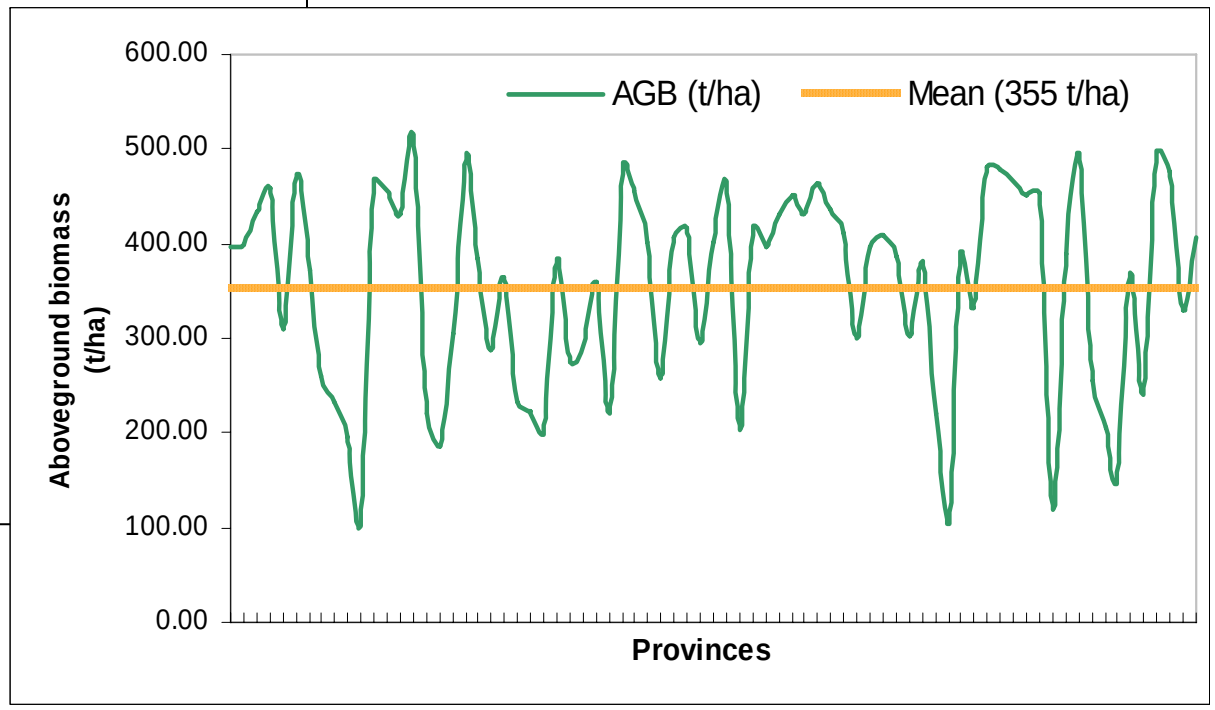
Data sources: Lasco et al, (2001); Guillermo (1998); Racelis (2000)

Potential aboveground biomass

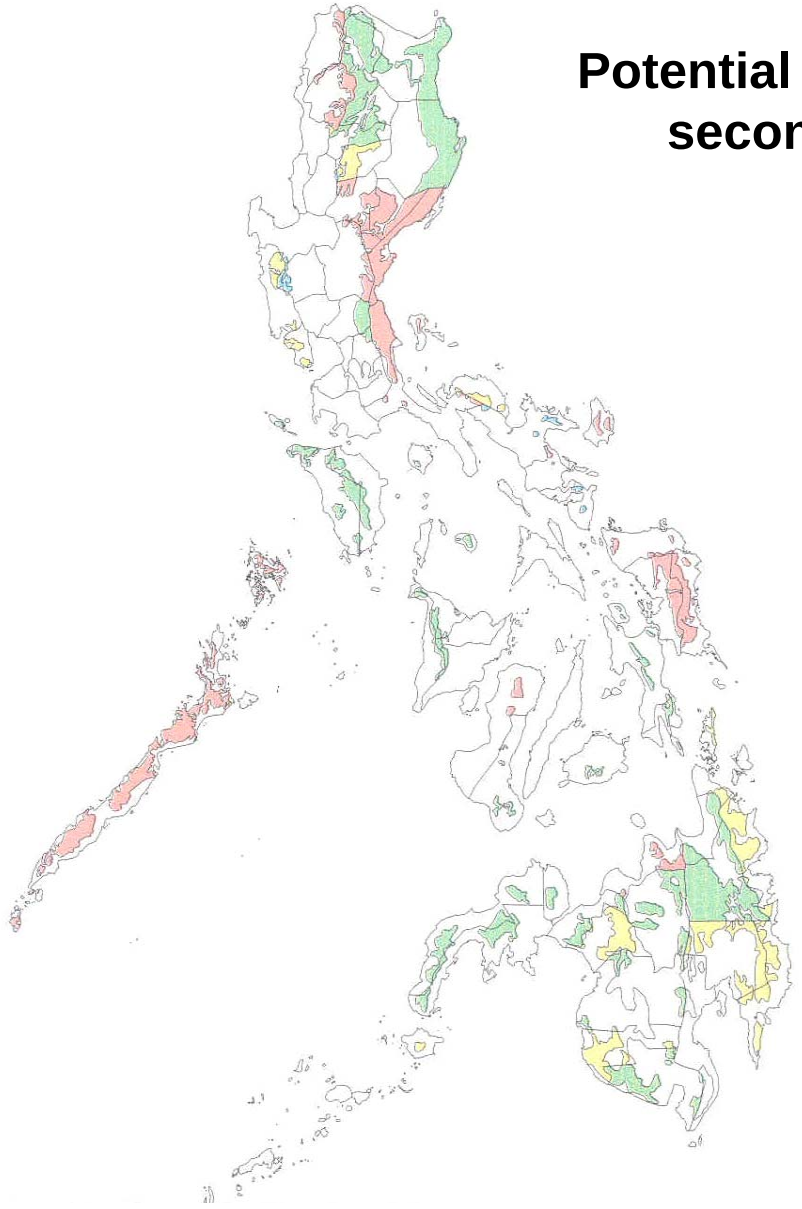


Potential aboveground biomass (t/ha) of secondary forests per province in the Philippines

Mean = 355.46 t/ha
n= 75 provinces
Range = 107.91 to 511.56 t/ha



Potential aboveground biomass (t/ha) of remaining secondary forests in the Philippines (1996)



Aboveground biomass (t/ha) of secondary forests

- Non-forested Area
- 100 – 200
- 201 – 300
- 301 – 400
- 401 – 500 +

1996 Land Use Map provided by the National Mapping and Resource Information Authority (NAMRIA)

Aboveground biomass computation

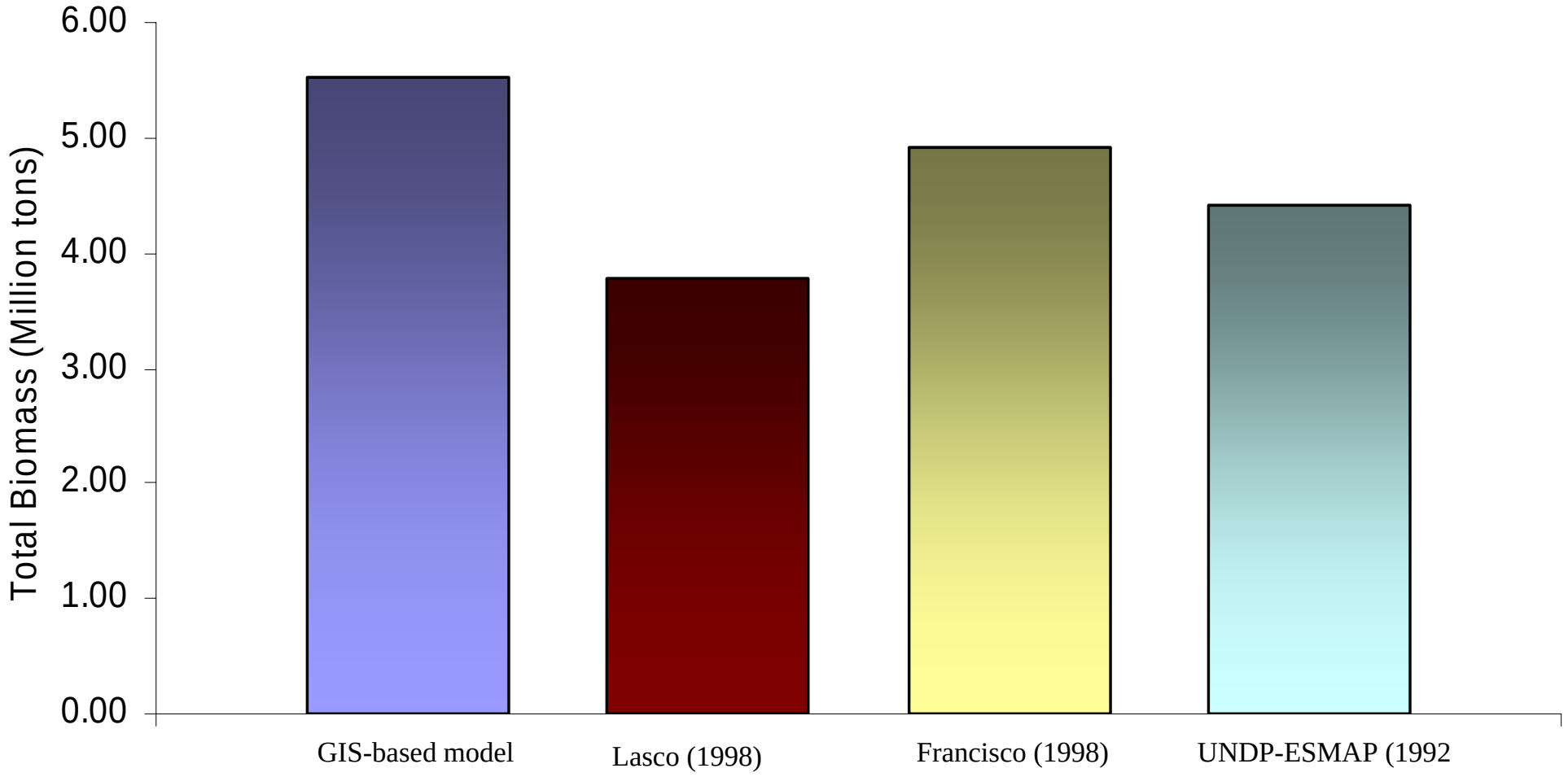
Computation of the aboveground biomass of secondary forests:

1. Biomass density (t/ha) **x** forest area per province
   = Total biomass/province

2. Total aboveground biomass in secondary forests
   = Σ Total biomass/province

Author	Biomass density (t/ha)
Lasco (1998)	258
Francisco (1998)	335
UNDP-ESMAP(1992)	300
GIS-based model	Province-specific values (100-500 t/ha)

Comparison of the total aboveground biomass in secondary forest (million tons) in the Philippines using biomass density values reported by different authors using IPCC default values and using the GIS-based model.



CONCLUSIONS

Use of GIS approach can:

- Reduce the uncertainty in estimates of aboveground biomass;
- Improve the quality of biomass estimates;
- Predict more accurate biomass estimates at different locations and environmental conditions; and
- Improve the computations for C stocks and preparation of national GHG inventory report

RECOMMENDATION

Improvements to this approach can be achieved:

- Further research on other factors that influence biomass production in forests and that should be included in future estimates;
- Enhancing the resolution of input maps;
- Incorporation of more recent GIS techniques as the technology; and
- Advances to reduce variability of biomass estimates at the local level.

THANK YOU!!!

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