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## OBJECTIVES

- DEVELOP A DATABASE ON BIOMASS, AEs FOR BIOMASS ESTIMATION IN VIETNAM;
- DEVELOP AEs FOR ESTIMATING BIOMASS OF EVERGREEN BROADLEAF, DECIDUOUS AND BAMBOO FORESTS IN CENTRAL HIGHLANDS, VIETNAM



## APPROACH

- LITERATURE REVIEWS ON ALLOMETRIC EQUATIONS AND BIOMASS INTERNATIONALLY AND NATIONALLY;
- DEVELOPED A GUIDELINE ON DESTRUCTIVE MEASUREMENT;
- GROUP DISCUSSION; EXPERT DISCUSSION AND TRAININGS ON THE DEVELOPMENT OF AEs;
- COOPERATION BETWEEN RESEARCH INSTITUTES AND UNIVERSITIES.

## METHODOLOGY – SAMPLING DESIGN

- CHOSE RESEARCH SITES (SURVEY - HIGH REPRESENTATIVE);
- SAMPLING PLOT SIZE (1 HECTARE).



### METHODOLOGY – DATA COLLECTION (1)

- ❑ SITE DESCRIPTION: SLOPE, SOIL TYPE, SOIL CHARACTERISTICS, CO-ORDINATE.....;
- ❑ TREE LABELLING AND TREE IDENTIFICATION;
- ❑ MEASURED DBH OF TREES (> 5 CM FOR WOODY SPECIES, > 2 CM FOR BAMBOO SPECIES);
- ❑ DIVIDED TREES INTO DIFFERENT DBH CLASSES, THEN CALCULATE IMPORTANT VALUE (IV).
- ❑ BASED ON N-G AND N-D DISTRIBUTION AND IV TO DETERMINE SAMPLE TREES.



### METHODOLOGY – DATA ANALYSIS (3)

- ❑ Laboratory analysis: dried at 105°C, until no change in sample biomass → water content → Dried biomass; wood density
- ❑ Data and allometric analysis: Excell, SPSS and SAS
- ❑ Tested allometric equations developed to choose optimal ones.

### TRAININGS FOR AEs DEVELOPMENT (1)

- Location: Supported by FAO, in Hanoi and Binh Thuan province.
- How to use SAS for developing linear and non-linear allometric equations;
- Main criteria for choosing the best equation: r correlation coefficient; results of Student and Fisher test; Correction Factor (CF) and Akaike Information Criterion (AIC);
- Discussed with international and national experts on gaps, future needs, constraints ... for further development of AEs.

### TRAININGS (2) – MAIN ISSUES IN AEs DEVELOPMENT

- ❑ TREE IDENTIFICATION (A LARGER NUMBER OF ECO-REGIONS, TREE SPECIES...)
- ❑ DATA COLLECTION (REACHING RESEARCH SITES, SLOPE, BIG TREES...→ DIFFICULT TO WEIGH)
- ❑ WHAT'S A GOOD SITE FOR DATA COLLECTION?, WHICH DEPENDS ON EXPERT EXPERIENCES.
- ❑ HIGH COST FOR DATA COLLECTION

### MAIN RESULTS ON AEs

#### Evergreen broadleaf forests:

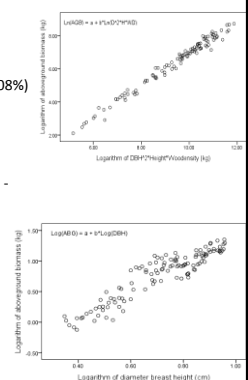
$$\ln(\text{AGB}) = -2.76 + 0.97 \cdot \ln(\text{D}^2 \cdot \text{H} \cdot \text{WD}) \quad (\pm 5.08\%)$$

#### Deciduous forests:

$$\ln(\text{AGB}) = 5.6 - 6.85 \cdot \ln(\text{DBH}) + 3.52 \cdot (\ln(\text{DBH}))^2 - 0.43 \cdot (\ln(\text{DBH}))^3 - 0.046 \quad (\pm 6.63\%)$$

#### Bamboo forests:

$$\text{Log}(\text{AGB}) = -0.77 + 2.16 \cdot \text{Log}(\text{DBH})$$



## LESSONS LEARNED

- ❑ DATA STRATIFICATION AND FILTERING WAS IMPORTANT
- ❑ SAMPLING DESIGNERS SHOULD BE EXPERIENCED EXPERTS
- ❑ NUMBER OF TREES FOR ASSESSING NEW AEs SHOULD BE INCREASED FOR ACCURACY; LACK METHODS FOR DETERMINING HOW MANY TREES FOR ASSESSMENT ARE ENOUGH?
- ❑ AKAIKE INFORMATION CRITERION (AIC) WAS THE MOST IMPORTANT VALUE FOR CHOOSING OPTIMAL EQUATIONS
- ❑ ACCURACY OF AEs DEPENDED ON VARIOUS FACTORS, NOT SOFTWARES WE USED FOR AEs DEVELOPMENT.

THANK YOU SO MUCH FOR YOUR ATTENTION

