Semi-destructive Method for the Development of Biomass Allometric Equation in Bangladesh

BACKGROUND

Development of allometric equations for biomass estimation requires extensive planning, field works, sample analysis in the laboratory, and data analysis. These field activities are mostly destructive, difficult and expensive to repeat. Sometimes, this destructive method of biomass measurement is not possible for the countries like Bangladesh where moratorium has given on felling of trees from the forest areas. Development of allometric equation using semi-destructive method involves trimming of some smaller branches (diameter < 7 cm) and measurement of base diameter of both trimmed and untrimmed branches. Biomass of bole and bigger branches (diameter > 7 cm) are measured from their volume and wood density. Semi-destructive method for the development of allometric equation contains seven steps from planning to final equation and the steps are as follow:

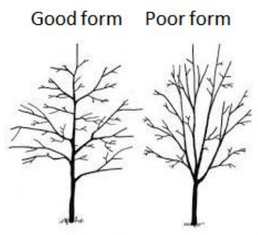
Step 1: Preparation of the field work

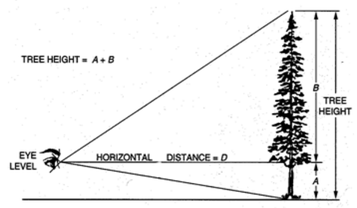
- Well trained field crews
- Required tools and materials

- Sampling scheme
  - Consider the Forest types, range and mean DBH, Girth, Total Height and the final objective.
  - Sample number is the tradeoff among precision, time and budget

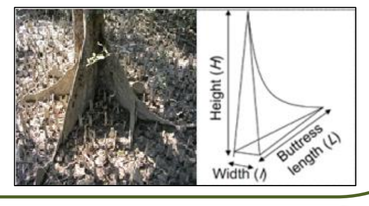
Step 2: Field measurement I

- Selection of individual tree
  - Sample tree with good form



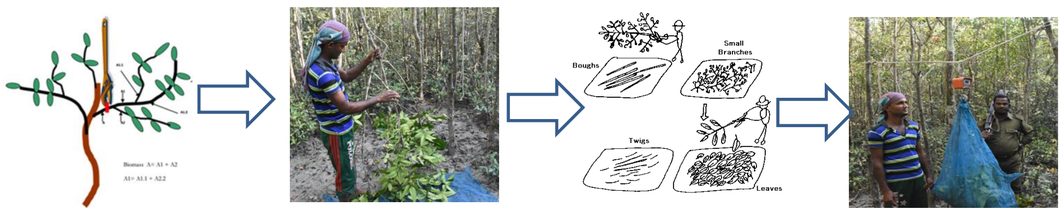


- Measurement of a standing tree
  - Measure diameter at 0.3 m and DBH
  - Height measurement
  - Measurement of buttress

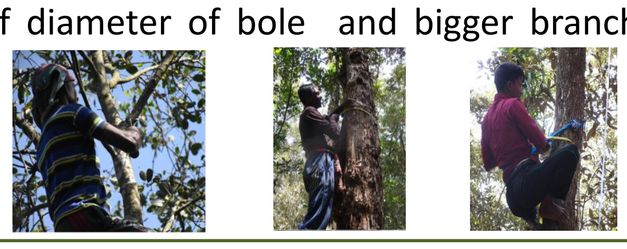


Step 3: Field measurement II

- Trimming of smaller branches (diameter < 7 cm) and separate into leaves, leaf containing smaller branches (LSB) and woody branches and record the fresh biomass



- Measure base diameter of all smaller branches
- Measurement of diameter of bole and bigger branches (> 7 cm) section



Step 4: Field measurement III

- Take sub-samples to measure the ratio of fresh weight of leaf and LSB

- Take sub-sampling to calculate fresh to oven-dry weight conversion ratio
- Wood density
  - Wood density samples can be collected from field or wood density value can be collected form secondary sources

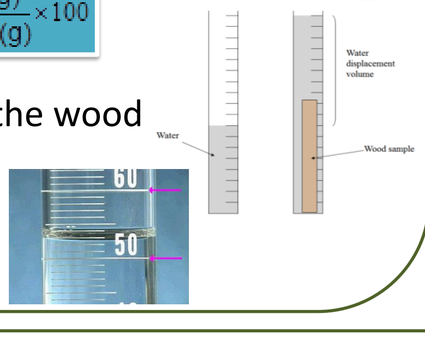
Step 5: Laboratory analysis

- Oven-dry the sub-samples at 105 ^{o}C until constant weight
- Organic carbon concentration in plant samples can be determined by ignition method at 450 ^{o} C

Loss on ignition (%) = $\frac{\text{Loss of weight (g)}}{\text{Oven dry weight (g)}} \times 100$

- Following formula is used to estimate the wood

Wood density (kg/m^3) = $\frac{\text{Sample weight}}{\text{Sample volume}}$



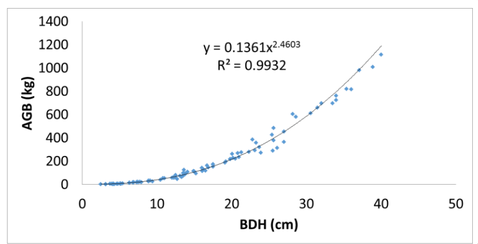
Step 6: Data compilation

- Log biomass (kg) = Log volume (m^3) X Wood density (kg/m^3) is used to calculate the biomass of bole and bigger branch
- Oven-dry biomass of trimmed branches is estimated from conversion factor of fresh to oven-dry weight
- Branch allometric equation are developed to estimate the biomass of untrimmed branches

Step 7: Selection of best fit equation

- The best fit regression equations were selected considering the lowest value of Akaike's information criterion (AIC), Furnival Index (FI), Root mean square error (Rmse), Mean square error (MSerror), and highest value of the Coefficient of determination (R^2)

Final output



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