



Modeling Growth of Chinese Tallow (*Triadica sebifera*) in Oak-Gum-Cypress Forest in Southern Mississippi



Nana Tian, Graduate Research Assistant, Zhaofei Fan, Assistant Professor,
Department of Forestry, Mississippi State University

Introduction:

Chinese tallow tree (*Triadica sebifera* (L.) Small, *Sapium sebiferum* (L.) Roxb) is a monoecious and deciduous tree, native to central and southern China. As a nonnative invasive tree species, it has aggressively invaded forestlands in southeastern United States, particularly the low- and bottom-land forests along the Gulf Coast of Mexico. This study, on the basis of a destructive sample of 11 tallow trees collected from a bottomland Oak-Gum-Cypress forest in southern Mississippi, developed a group of individual tree level models to reflect the growth of diameter, total height and standing volume/biomass (dry weight) with age for Chinese tallow. Moreover, we used the destructive sample data to fit a taper equation and explore allometric relationships between diameter, total height and standing volume/biomass of Chinese tallow. These results are useful to estimate and compare competition potential and establishment rate of tallow trees relative to other native trees threatened by its invasion and rapid establishment. Resource managers could use this information to design efficient treatments to control and mitigate further invasion of tallow.

Materials and Methods:

Eleven sample tallow trees were selected from a bottomland Oak-Gum-Cypress forest in southern Mississippi for data collection.

Destructive field measurement:

- (1) Measure total height and diameter at breast height (DBH) of the sample tree;
- (2) Fell the tree at about 0.5 feet stump position and clear branches;
- (3) Divide stem into 3 feet length sections and extracted disks from the middle of each of these sections (Figure 1); and
- (4) Measure diameter outside and inside bark (DOB and DIB) at upper and lower end of each section and disks. All disks were brought back to lab for further measurement and analysis.

Lab data analysis and modeling:

- (1) Measure disk fresh weight with and without bark use a digital scale;
- (2) Measure disk volume by immersing it into a (15 x 30 x 35 cm) container with water (based on Archimedes Principle);
- (3) Count rings on sanded disk to determine (see picture of disks) age;
- (4) Dry disks in an oven for 24 hours (at 120°C) to weigh dry weight;

The relationships of DBH-age, total height-age, standing volume-age and DBH-total height were fitted using SAS, and stem taper equation was fitted using the T-profile software.

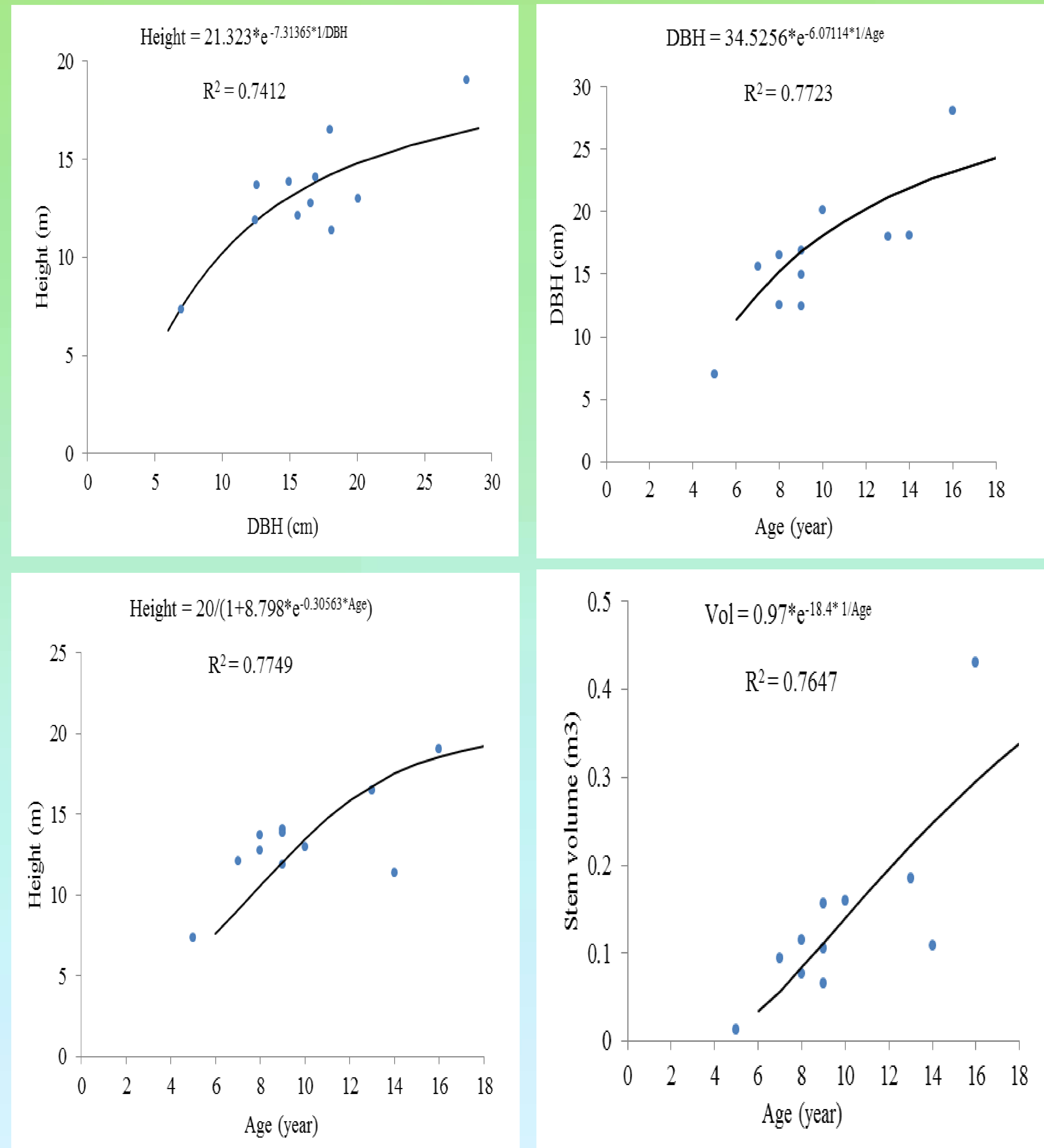


Figure 2. Fitted models of Height-DBH, DBH-Age, Height-Age and Volume-Age of tallow trees.

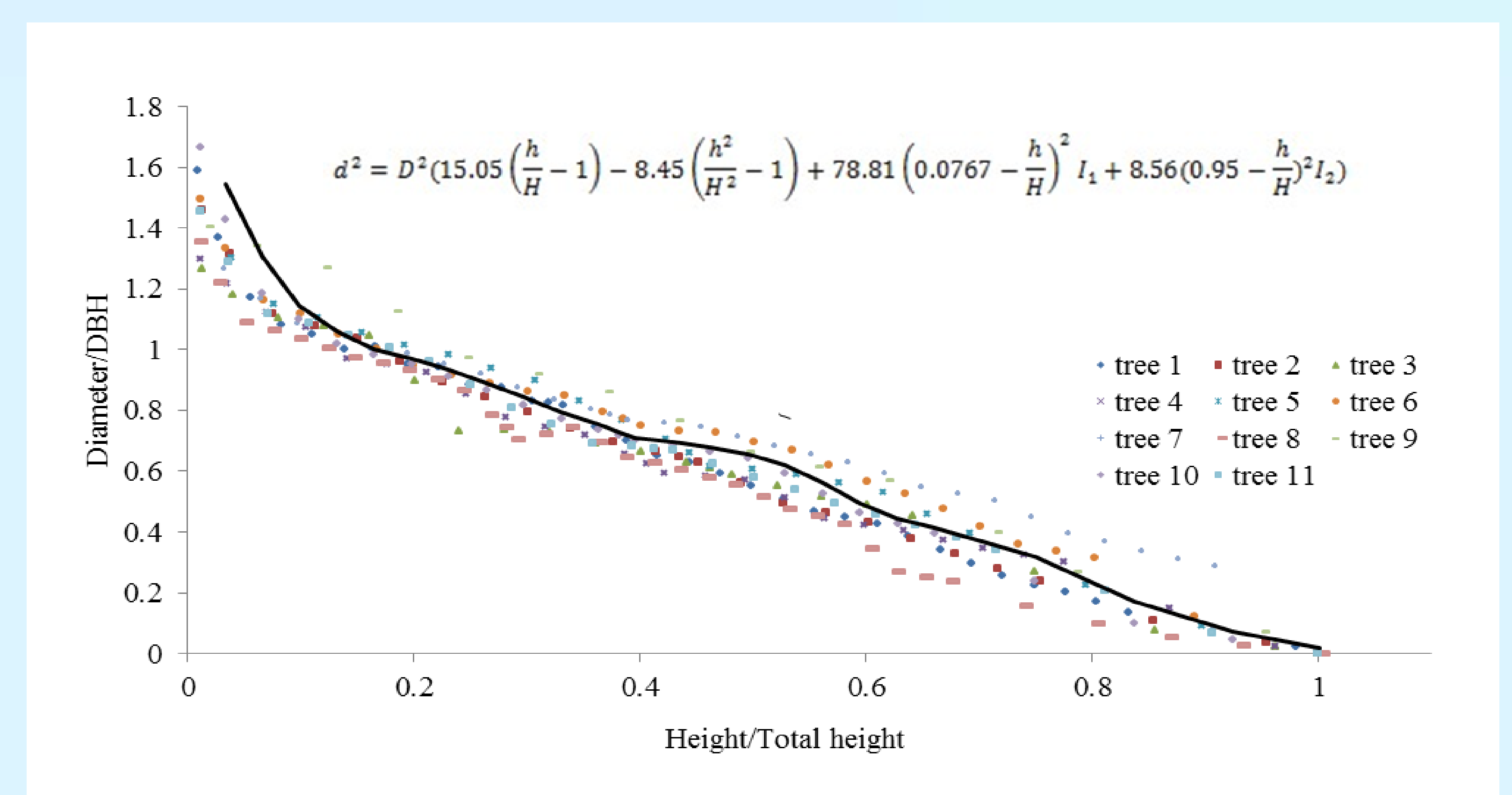


Figure 3. Fitted stem taper equation of tallow trees.

Conclusions:

Tallow has severely invaded coast forest lands which is a serious threat to forest health. Fast growth make it a aggressive competitor to many native tree species. Compared our results (growth models) with growth data for many native species, coastal forests, particularly low- and bottom-land forests are much vulnerable as more tallows colonize and establish based on the fact that tallow can grow in an equal rate or faster than most native species. To evaluate tallow's competition ability and invasiveness of different forest communities, estimation of tallow's growth under various site and environmental conditions will be needed in future studies.

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References:

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Results and discussion:

The DBH-age, biomass-age and total height-DBH relationships could be quantified by exponential regression models, while the total height-age relationship was expressed by Logistic regression model. Based on fitted regression models, a 16-year tallow tree, on average, can reach up to 25 cm (10 inch) in DBH, 18 m (63 ft) in total height, and 0.3 m³ (10 ft³) in stem volume. This growth rate is comparable to American sycamore (*Platanus occidentalis*), a commonly found bottomland species. Tallow's growth rate is an important parameter to estimate its colonizing and establishing potential in different forest types.

