Measuring Baldcypress Tree Height Using Pictometry® Hyperspatial Multispectral Imagery

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Abstract

Tree height is a critical component of forest inventory assessment and estimating the height of trees has been a mainstay in forest inventory assessments for decades. Although estimating tree height in situ is relatively straightforward, the ability to estimate tree height for multiple individual trees or stands of trees over remote and expansive areas can be time consuming and expensive. The aim of this project was to ascertain if Pictometry® estimated tree height could be used in lieu of field-based tree height estimation. A linear correlation coefficient (r) between actual baldcypress tree height and Pictometry® estimated baldcypress tree height for 60 trees was 0.999. Results indicate that Pictometry® estimated tree height can be used in lieu of field-based tree height estimation for open grown baldcypress urban forests.

Keywords: Pictometry®, hyperspatial, accuracy, tree height, baldcypress

Introduction

Tree height is a critical component of any forest inventory assessment. Estimating the height of trees has been a mainstay in forest inventory assessments for decades (Avery and Burkhart 1994). When performing a forest stand assessment the height of an individual tree, or average height of a stand of trees, is required to assess tree age (Monserud 1984), estimate volume...
Numerous methods to estimate tree height have been developed and proven successful. Traditionally, estimating tree height for an open grown individual tree or average height of a stand of trees has been estimated with a clinometer (Williams et al. 1994). In addition, remotely sensed imagery via a stereoscopic pair of aerial photographs has proven successful in estimating tree heights by measuring parallax displacement (Paine 1981). More recently, with the advent of newer technology, Lidar data have been used to measure the height and elevation of the landscape’s physical attributes (Maltamo et al. 2006). Pictometry® high spatial resolution data, which represents remotely sensed image data collected from up to 12 oblique perspectives, depicts the front and sides of vertical features (Jurisch and Mountain 2008). The ability to measure the size and position of objects on the earth’s surface with Pictometry® data has the potential to revolutionize tree height estimation.

This study evaluated the use of Pictometry® hyperspatial 4-inch (10.2 centimeters) multispectral imagery described by Dailey (2008) to estimate the height of baldcypress trees on the campus of Stephen F. Austin State University (SFASU), Nacogdoches, Texas by deriving the linear correlation coefficient between actual tree height and Pictometry® estimated tree height for 60 trees.

Methods

This study evaluated the use of Pictometry® hyperspatial 4-inch (10.2 centimeters) multispectral imagery to estimate the height of baldcypress trees on the campus of SFASU, Nacogdoches, Texas. The heights of 60 baldcypress trees along the banks of LaNa Creek in Nacogdoches, Texas, chosen for their proximity to LaNa Creek and open grown location, were measured with a telescopic height pole in 2.54 centimeter increments (1 inch increments). The heights of all 60 baldcypress trees were measured onscreen using Pictometry® oblique hyperspatial 4-inch (10.2 centimeters) multispectral imagery via the Pictometry® patented Internet-based interface. A linear correlation coefficient between actual tree height and Pictometry® estimated height for all 60 trees was calculated.

Results and Conclusion

There was minimal difference between actual tree height and Pictometry® estimated tree height. Mean actual tree height for all 60 trees was 7.07 meters. Mean Pictometry® estimate tree height for all 60 trees was 7.10 meters. A linear correlation coefficient between actual tree height and Pictometry® estimated height for all 60 trees ($r = 0.999$) indicating that actual tree height was highly correlated with Pictometry® estimated tree height. Remote sensing with its ability to collect data systematically over large geographic areas has the potential to aid field-based tree height estimation within an urban setting. The integration of hyperspatial resolution multispectral data into an Internet-based interface was effective at estimating tree height proved to be highly accurate. Estimating height of open grown urban trees using Pictometry® hyperspatial 4-inch (10.2 centimeters) multispectral oblique imagery on-screen via an Internet-based interface could be used to supplement or replace time consuming field-based tree height estimation.
References