Volume predictions for natural vegetation and *Eucalyptus* plantations in savanna ecosystems with field observations and Landsat multitemporal imagery in Brazil

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**ABSTRACT**

Accurate information on vegetation structure and timber production in Brazil is fundamental for the definition of strategies for both natural and planted forest resource management over time. Traditional methods of vegetation assessment rely on standardized forest inventory methods using fixed area plot sampling, which is expensive and time-consuming to implement. In addition, the resulting forest estimates are extrapolated across the large, heterogeneous vegetation with little reference to natural heterogeneity related to soils, topography and disturbance patterns. Thus, the combination of remote sensing information with field data has been used to fill the information gap left by the data collected only in the field. Therefore, the aim of this study was modelling and predicting volume for natural savanna vegetation and *Eucalyptus* plantations through integration of forest inventory data and remote sensing imagery. In the northern region of Minas Gerais state, Brazil, savanna ecosystems are characterized by natural shrubs and trees and are surrounded by *Eucalyptus* plantations established with variable densities associated with different soil conditions and managed for timber production on short rotations (5 to 7 years). Natural savanna areas may have more than 30% crown cover and a continuous herbaceous ground layer; *Eucalyptus* plantations have higher total volume as a result of management practices to achieve higher basal area, volume and stem density. The forest inventory was carried out in a sample of 20 *Eucalyptus* stands in 2006-2010 (annually) whereas in natural savanna areas the field data was collected on 40 plots in 2005. Volume estimates ranged from approximately 32 to 276 m³/ha in *Eucalyptus* plantations, and from 3 to 104 m³/ha in natural savanna vegetation. These sample sites were then processed in a multiple linear regression modelling approach with radiometrically- and geometrically-corrected multitemporal LEDAPS Landsat TM imagery acquired for each year (USGS database). The best multiple linear regression models that utilized forest inventory and Landsat spectral information provided good estimates of volume when compared to estimates developed from an independent sample. For each volume model, the Root Mean Square Error (RMSE) was less than 30m³/ha; a similar pattern of error was noted when the Landsat spectral estimates were compared to the use of forest inventory data alone. The overall interpretation of these results is consistent with results reported elsewhere in natural savanna ecosystems and *Eucalyptus* plantations in Mexico and elsewhere in Brazil. The results of this study support the development of an operational capability to use Landsat-based multiple linear regression models to predict volume for forest management planning in savanna ecosystem and *Eucalyptus* plantations in Brazil.