The abstract of the Ph.D. thesis

a) General information:

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Name of the thesis: The scientific and practical basis development to monitor CO_2 sequestration of the evergreen broadleaf forest in the Central Highlands.

Agricultural Ph.D Thesis, Major: silviculture.

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b) The contents of compendium

i) The research purpose and object of the thesis: Contributing to a theoretical basis aiming at building models of biometrics for estimating biomass, carbon of forest trees and stands; Building methods to describe the structure and estimation of biomass, stand carbon; Providing methods for monitoring CO_2 sequestration by remote sensing and GIS technology. *Research objects*: evergreen broadleaf forest types including forest conditions which are very rich, rich, medium, and poor. Forest conditions were formed by the impactive level of selective harvest and different recovery time. In general, forests were selectively exploited and recovered in some degree, only a few or no forest conditions were significantly affected. General studies for the species and for some of common plants in forest stands; Tree biomass and forest carbon: Including in 5 parts (stem, branches, leaves, bark and roots); Forest biomass and stand carbon: Including biomass and carbon in 5 pools of the forest in IPCC (2006).

ii) *Research Methodology*: Applying the IPCC (2006) to study measuring and monitoring CO_2 sequestration and emission from the forest; in which there were two groups of data to be studied: i) Area variation, forest quality and ii) Variation in 5 carbon pools in forest stands; The first data group is approached by using remote sensing and GIS technology. Well-supported remote sensing for monitoring forest area changes; Also with the point between remote sensing data and biomass relationships, so building relationship models between biomass, forest carbon with remote sensing indicators will be the basis for indirectly estimating forest carbon change over space and time on a large scale; The second data set is based on approaching biometric models and biostatistics to estimate biomass, carbon in pools indirectly through the investigation factors easily measured. To build biometric models needs to directly measure biomass, forest carbon through samlpe trees; on that basis formulating the biometric models for each part of trees, pools in stands. From here codified to establish technology solutions in monitoring estimated CO_2 sequestration and emissions from forest over space and time.

iii) The main results and conclusions:

1. Scientific basis of building optimal allometric equation :

Selecting variables to participate in models : Use the criteria of Mallow 's Cp to select the best variable for biometric pattern; *Method of model estimation* : Using the least square method without weights, coefficient model for determining high and low variation; *Selecting of the appropriate function* : Based on 7 synthetic criteria with the

order of priority is the smallest value of S%, because it reflects the difference between the observed and estimated through the smallest function; The next priority AICmin criteria and CF = 1; R^2_{adj} and t only is the first reference criteria to select the function rather than the decision criteria; Normal P-P two graphs and residual variation charts are the most visually obvious survey of the estimated function.

2. Allometric equation for estimating biomass, forest carbon :

The model estimated biomass, forest carbon on the ground: Form 4 variables DBH, H, WD and CA has the lowest variation S% (13,9% - 20,5%), can be applied in high accurate requirements; The biomass estimation models, below-ground carbon: For BGB biomass estimation models ranged from 32,9% - 43,5% and carbon C (BGB) is 38,4% - 54,2%; Models according to plant family and volume: Having distinct difference between estimated biomass according to their plant family, WD group; Therefore approaching models in the direction of plant genera and WD group will increase reliability.

3. Biomas, carbon of stands:

Productivity and biomass decentralization for measuring and monitoring changes in biomass, carbon of stands is for better accuracy. This thesis has also divided 3 levels of productivity and 3 levels of biomass; CO_2 distributed structure in stands is highest in trees above the ground (47,4%), the second is soil organic carbon SOC(46,3%), carbon in forest tree roots 5,3%; remaining carbon in the litter pools, vegetation, dead wood has a very low rate, from 0,1% to 0,6%; total of 3 pools is 1%; Total carbon in 6 pools is as low as 127 tonnes/ha corresponding to sequestration 469 tonnes CO_2/ha; the highest is 377 tonnes of carbon/ha corresponding to sequestration 1,385 tonnes CO_2/ha. CO_2 sequestration capacity of the evergreen broadleaf forest in the Central Highlands averages 12,3 tonnes/ha/year, the highest is 17,3 tonnes/ha/year and the lowest is 5 tonnes/ha/year.

4. Satellite image classification SPOT 5 and using GIS in monitoring CO_2 sequestration:

Methods of unsupervised classification and setting the relationship between TAGTB with variable combinations 3 class and 4 class classify for mapping forest biomass with error of 6,3%.

Coordinating biomass mapping results on the basis of SPOT 5 unsupervised image classification with forest carbon biomass models in GIS is as a basis for monitoring CO_2 sequestration over time and space.

5. Applicable solutions - GIS remote sensing technology and Allometric equation in measuring, monitoring CO_2 sequestration:

Applicable solutions are setting for three main groups: i) Residential communities involved in monitoring forest carbon in REDD +, ii) Professional technical forestry staffs of forest owners, management levels and iii) The forestry experts, GIS remote sensing. According to the three-step process: i) satellite image classification into combinations; ii) forest data collection; iii) Use the biometric model to estimate biomass, carbon; iv) Manage and update information of sequestration and CO_2 emissions in GIS.