Use of spaceborne LiDAR for monitoring of tropical forests

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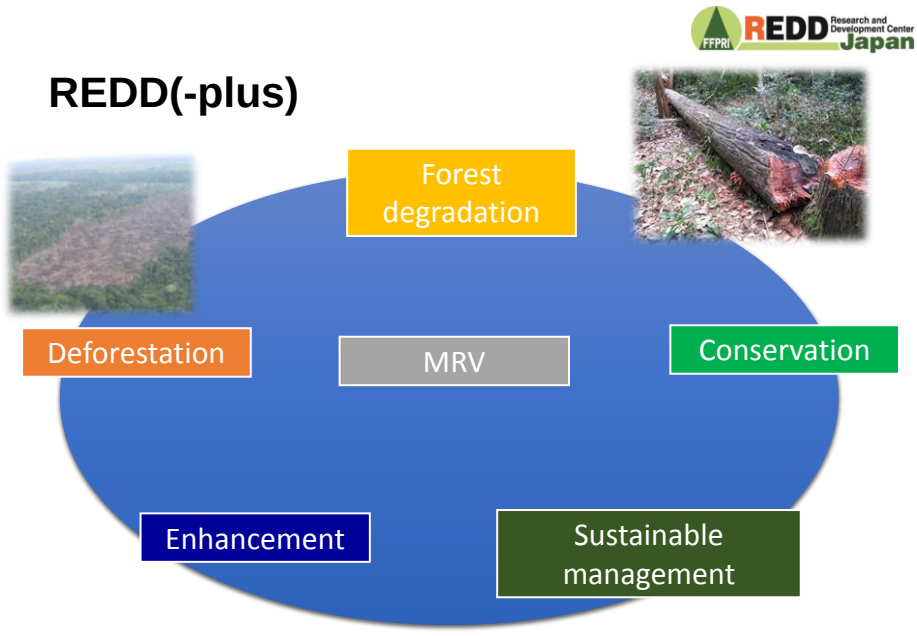
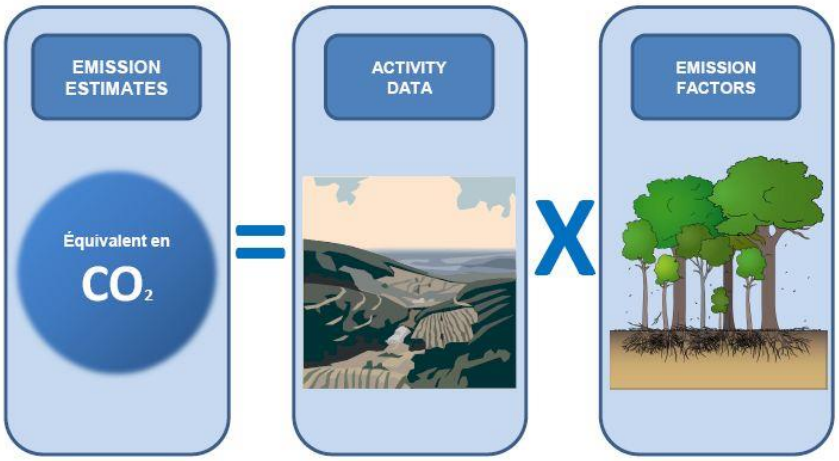
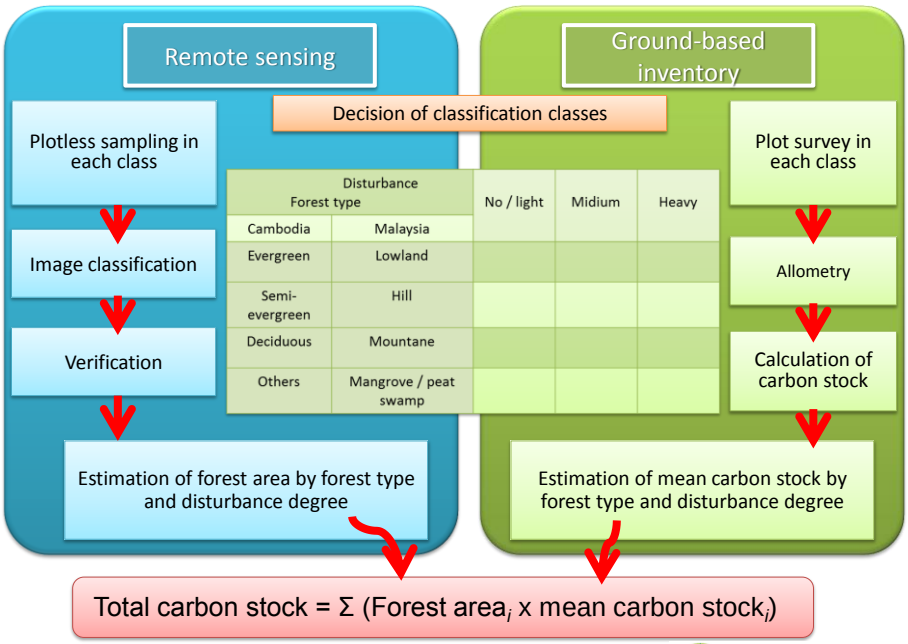


Calculation of GHG emission from LULUCF sector



Danilo Mollicone, FAO



REDD Research and Development Center Japan

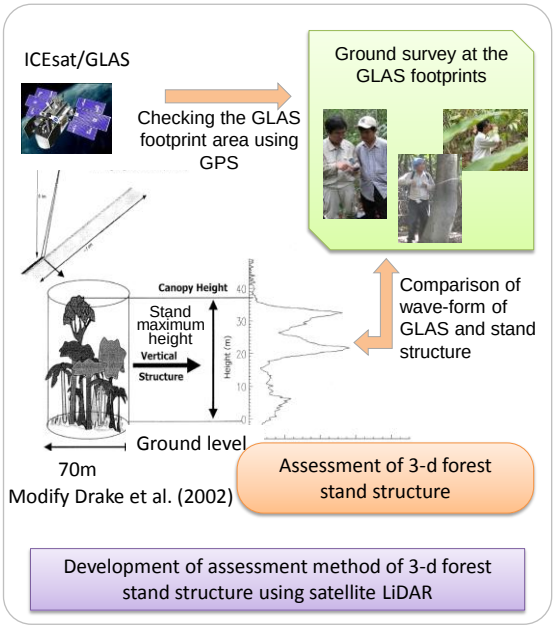
Problems in field survey

- Ownership
- Accessibility and road condition
- Weather
- Topography (steep slope, stream, etc)
- Dangerous animals, insects, and plants
- Land mines
- Illegal logger

Characteristics of satellite LiDAR waveform in tropical rain forests

Objective

- To investigate the characteristics of satellite LiDAR waveform in tropical rain forests from the comparison with canopy condition derived from high resolution satellite data.



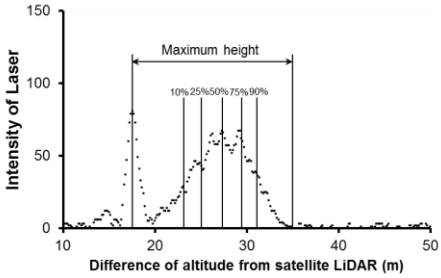
The multiple regression model for presuming the aboveground biomass

The heights at 10, 25, 50, 75 and 90 % of relative accumulation of the reflective intensity of laser pulse after removing the noise signal in each footprint (h_{10}, h_{25}, h_{50}, h_{75}, h_{90}) were estimated from the waveform of ICESat/GLAS data.

$$AGB = \beta_0 h_{10}^{\beta 1} h_{25}^{\beta 2} h_{50}^{\beta 3} h_{75}^{\beta 4} h_{90}^{\beta 5} \quad (1)$$

The equation is represented as follows:

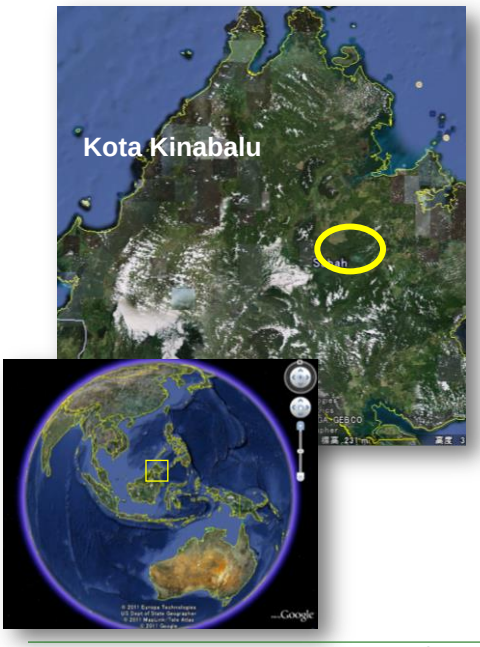
$$\ln(AGB) = \ln\beta_0 + \beta_1 \ln h_{10} + \beta_2 \ln h_{25} + \beta_3 \ln h_{50} + \beta_4 \ln h_{75} + \beta_5 \ln h_{90} \quad (2)$$



The relative integrated value of the reflective intensity of GLAS data, and the reflective intensity to the maximum big tree quantity from the ground

Study area

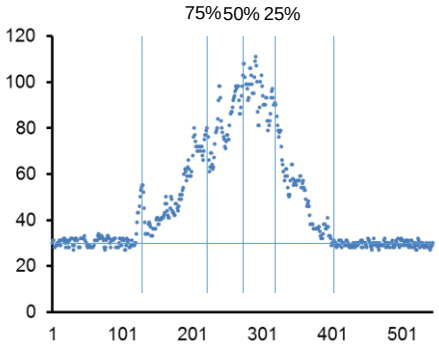
- Tangkulap Forest Reserve, Sabah, Malaysia
- 117 16’E, 5 22’ N
- This forest reserve had been degraded due to intensive and unplanned harvesting in the past.
- Sabah Forestry Department prepared a 10-year Forest Management Plan (2006-2015) hoping that if properly managed, restored or rehabilitated.

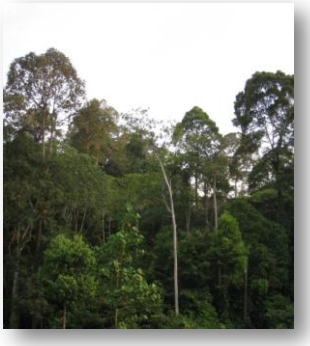


Field survey at the center of LiDAR footprint

Waveform of LiDAR data in a relative mature forest

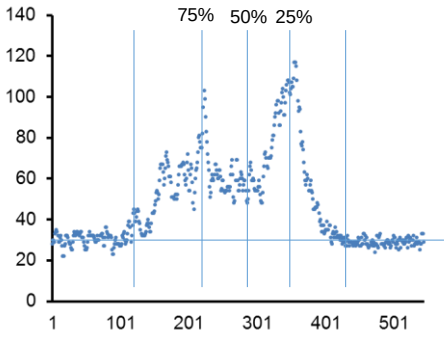
- Maximum tree height derived from LiDAR data was about 43 m.
- Intensity has a peak around 26m height and it means canopy layer.

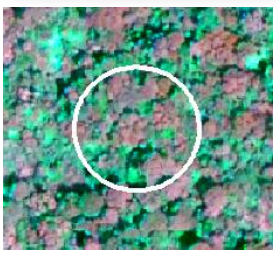




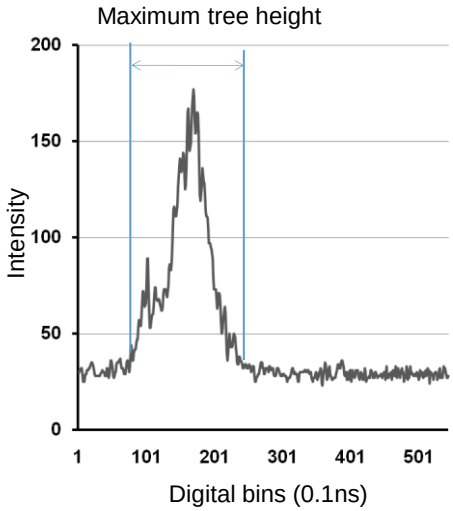
Waveform of LiDAR data in a degraded forest

- Maximum tree height derived from LiDAR data was about 42 m.
- There are several peaks through all layers.





Waveform of LiDAR data in a rubber plantation



- Maximum tree height derived from LiDAR data was about 23 m.
- Intensity has a peak around 15m height and it means canopy layer.

Concluding remarks

- Satellite LiDAR is very useful for monitoring tropical forest and estimating emission factor because of acquisition of vertical information without access.
- High density of data is required for accurate estimation of forest carbon stock.
- Integration of satellite LiDAR with other satellites with wall-to-wall observation is needed for REDD+ monitoring.

Any question
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