FOREST MAPPING, INVENTORY AND BIOMASS ESTIMATION TECHNIQUES FROM REMOTE SENSING: AN OVERVIEW

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1.INTRODUCTION

The Intergovernmental Panel on Climate Change (IPCC) has documented the need for mitigation of global warming driven by anthropogenic greenhouse gas emissions. The IPCC has shown that global carbon emissions could be reduced by as much as 20% by reducing deforestation and forest degradation alone. To achieve this robust and comparable national monitoring, reporting and verification (MRV) systems are needed so that certainty can be provided in respect to the production of national forest carbon emissions estimates. Remote sensing technologies provide the only global, near-real time and repetitive data source to monitor changes in forest cover and together with ground information, model and retrieve reliable measures of large area biomass and carbon emissions.

2.BACKGROUND

Tropical forests contain around 40% of the world's above-ground vegetation biomass. Preservation of the tropical carbon sink is the prime concern of the Reduced Emissions from Deforestation and Degradation (REDD) initiative of the United Nations Framework Convention on Climate Change [1]. At the UNFCCC meeting in Copenhagen in December 2009, decisions will be made in respect to a REDD Carbon Market. Whatever form this market takes, it is clear that remote sensing could and should play a key role in providing carbon baseline estimates of forest biomes and in particular, for those found in tropical areas.

At present there is no consensus on the appropriate remote sensing technologies for estimating tropical forest biomass, and this remains a key issue for REDD mechanisms and carbon market credit allocation and monitoring. Cloud cover in the tropics and intensity saturation at high-biomass suggest that a combination of low frequency SAR and interferometry using airborne sensors could provide a solution for quantitative above-ground living biomass estimation. Both airborne and satellite data, whether optical, infrared or microwave, can play an important role in determining cover and monitoring extent and change. LiDAR data also has potential information content. Ground information is essential in calibrating retrieval algorithms, and the meaningful and continuing provision and combination of ground data with remotely sensed data is an important, but insufficiently explored topic.

3.SCOPE OF PAPER

This paper presents an overview of the use of remote sensing in mapping intact forest extent and in detecting deforestation, degradation and tree re-growth in tropical areas. Experiments across a variety of biomes demonstrate a stable relationship between forest attributes and for example, radar backscatter. These include tree basal area, trunk height, canopy extent and closure and total above ground biomass.

While airborne systems provide higher resolutions, they are limited by extent of coverage and cost. Satellite sensors offer extensive and repetitive coverage more cheaply, but at lower resolutions. Continued research into the synergistic use of radar and optical sensors and the integration of airborne and satellite data provide the potential for developing large area "wall to wall" monitoring of forests and the quantitative retrieval of forest biomass and carbon emissions.

Continuous global forest carbon assessment is critical to measuring greenhouse gas emissions. Assessment techniques have to be quantitative and accurate and be shown to operate consistently over a range of forest types. The recently announced GEO Forest Carbon Tracking Program [2] seeks to demonstrate the feasibility of forest mensuration through the co-ordinated use of remote sensing and earth observation thereby providing input to future national forest carbon and REDD monitoring systems.

4. REFERENCES

[1] Reducing emissions from deforestation in developing countries: approaches to stimulate action, United Nations Framework Convention on Climate Change, Conference of the Parties, Eleventh Session, Montreal, 28 November to 9 December, 2005, 11p.

[2] Group on Earth Observations (GEO), "GEO Forest Carbon Tracking: Satellite Data Product Specifications", draft v3, December 1, 2009.