THE USE OF ALOS PALSAR FOR SUPPORTING SUSTAINABLE FOREST USE IN SOUTHERN AFRICA: A CASE STUDY IN MALAWI

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Malawi, a landlocked country in southeast Africa, is one of the poorest countries in the world, qualifying for relief under the HIPC (Heavily Indebted Poor Countries) initiative, which was designed to help the world's 33 poorest countries. Malawi has a high population density, one of the highest in sub-Saharan Africa, and is highly dependent on subsistence agriculture. According to the latest available data 85% of the population lives in rural areas and 53% live below the poverty line, on less than US$1 a day. Malawi has no natural resources except its forests, and consequently relies heavily on its timber resources to generate vital revenue. The Viphya plantation is considered to be the largest plantation forest in Africa. However, it has been estimated that while the annual consumption of forest products are estimated at 15 million m^3, the sustainable supply is less than 8 million m^3. Projections based on primary forest loss experienced between 1990 and 2005 suggest that all primary forest in Malawi will be degraded or deforested by 2040 [1]. These estimates led to the launch of Malawi's National Forest Programme in 2001, outlining a top-down framework of sustainable goals and best practice standards for forest management, but it has not been quite as successful as hoped with deforestation and forest degradation from illegal logging still a prominent issue.

Malawi's forests are primarily dry tropical forest, with some areas of wet tropical forest and plantations of exotic species (primarily pine and eucalyptus species). An investigation into deforestation and forest degradation in the Thazima region of Nyika National Park and Mkuwazi Forest Reserve was conducted in collaboration with local communities, the Department of National Parks and Wildlife, the Department of Forestry and the Forestry Research Institute of Malawi, as well as staff and students from Chancellor College, Malawi, and the University of Edinburgh. This investigation included analysis of Landsat EMT+ imagery from 1990 and 2000, existing literature and land use maps, as well as community consultations and site visits, to obtain estimates of past trends in deforestation and identify current threats in the project areas. Existing carbon stocks were then quantified using standard inventory methods [2]. A total of 203 temporary plots, giving a combined total of 3,733 individual tree measurements were obtained, using a random stratified sampling technique. This provided per hectare carbon estimates for the different forest types present at each site, including the dominant Brachystegia (Miombo) (~32.1 tC ha^{-1} Nyika; ~98.1 tC ha-1 Mkuwazi), as well as evergreen (~205.1 tC ha^{-1} Nyika; ~171.1 tC ha-1 Mkuwazi) and riverine (~13.3 tC ha^{-1}) forests, savannah (~15.8 tC ha^{-1}) and customary (unprotected) land (~6.4 tC

ha^{-1}) [3]. Existing allometric equations that most closely matched the forest type in question were used, and a carbon content of 50% of biomass was assumed throughout.

Previous studies (such as [4]) have shown the potential for estimating forest height and biomass from SAR, but there has been very little work done on this in Africa, particularly on a sub-national scale. ALOS PALSAR data from 2006/7 and JERS-1 data from 1991 is used to assess the suitability of these instruments in providing a rapid and robust means of obtaining national-scale biomass and forest cover change (de- and re-forestation) estimates. These satellite data are compared to the carbon stock estimates obtained by forest inventory measurements described above to assess their accuracy compared to ground-based survey methods. An analysis of the relationships between biomass and backscatter for different forest types will be conducted using regression analysis. An analysis of changes that occur between the images is conducted to identify areas of forest cover change over the period 1990/1-2006/7. An assessment of the errors and uncertainties in these relationships is included.

This research will evaluate the suitability of ALOS PALSAR for supporting sustainable forestry on a national and regional level within Malawi, by providing estimates of forest biomass and identifying areas of land cover change when used in conjunction with JERS-1 data. If this is the case, this research has the potential to help generate vital government revenue, as well as supporting community forestry projects, though the implementation of REDD programmes linked to global carbon trading schemes. The results of these analyses can also be used as a benchmark to help quantify the success of future carbon offsetting schemes, improve protection of forest reserves and national parks through specific targeting of resources, and be used in conjunction with other socio-economic data to help monitor the success of the National Forest Programme. These results will also be placed in the context of similar studies in southern Africa [5].

Bibliography

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