EFFECT OF BURN SCAR PATTERN VARIABILITY ON MEDIUM RESOLUTION BURNT AREA MAPPING IN SOUTHEAST ASIA

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1. INTRODUCTION

Factors like climate, ecosystem, land management policies etc. cause considerable variation in fire regimes, which results in a highly varying distribution of burn scar patterns and sizes. This directly affects the usability of a given remote sensing data for burn scar mapping purposes in a given region. Several authors have noticed variation in the usability of coarse and medium resolution burnt area mapping depending on burn scar patterns and size distribution [e.g. 1, 2]. Fire regimes in insular Southeast Asia have been noticed to vary considerably, ranging from small-holder burning that causes high numbers of small burn scars (typically <25ha), to large-scale land clearance fires and wildfires which commonly burn areas in excess of 1000ha [3]. In this paper we investigate whether burn scar patterns and sizes correlate with land cover or soil types in Southeast Asia and how this affects medium resolution burnt area mapping in this region. Our results differ from results obtained in other regions and therefore further emphasize the special nature of insular Southeast as a fire region.

2. MATERIALS AND METHODS

Reference burnt area maps based on 16 high resolution SPOT 4 and 5 images located in the most fire-affected areas of Sumatra and Borneo in 2006 were overlaid with land cover and soil maps to examine variation of burn scar patterns and size distribution. Subsequently, usability and limitations of medium resolution burnt area mapping in different land cover and soil types were evaluated using a simulation of medium resolution burnt area mapping. In this simulation 500x500m grid cells containing at least 50% burnt area were considered detectable as burnt.

3. RESULTS AND CONCLUSIONS

We discovered that although the number of small burn scars (<25ha) was found to be high throughout the region, the proportion of total burnt area found in small scars varied remarkably (from 3% to 97%) between study sites. Unlike in other regions [e.g. 2, 4], land cover type did not have strong correlation with burn scar size in insular Southeast Asia. Instead, soil type was found to be strongly correlated with burn scar size in this region (Figure 1). Consequently, the medium resolution burnt area mapping simulation resulted in 86% detected burnt area in wetlands (peat and alluvial soils) as opposed to only 33% in other areas. We believe that in insular Southeast Asia continuing land cover change with fast expansion of managed agroecosystems together with the use of fire as a tool and the fire vulnerability of degraded ecosystems create a complicated collection of fire regimes, strongly dependent on the degradation level, stage of development and land management policy issues in a given area, but less dependent directly on land cover type. Peatland areas are currently under large scale land cover changes and physical characteristics of peat promote lingering fires that result in large burn scars. Therefore we conclude that medium resolution satellite data can be reliably used to estimate the extent of burnt area in Southeast Asian wetlands. These often extremely degraded wetland areas experience yearly burning in varying intensities and are the main source of both the annual haze affecting large areas of insular Southeast Asia and fire induced carbon emissions in this region [5]. However, the usability of medium resolution satellite data for burnt area mapping in other (non-wetland) areas in this region was considered to be low due to large proportion of burnt area found in sub-pixel size burn scars.
Figure 1. Cumulative percentage of burnt area by burn scar size (ha). Diamonds refer to peat soil, circles to alluvial soil and triangles to other soil types. X-axis scale is set to logarithmic in order to create a more visually meaningful figure given the wide range of burn scar sizes. Note that burn scar sizes corresponding to typical spatial resolutions of medium/coarse resolution satellite sensors (250m → 6.25ha, 500m → 25ha and 1000m → 100ha) have been marked.

3. REFERENCES


