Burned area mapping in southern Africa:
case study synthesis and regional application of MODIS data

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Abstract:

Southern Africa is subjected to some of the most extensive biomass burning in the world. Fires occur due to both natural and anthropogenic causes, primarily lightening and land management. Systematic monitoring of burned areas is needed by the global change research community as an input to biogeochemical models and is required to understand and model how fire regimes are likely to change as a function of climate, population dynamics, and land use change. There are no adequate data on the occurrence, size distributions or trends in fire numbers or areas burned annually in Southern Africa. Local data exist for national parks, forests, and conservation areas, but are not representative of the region as a whole because these lands are largely protected from the influence of people and are subjected to specific fire management policies.

This three-year project will conduct synthesis research that integrate results from multiple case studies that address the drivers of Land Cover Land Use Change (LCLUC). The research will utilize the improved remote sensing capabilities provided by MODIS and Landsat ETM. MODIS was launched December 1999 on NASA's first Earth Observing System (EOS-Terra) satellite, and is designed to provide long-term records of the atmospheric, terrestrial, and marine ecosystems. The new spectral bands and spatial resolution of the MODIS instrument provide the means for improved study of fire and burned area. MODIS 500m burned area data sets will be made for all of Southern Africa for 2000, 2001 and 2002 using a recently developed algorithm that maps the location and approximate day of burning.

An applications component is included and meets an important NASA programmatic need to use MODIS data in the applications domain. The applications component follows a guiding Global Observations of Landcover Dynamics (GOLD) principle that the user community play an active role in defining product requirements and in undertaking product assessment and testing of pre-operational algorithms. The work is being undertaken with collaborators located at eight case study sites throughout Southern Africa. The collaborators are founding members of the Southern African fire network (SAFNET) which is emerging from the Miombo Network, GOLD-Fire, and SAFARI 2000 initiatives. They have existing projects with strong interests for long term fire information to support their research and operational agendas in resource management and environmental assessment. The collaborators will initially evaluate and subsequently utilize satellite data in their decision-making processes for fire management and reporting. Landsat ETM data acquired over the case study sites will be used to validate the regional MODIS burned area product. These data will be used to provide an improved understanding of the relationship between fire timing, occurrence, burn size and spatial distribution, land cover change and land use practice.

The research will be developed around a number of LCLUC hypotheses that explore the interplay between physical and human variables on fire size and timing. The relationships that this research will establish will form a basis for future predictive modeling that relate people (e.g., population growth), climate (e.g., interannual variability of rainfall) and fire (e.g., emissions and ecology impacts). The validated MODIS burned area product will be used to evaluate and establish hypotheses at the regional scale and their robustness will be tested locally using the case study data.

The collaborators will design the transition of this work from research and validation into operational implementation in the final year of the project. The key requirements that will be addressed for their particular applications are: timeliness, accuracy, utility and interpretability. The long term goal is to identify the pathway to transition this work into an operational fire monitoring system for Southern Africa that will meet the fire information needs of policy makers, the scientific community and natural resource managers.