Impacts of Conflict on Land Cover, Land Use, Fire Dynamics and Biodiversity Potential in the Imatong Mountains of Southern Sudan

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Inroduc ion

Armed conflict negatively impacts biodiversity through habitat destruction and fragmentation, direct loss of animals from poaching or land mines, over-exploitation of natural resources, and increases in land and water pollution (Kanyamibwa 1998, Gleditsch 1998, Shambaugh 2001, McNeely 2003, Short 2003). In some cases, however, wars can have a positive impact on biodiversity, through the creation of “no-go zones” that reduce pressure on the natural landscape due to the absence of exploitative human activity in the area (Martin 1999, McNeely 2003, Vanasse 2003). In Sudan, where hostilities have been closely linked with competition for natural resources ( Suliman 1993, Vanhouven and Nimir 2004, UNEP 2007), and have historically been detrimental to wildlife (Cobb 1981, El-Mahdi 1996, Vanhouven and Nimir 2004), satellite monitoring of land use and fire activity can provide insight into the complex relationships between conflict, land cover/land use change (LCLUC) and biodiversity.

Research Goals

Focusing on the Imatong Mountains and surrounds, the primary goal of this research is to better understand how human activity drives changes in land cover/land use, both during and immediately following the most recent conflict; further, the research will seek to understand the implications of future changes in land cover for biodiversity. Specific research questions (RQs) in support of this goal, and their associated competing hypotheses are as follows:

**RQ1:** How have human activities impacted forest cover found in the study region, both during and immediately following the most recent conflict?

**RQ2:** How have demographic shifts during the conflict and post-conflict period affected the fire regime, and what do these changes reveal about human activity during this time?

**RQ3:** How do observed changes in land cover and land use impact biodiversity and what are the implications for conservation?

The data for this project will be acquired through remote sensing and field-based observations, and are based on the timeline depicted in Figure 2, indicating major milestones of the civil war in Sudan beginning with 1) the 1983 Bor Mutiny that set off the latest twenty year period of heavy fighting and 2) the 2005 CPA, which effectively ended the hostilities between government forces and the SPLA.

A similar approach will be taken to compare changes in the fire regime during the two periods. Burned areas will be detected using daily MODIS surface reflectance data at a spatial resolution of 250m for years 2000 - 2008. The resulting near-daily burned area maps will be used to construct a detailed fire chronology to separate out different ignitions. Mapping six pre and three post-retirement years will provide a controlled experiment to determine the effect of returning populations on fire activity through correlations with land cover and indicators of human pressure. The observed changes in forest cover and fire regime will be linked to people by developing robust, spatially explicit layers of key indicators of human activity. Specifically, the research will use ASTER 15m data to develop layers of villages, roads and fields - three different indicators of human pressure. These indicators will be developed during conflict and updated post-conflict to explore how the return of refugees and IDPs is altering human pressures and impacting forest cover (Figure 8). Using the Change Prediction tool in IDRISI LCM, a soft prediction model will be developed showing vulnerability to change for the transitions described above.

Recently acquired aerial photos reveal that natural Podocarpus latifolius forest found at higher altitudes in the Imatong Massif are largely intact, as are many of the pines, pines and teak plantations developed by the Imatong Forestry Project prior to the restart of war in the 1980s. By contrast, the nearby Dorgonata Hills appear to have been heavily logged.

Finally, various biodiversity metrics will be compared with each of the land cover types found throughout the region to determine which areas are more biologically diverse than others. Inputs to this assessment include species data to be collected by WCS in 2009 and converted to a spatial format compatible with a GIS, as well as detailed land cover maps developed for RQ1. The remaining analysis will focus on a single species to assess implications of future changes in habitat on conservation efforts. A habitat assessment will be performed using IDRISI LCM to designate land as belonging to five different categories: primary habitat, secondary habitat, primary potential corridor, secondary potential corridor, and unsuitable. The habitat suitability assessment will be further refined by converting presence data for the selected species into range polygons in a GIS and analyzed in concert with several key environmental variables using Mahalanobis typicalities embedded in IDRISI LCM. The results of this analysis will indicate potential distribution of the selected species currently and at a designated point in the future, assuming that the nature of development stays the same.

**References Cited**