

SOCIAL DRIVERS OF LAND COVER CHANGE AROUND AFRICAN TRANSBOUNDARY PEACE PARKS



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Introduction

Economically underdeveloped regions in Africa have become a key focus of environmental conservation, in large part because high levels of biodiversity still exist in these areas. Transboundary natural resource management (TBNRM) approaches have been increasingly used in Africa to promote both conservation and economic development goals. Specifically, they are expected to 1) reduce dependence on subsistence agriculture in high biodiversity areas, 2) increase alternative formal employment opportunities within the park and in supporting industries, 3) facilitate community development projects and improved transportation infrastructure, 4) advance conservation goals in expanding the wildlife habitat and preserving existing biodiversity. However, the success of the Peace Parks approach relies largely on the ability of economic incentives to induce local residents to participate in land use practices consistent with tourism, including preserving wild game species for tourist viewing and refraining from using certain land—such as wildlife corridors—for livestock grazing or agriculture.

The Great Limpopo Transfrontier Park (GLTP) was established in November 2000 to develop a contiguous wildlife corridor linking protected areas across Mozambique (outlined in orange), South Africa, and Zimbabwe. South African and Zimbabwean components of the GLTP have functioned as protected areas prior to the GLTP establishment. In contrast, the Mozambican section of the GLTP still has ~ 26,500 residents within its borders distributed among ~50 villages ranging in size from 150 to 2000 people and ~ 5,000 heads of cattle (Spenceley 2006). With the relocation of 1987 animals to the Mozambican part of the GLTP (ibid), the resident population is now competing with the wildlife for resources as evidenced by a large perceived amount of human/wildlife conflict and the resentment towards the conservation goals.



Research Questions and Hypotheses

Scientific Goal

Map, quantify, and attribute the Land Cover Land Use change within the Mozambican portion of GLTP to socio-economic causes

Research Questions

Economic theory predicts that establishment of GLTP should boost the tourism sector and shift local dependence on subsistence agriculture to jobs associated with park tourism and supporting infrastructure development. The 10-year period after the establishment of the GLTP allows for sufficient time for the benefits to have manifested at least in some degree. The apparent contradiction between the theoretical prediction and the attitudes of the local residence poses the three major research questions for the proposed study:

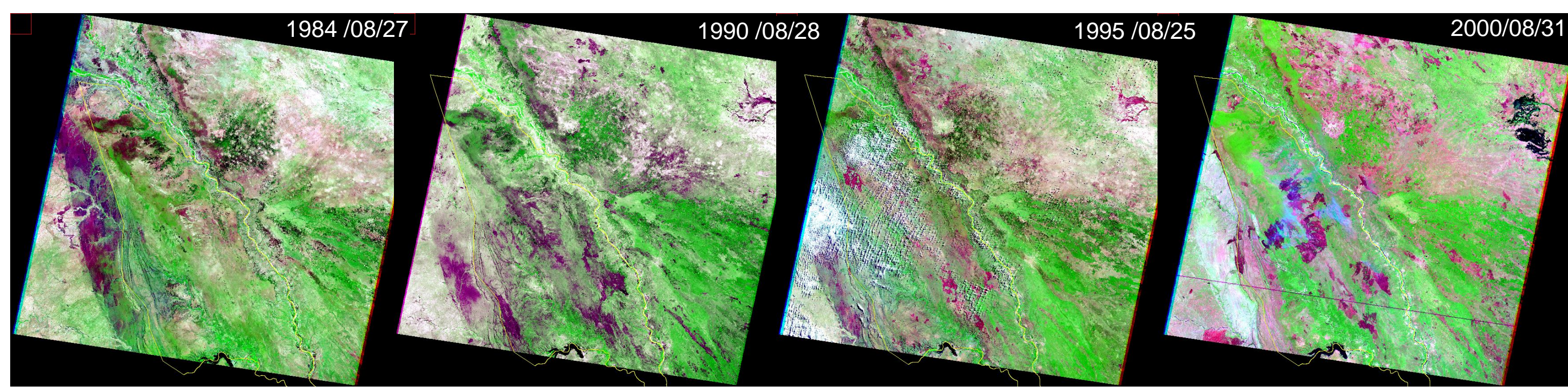
1. How does self-reported use of natural resources compare with land use patterns evidenced by remotely sensed images across different governing entities?
2. Do households located in GLTP have different land use patterns than those located outside the park?
3. Do land use patterns vary according to the attitudes of local residents towards the park?

Hypotheses

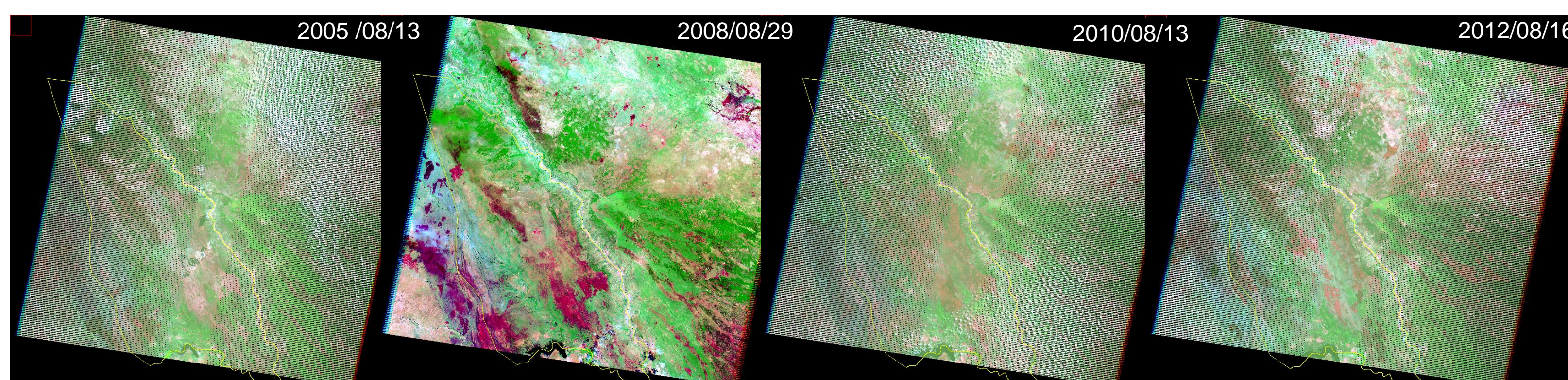
1. Land use patterns vary according to the attitudes of local residents towards park management and wildlife: dissatisfaction with GLTP among residents results in land use patterns consistent with greater reliance on natural resource use, and thus is contrary to the conservation goals.
2. Rates of tourism infrastructure development are too slow to counteract the immediate impact of park-induced restrictions on resource use and wildlife-human conflict.
3. Economic development associated with GLTP benefits areas outside the park more than residents remaining within the park.
4. Very High Resolution (VHR) data are required to assess impacts of economic development as most village-based LCLU patterns are too fine in these communities to be scaled-up to the mod-res levels.
5. Larger objects related to the developments of tourism infrastructure can be observed from the moderate resolution imagery and thus can be used to assess the parks' impact on the potential local/regional economic development.

Research Design

Task 1: Establish spatial patterns of land use and land cover change around the GLTP before and after the establishment of the Peace Park in 2000 from Landsat imagery.



- Pre- (above) and post- (below) GLTP (yellow outline) establishment patterns of land use and land cover will be characterized from Landsat data imagery. Within GLTP and in 50 km buffer around GLTP we will map and quantify annual (or bi-annual) distribution of:
 - tree-, shrub-, and grass-dominated communities
 - bare and built-up
 - water
 - cropped areas
 - assess grassland productivity



Task 3: Map village-scale changes in land built-up space and its configuration from VHR imagery

- We will develop an automated or semi-automated approach to map rural settlements from Very High Resolution (VHR) satellite imagery for at least 3 time periods between 2002 and 2013, ideally:
 - 2002
 - 2009
 - 2012
- We will use multi-spectral, textural and object-oriented approaches to extract features of interest from the VHR images



VHR image of Chibotane village
Data source: Google Earth



House structure in Chibotane village located inside GLTP boundary
Photo: J. Silva

Feature of interest will include:

- community-level benefits:
 - schools
 - clinics
 - roads
 - other relevant infrastructure (e.g. new places of business)
- individual-level benefits:
 - zinc roofs
 - size of livestock corrals
 - size, total extent and distribution of individual cropped areas
 - changes in size and configuration of individual residences

Task 2: Analyze patterns of LCLU change within and outside GLTP and link them to existing socio-economic data.

- Quantify rates and direction of changes in:
 - forest cover
 - extent of cropland areas
 - grassland productivity
 - extent of built-up area
 - land accessibility (expressed through distance to the nearest road)
- Relate the rates of change after the establishment of the GLTP to:
 - the observed socio-economic dynamics within the region to control for the socio-economic changes unrelated to the establishment of the GLTP
 - local-level qualitative and qualitative surveys of households within and outside GLTP



Abandoned cropped area within the GLTP boundary since the establishment of the park
Photo: J. Silva

Task 4: Analyze changes and built environment and link them to local perceptions of park impact on livelihoods.

- Analyze data on self-reported natural resource use and perceived changes in resource availability
- Compare results with data on spatial land use patterns observed from remotely sensed images
- Relate these patterns to residents' attitudes towards park

Task 5: Field validation of perceived socio-economic linkages between LCLU change and human wellbeing.

Community feedback will serve to "ground truth" the findings regarding the causes of LCLU change and allow participants to offer their own interpretations of land use patterns identified from remotely sensed imagery.



Community leaders discussion/survey led by Co-I Silva
Photo: J. Silva

Task 6: Identify and test scaling potential (VHR-to-Landsat) for LCLU metrics linked to assessment of human livelihoods and ecological systems

Task 7: Apply the selected metrics to the full extent of GLTP and the buffer zone to assess the regional impact of the park on ecosystems and population in Mozambique.

Task 8: Synthesize and publish major research findings.

References and Acknowledgements

Spenceley, A., 2006. Tourism in the Great Limpopo Transfrontier Park. *Development Southern Africa*, 23(5): 649-667.
The project is supported by the NASA Land Cover Land Use Change program Early-Career Investigator grant NNH11DA001N.