

Population Growth and Landscape Change: the Potential for Impact from Industrial Oil Development in an African Biodiversity Hotspot

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INTRODUCTION

Commercially viable oil reserves were discovered in the Albertine Graben portion of the Albertine Rift Biodiversity Hotspot in 2006. This region has been estimated to contain more than 2.5 billion barrels of oil (Shepherd 2013), with a projected daily yield between 200,000 – 350,000 barrels per day (Vokes 2012). This new found resource has the potential to boost the Ugandan economy.

Large industrial activities within protected areas (PAs), often brings immense changes to the subsistence livelihoods of surrounding indigenous communities. It can lead to new roads and access to the PAs, leading to new markets and further land conversion to farms (Prinsloo et al. 2012). Increased population pressure and land-use intensification surrounding parks threatens PA sustainability, strains park-neighbor relations due to crop raiding by park-protected wildlife on the adjacent farms, and alters ecological function and biodiversity within the parks.

PROBLEM STATEMENT

- Limited studies have been undertaken on the early landscape level impacts of oil development to this highly sensitive region.

RESEARCH QUESTIONS

- How has the population grown and where are localized hotspots of population growth around MFCA since oil development has begun?
- What are the landscape impacts from oil development in and around MFCA, including changes in vegetative productivity, habitat fragmentation, and habitat loss?

METHODS FOR PRELIMINARY RESULTS

- Creation of gridded population density data based on Uganda Bureau of Statistics census data for census years between 1959 and 2012 (2008-2012 are projected census data).
 - Mean population density values were extracted for each district surrounding MFCA compared between years.
 - This data places historical population growth in perspective of current trends.
- Time-series decomposition analysis (BFAST method, Verbesselt et al. 2010) of MODIS EVI (323 images, 2000-2014).
 - used to inform disturbances and change during the time-series dates
 - The southwest area was picked due to high population growth and presence of oil development, while northern area has low population growth and no oil development.

RESULTS

- Population Density Change Results (Fig. 2 & 3)
 - Districts north of MFCA had lowest population growth, with Nwoya District having a growth rate of just 0.7% between 2011 and 2012.
 - Districts south of the PA had the highest population growth, with Kiryandongo and Masindi having 5.9% and 5.6% growth rates between '11 and '12, respectively.
 - Districts East and West of the park had growth rates between 3.1% and 3.3%.
- BFAST Results
 - N area (low pop. growth and no oil) (Fig. 4)
 - 1 break in trend (95% C.I.)
 - April 2002 (May 2002-Sept. 2002)
 - 1 break in seasonal component
 - April 2005 (Sept. 2004-Oct. 2005)
 - SW area (high pop. growth and oil (Fig. 5))
 - 3 breaks in trend (95% C.I.)
 - May, 2005 (Feb. 2005-June 2005)
 - May 2008 (Apr. 2008-May 2008)
 - July 2010 (July 2010-Oct 2010)
 - No breaks found in seasonal component



Oil rig located within Murchison Falls Conservation Area

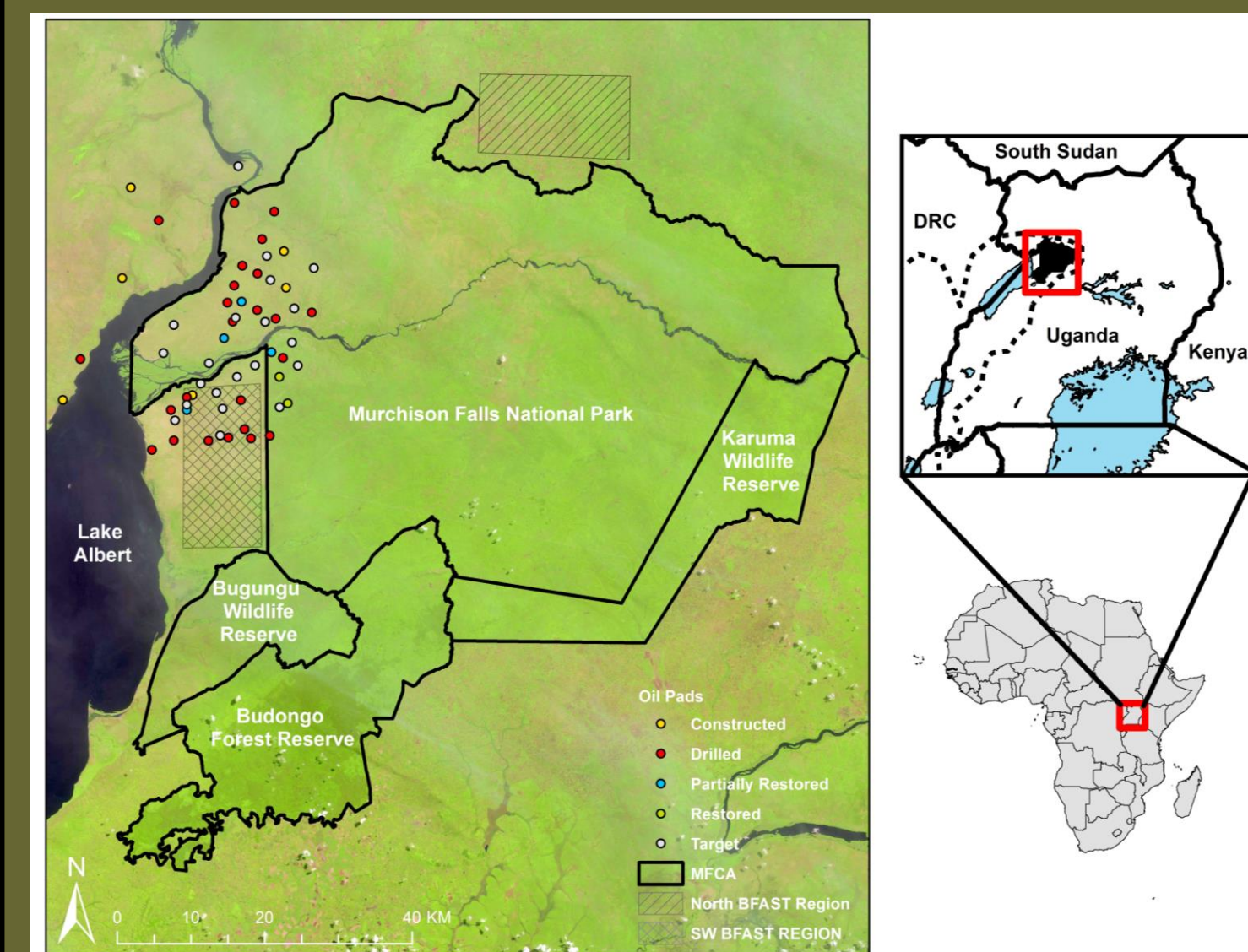


Fig 1: Study area map of Murchison Falls Conservation Area, located in Western Uganda.



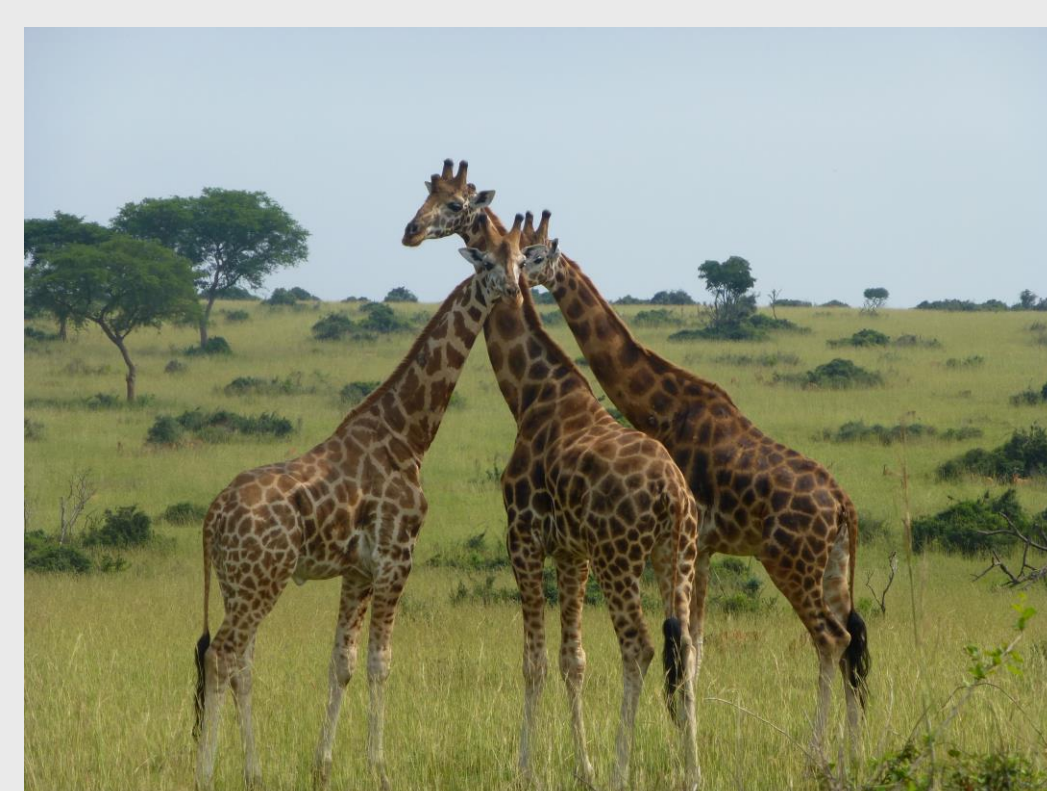
African Buffalo in Murchison Falls Conservation Area

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Rothschild's Giraffes in Murchison Falls Conservation Area



Savanna landscape in Murchison Falls Conservation Area

STUDY AREA

Murchison Falls Conservation Area (MFCA) (Fig. 1), was established in 1952. It is of high ecological importance due to presence of numerous globally and regionally threatened species and is home to 780 species of birds, mammals, reptiles, amphibians, and plant species. The Rothschild's Giraffe, a species with fewer than 470 wild individuals left, has its only remaining, naturally occurring population within MFCA. MFCA has the second highest visitation of all PAs (27%) in Uganda in their USD600 million tourism industry. Many have expressed fear that the tourism industry could be compromised by this industrial activity, as the primary oil exploration area is located in areas of largest tourism interest (Segan et al. 2012)

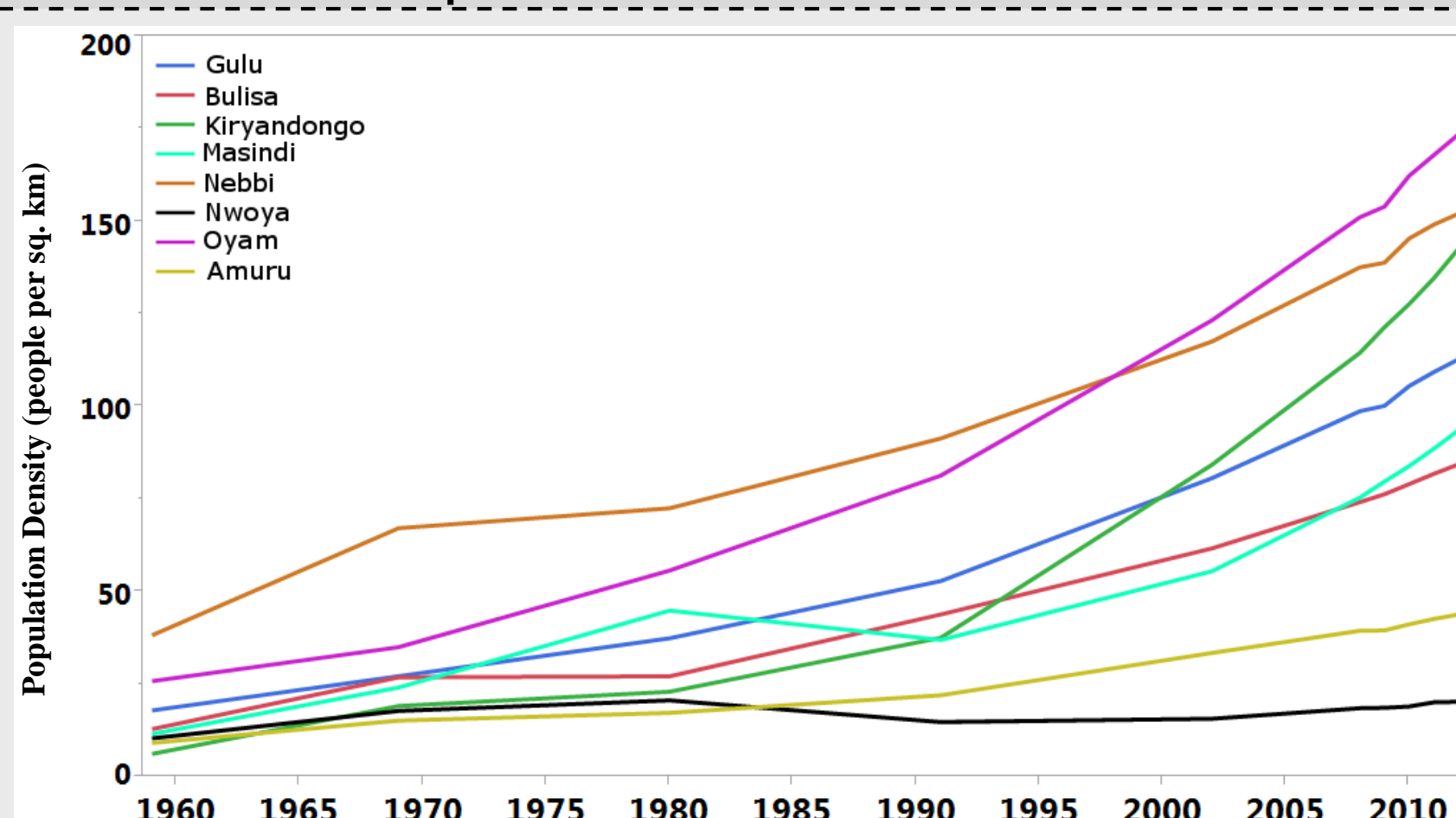


Figure 2: Change in human population density of the districts surrounding MFCA between 1959 and 2012.

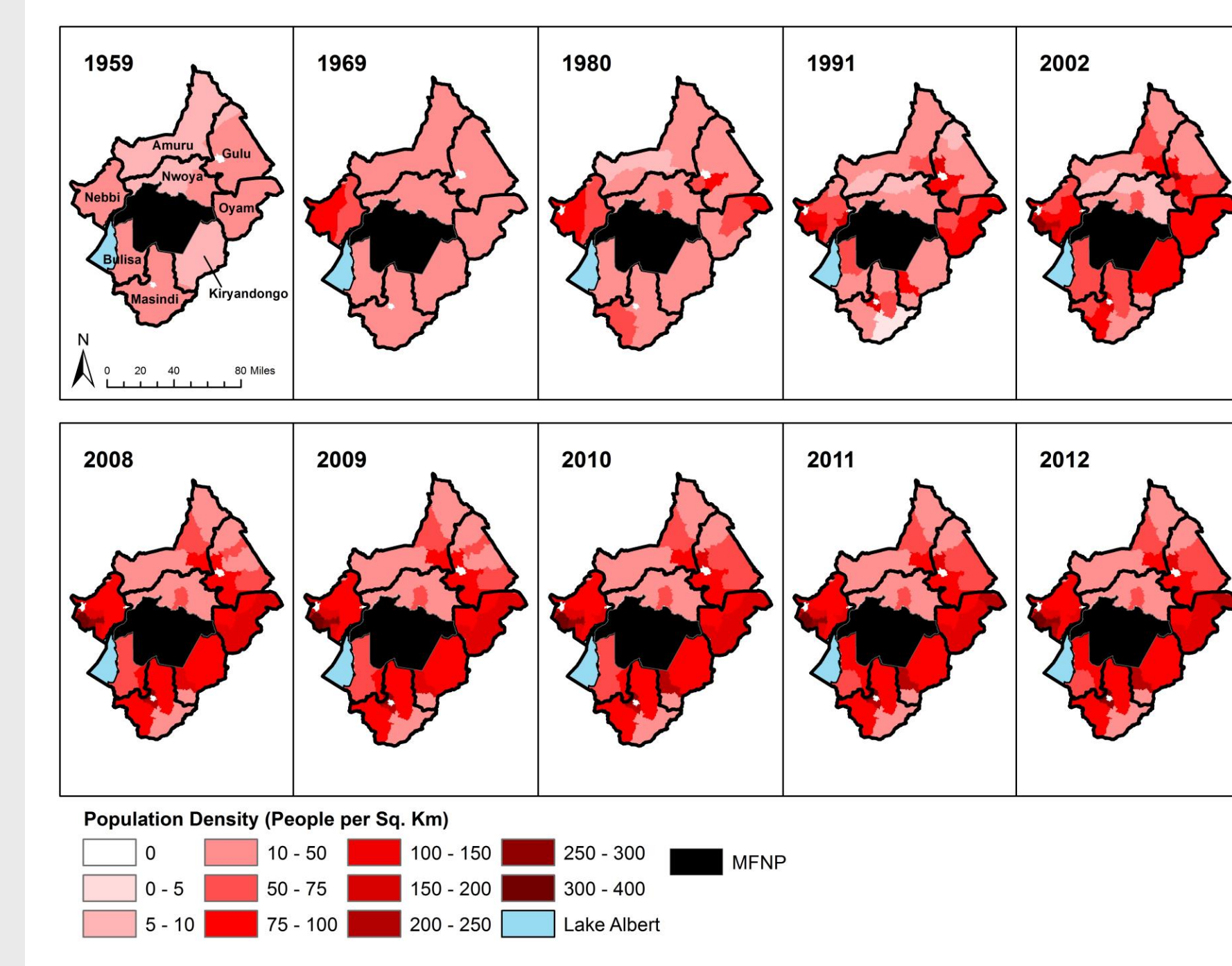


Fig 3: Change in human population density for the districts surrounding MFCA between 1959 and 2012.

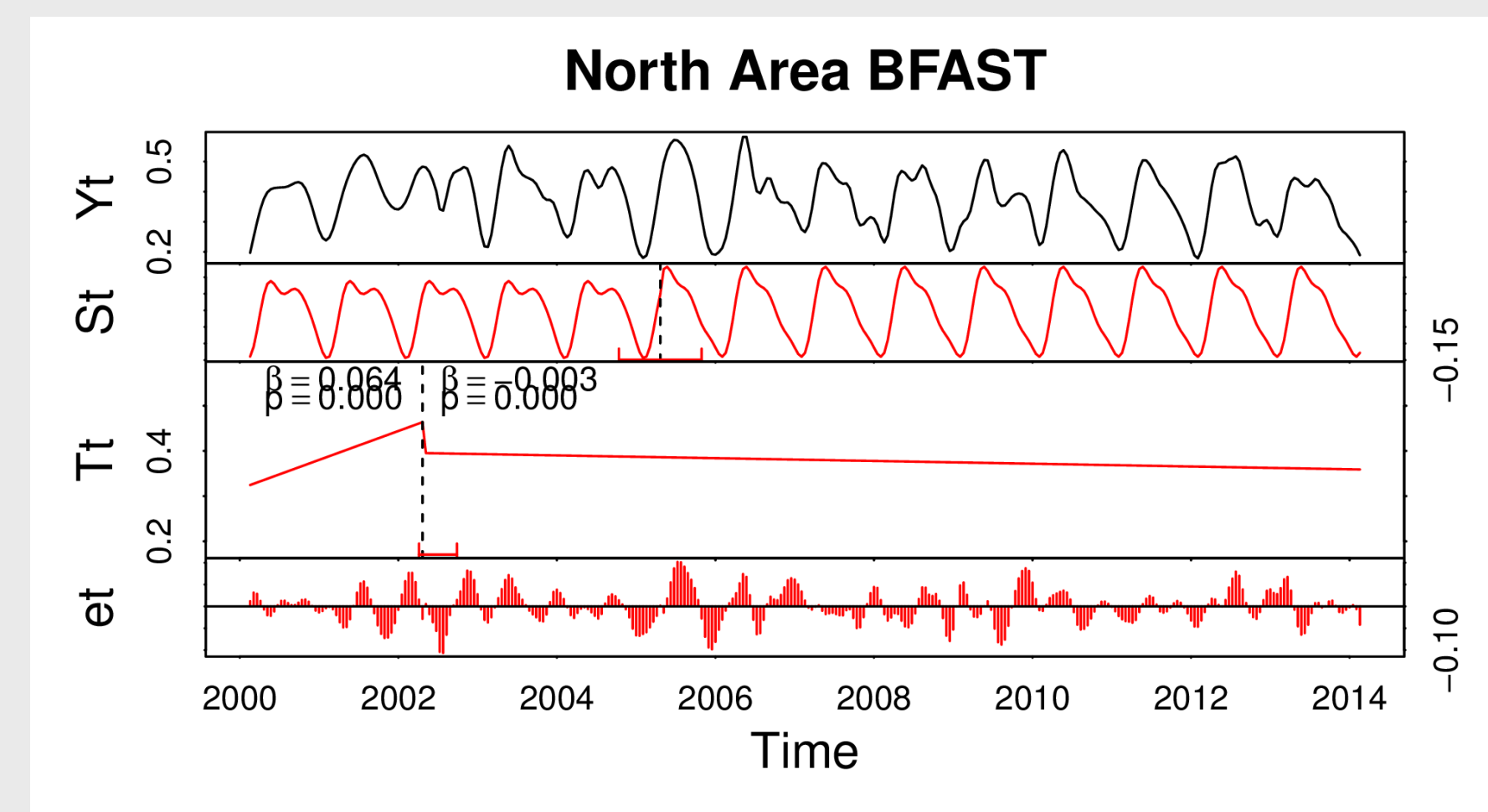


Figure 4: BFAST results of an area north of MFNP where there is an absence of oil development and low population growth, with original data (Yt), and fitted seasonal (St), trend (Tt) and remainder (et) components. Breakpoints (---) with direction and magnitude of abrupt change within a 95% confidence interval (red bracket below).

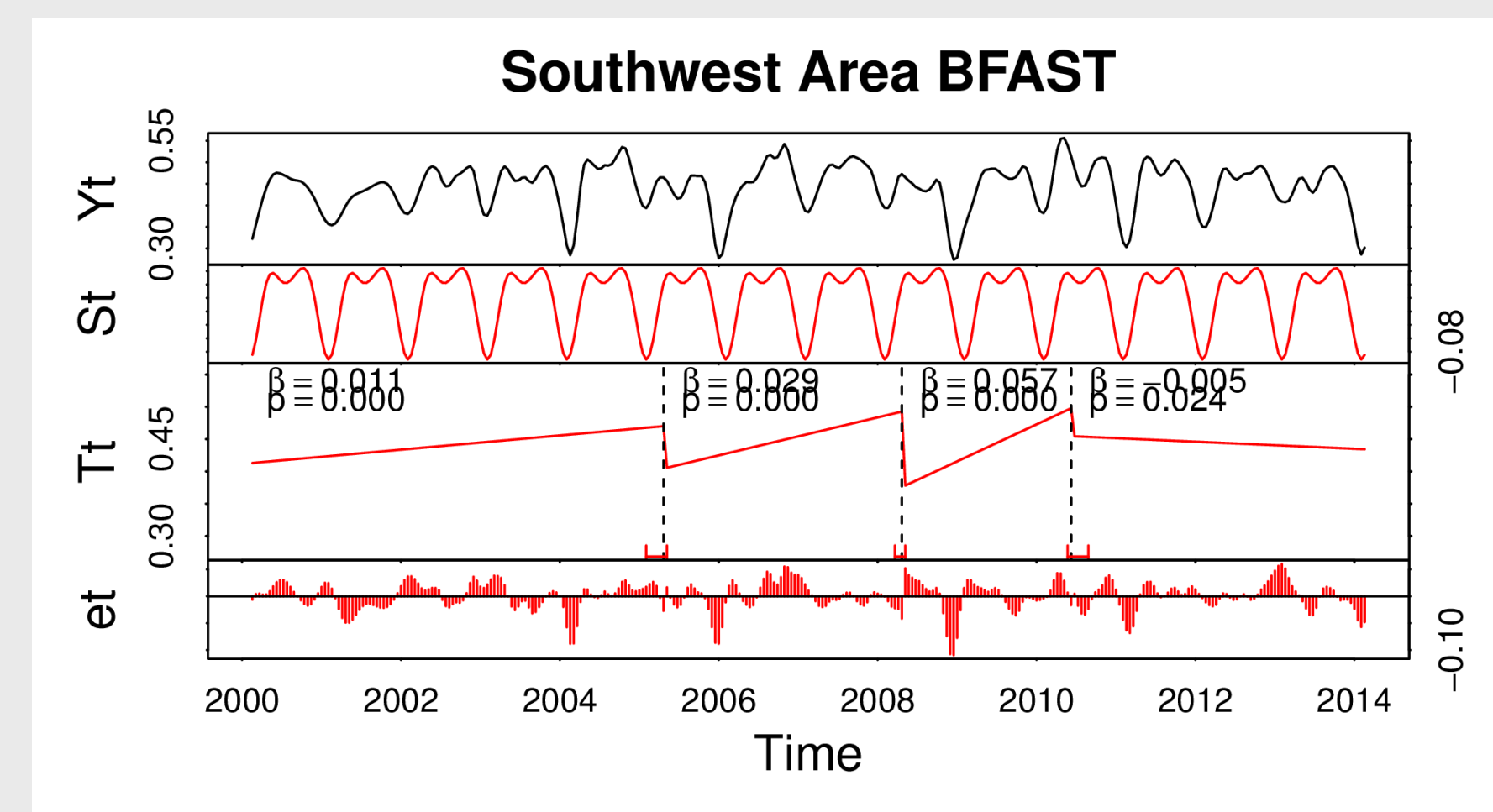


Figure 5: BFAST results of an area southwest of MFNP where oil development has started with high population growth, with original data (Yt), and fitted seasonal (St), trend (Tt) and remainder (et) components. Breakpoints (---) with direction and magnitude of abrupt change within a 95% confidence interval (red bracket below).

GOING FORWARD/2014 FIELD SEASON

- This study will seek to investigate and attempt to find links of changes in landcover and migration are explicitly due to oil development.
- Landcover cover and spatial pattern change
 - Creation of 2000 (pre-oil condition) and 2014 (current condition) landcover maps using Object Based Image Analysis.
 - Analyze spatial pattern change with the vector based program, Polyfrag (MacLean 2012).
 - Human population change
 - Locate hotspots of population growth using landcover change (agricultural/developed) and increases in population based on Worldpop '00 and '15 population density grids.
 - Human qualitative surveys seek to understand:
 - push/pull factors of migration
 - timing of increases in population
 - Inform BFAST analysis
 - Why did breaks occur in trend, and what event happened to cause the break.