LANDCOVER CHANGES ALONG THE BOTETI RIVER, BOTSWANA

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The ongoing research presented here is part of a project called "River Basin Management of Ephemeral Rivers in the South African Development Community (SADC)" conducted by the Harry Oppenheimer Okavango Research Centre (HOORC) in collaboration with the Desert Research Foundation of Namibia. The overall goal of this project is to contribute towards improved livelihoods of people dependent upon natural resources in ephemeral river basins. By achieving this goal this project would contribute to long-term sustainable and equitable use of water, riparian forests and other woody vegetation and related resources in ephemeral river basins of the SADC region. This directly contributes to the objective of combating desertification, defined by the UNCCD as "inclusive of activities, which are part of the integrated development of land in arid, semi-arid and dry sub-humid areas" (see: www.unccd.int).

To assess natural resource availability, this study uses remote sensing techniques to detect vegetation and landuse changes along the Boteti river in north western Botswana. The Boteti, fed by the waters of the Okavango Delta through the Thamalakane and Boro rivers supplemented by local summer rains, meanders through the Ngamiland and Central districts and -in the past- flowed into the Makgadikgadi salt pans. Currently, the river terminates at variable distances from Maun. Since 1993 variable sections of the river did not receive water every year, cutting local ecosystem off from floodwaters and thereby impacting a range of natural resources (Vanderpost, 1995). Some of these impacts can be detected through remote sensing techniques.

Three Landsat (TM and ETM+) images cover the study area. To obtain best vegetation characteristics, end of rainy season (March/April) scenes were selected for 1990 and 2000 for a relevant time series as described by Heinl et al. (2007). The start of the time series, 1990, represents the stage, when the Boteti river was still flooding throughout Ngamiland and parts of Central district, whereas in subsequent years the floodwaters persisted only through the upper reaches of the study area.

The research is concentrated on an area from the confluence of the Thamalakane and Boteti rivers (23º22'31.4, 20º8'24.2) south of the town of Maun downstream to the village of Mopipi (24º52'6.5, 21º12'6.9). All images were geometrically corrected using a polynomial

model with twenty-five ground control points (gcp) with an average RMS Error of 33.0147 meters. The images were then classified into 50 classes using an unsupervised ISODATA method with a convergence threshold of 0.98 and with 30 iterations. After the application of a neighborhood filtering function with a kernel size of 3x3 pixels, the classified images were available for visual interpretation and the application of a change detection algorithm.

Based on visual interpretation of the classified images and the researcher's field-knowledge, there appears to be evidence that riparian woodland vegetation suffered most from the hydrological changes of the Boteti river and experienced the highest decrease in abundance along with dense woody vegetation classes. Consequently, bare open soil and broadleaf and Acacia shrub land vegetation appear as the beneficiaries of the changed ecological conditions. This change appears to be related not only to hydrological change but also to increased population pressures in the area (Vanderpost and McFarlane, 2007). Initially much of the area was home to cattle herders who watered their cattle and goats in the river. As the river dried out, more herders turned to groundwater sources. In addition, village populations have increased rapidly over recent decades resulting in increased groundwater consumption for domestic uses. This may have contributed to a decline in the local groundwater table.

Groundwater decline may have affected riparian woodlands and certainly has affected flood recession farming which was a significant livelihood activity in the river basin. Increases in population inevitably also required the increased use of wood for building purposes which may further account for the decline in riparian and dense woodland, whereas expansion of shrubland may be a result of increased cattle and smallstock grazing that contributed to bush encroachment.

Landcover changes observed from satellite images over the Boteti river basin over the 1990-2000 decade, particularly a decline in riparian and other dense woodlands and an increase in shrubland and bare soil, appear thus to be related to a combination of hydrological change in the area and increases in human population numbers and activities such as livestock grazing.

References:

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