# *Waterbuck (Kobus ellipsiprymnus defassa)* as an ecosystem health indicator in Lake Nakuru National Park, Kenya

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## Abstract

Lake Nakuru National Park was created in 1968. In 1987, as local human population pressures increased, an electric fence was erected around the park. Lake Nakuru Basin has undergone extensive and rapid land cover and land use change, including significant upland forest losses resulting in changes to the timing and amount of flow reaching the Park from the River Njoro. While many studies analyze land use changes and their environmental impacts at site specific scales, this research looks toward broad-scale landscape changes and their potential impact with regard to forage availability for common waterbuck (*Kobus ellipsiprymnus defassa*) within the enclosed park. Once the most abundant ungulate within the park, it's numbers are decreasing possibly as a result of upstream land cover changes. Consequently, this species may serve as an indicator of threats to ecological services within the Park. In addition, interspecific competition with African buffalo (*Syncerus caffer*) is explored as a factor.

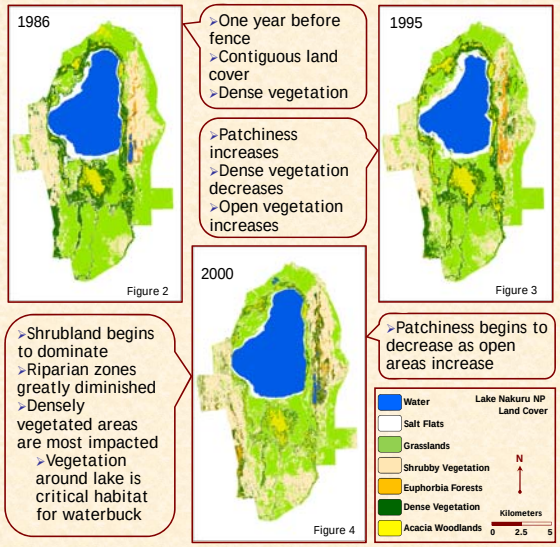
## Background & Methods

The River Njoro is one of five rivers feeding Lake Nakuru and supplies 65% of all surface flow to the lake. Within the Njoro watershed, significant land cover changes have occurred since 1986 (Baldyga et al., 2007) with concurrent changes in river flows into the park (Miller et al., 2007). Using Waterbuck census records collected by Kenya Wildlife Services from 1986 to 2000, R. Njoro simulated flow, precipitation, and cover type estimates from satellite imagery; questions are proposed regarding the impact of broad scale upland land cover changes.

## Study Area

Figure 1


## Land Cover and Land Use Change




Flows into Lake Nakuru have decreased substantially as a result of upland land cover changes (Miller et al., 2006; Table 1; Figure 7). Decreased flows have subsequently reduced the coverage of dense riparian vegetation. Erecting a wildlife-proof fence around Lake Nakuru National Park led to the cessation of wildlife migrations, thus placing increasing pressure on forage resources within the park (Mwangi and Western, 1998; Mwangi, 1998).

**Table 1:** Changes highlighted in red are resulting in the greatest impacts to the hydrological regime within the River Njoro watershed (Baldyga et al., 2007).

| Land Cover Class | Land Cover Present as % of R. Njoro Uplands | | |
|---|---|---|---|
| | 1986 | 1995 | 2003 |
| Grass | 12% | 13% | 16% |
| Forest | *62%* | *57%* | *47%* |
| Plantation | 16% | 23% | 13% |
| Riparian | 3% | 3% | 3% |
| Degraded | 0.30% | 0.10% | 2% |
| Large-scale Ag | 2% | 2% | 2% |
| Small-scale Ag | *5%* | *2%* | *17%* |

**Figure 5:** Waterbuck resting near the lake edge. Lake Nakuru National Park is considered to have the highest density of these animals in Kenya.

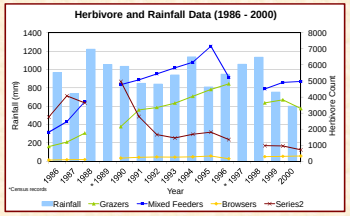



**Figure 6:** Herbivore populations within the park follow an expected relationship with rainfall in savanna ecosystems, ebbing following low rainfall (Coe et al., 1976). Waterbuck are experiencing a more significant decline among the grazer group, however.

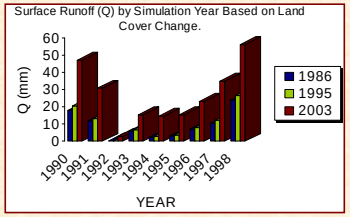
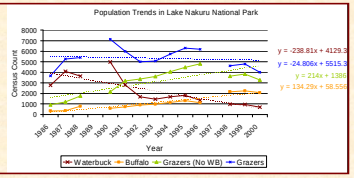



**Figure 7:** Simulated surface runoff (Q) using observed rainfall from 1990 – 1998. These results indicate that the trend and magnitude of change for flow in the River Njoro is toward flashier and increased flows as land use changes (Table 1; Miller et al., 2007).

## Discussion

Preliminary analyses point to important changes occurring within Lake Nakuru National Park and perhaps its greater ecosystem. Because waterbuck traditionally have a high density here, their declining population may serve as an indicator of negative impacts from these changes. Studies from surrounding areas point to several noteworthy and recent changes to ecosystem health such as land use change, water quality and quantity decline, heavy metals presence, and changes in animal assemblages (Baldyga et al. 2007, Miller et al., 2006).

**Figure 8:** Beginning in 1990, as the overall grazer population begins to slightly increase, the waterbuck population sees a dramatic decrease. By 1992, the population stabilizes at a lower than usual count.



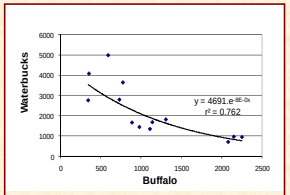




**Figure 9:** There was a strong negative correlation between buffalo and waterbuck populations. There may be a population threshold at which waterbuck are unable to compete.

**Figure 10:** Buffalo are a traditionally migratory herbivore, but their migration ceased in 1987. Restricted buffalo movement may have led to interspecific competition with waterbuck, and subsequent waterbuck population decline.

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