Conceptualising the hydrology of tropical wetland habitats to inform biodiversity management in northern Zambia

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Overview

- Zambia: Introduction and natural resources
- Potential threats to key habitats
- Study area and aims
- Results
- Conclusions and further work
19 National Parks and 34 adjoining Game Management Areas (GMAs) make up a third of Zambia’s area

- Mainly riverine wetlands and seasonally inundated floodplains
Zambia

- One of the poorest countries (DfID), limited economic base
- One of Least Developed Countries (United Nations)
- Estimated 10% of population formally employed
  - Potentially >20,000 in tourism
- Unlikely to meet key Millennium Development Goals by 2015:
  - MDG 1: ‘End Poverty and Hunger’
  - MDG 7: ‘Ensure Environmental Sustainability’
- **Projected c. 1000% population growth rate by 2100**
  - currently 13-14 million, to over 100 million?
- Maintenance of river ecosystem health will help support biodiversity and safe water supply
Study Area: Kasanka National Park

- 420 km² (Designated in 1972)
- Neglected till late 1980's; poaching high
- Important freshwater habitats (high mammal & bird diversity)
Fundamental freshwater habitats: conservation and ecotourism

- Dambos & floodplains
- Mushito
- Fruitbats
- Sitatunga – river floodplains
- Crocodile
- Rivers
Management issues:

• Climate and hydrological pressure
  – ↓ Rainfall, ↑ Temperatures?
    \(\text{(e.g. Sithole & Mweri 2009)}\)
  – ↑ Demand & changing land use in upstream catchment?

• Burning
  • Too much or too little?
  • Effects on habitats?

• Implications for sources and sinks?
Seasonal dambos: Climate driving hydrology

![Graph showing lake level and precipitation over time.]

- Lake level (cm) from October 2005 to September 2008.
- Precipitation (mm) from 1989/90 to 2006/07.

Rainfall (mm) for different years:
Hydrological monitoring objectives

• Understand relationships between catchment recharge areas and freshwater habitats

• Understand threats to hydrological processes underpinning freshwater habitats

• Input to wider management plan for KNP

- **39 sites routinely sampled 2005 - 2008 (rivers, boreholes, seasonal lakes)**

- Tracer study (Electrical conductivity, alkalinity, oxygen isotopes)
Waterbody characteristics

- δO18 correlated to Axis 1
- Mean Alkalinity correlated to Axis 2
- Cumulative percentage variance of Axis 1 = 87.2
- Axis 1 and 2 combined = 98.5

Dark/open = 2005
Gray/closed = 2006
X = lakes
+ = groundwater
Conceptualised model of hydrological inputs

LUWOMBA: Water input from outwith park boundary; Little interaction with groundwater in KNP

KASANKA: Increasing groundwater and wetland interaction downstream

HEADWATER WETLANDS:
- Wet season (increasing rainwater dominance)
- Dry season (groundwater dominance in some lakes)

Proposed farm intensification to the south of park?:
- Groundwater and river abstraction?
- Increased siltation in river habitats?
- \( \uparrow \text{NO}_3^- \) to surface and groundwater from fertilizer application?
Conclusions and recommendations

• Complex systems, largely climate driven, prone to human impact

• Major threats from outside of park
  – impoundments and river water abstraction
  – Fertilizer application and groundwater sensitive river headwaters

• Ensure protection of these headwater catchments
  – Designation as ‘conservation areas’ under KGMA Land Use Plan?

• Protection of wider catchments from over-burning
  – Maintain perennial flow and hasten recharge of wetland areas.
Thank you: ......any questions?