SUPPORTING THE OKAVANGO DELTA MANAGEMENT PLAN

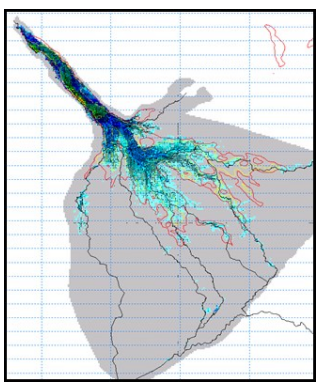
Helping Botswana protect the Okavango Delta wetland system

The Okavango Delta covers about 6,000 km² of a permanently flooded swamp with shallow water depths and extensive surface vegetation. The dynamic flow, flood and wetland extents within the delta form the basis for the ecosystem and economic value of its wildlife and tourism. The provisions of the Wetlands Policy, in conjunction with the obligations under the Ramsar Convention required the Botswana government to develop an integrated management plan of the delta. Known as the Okavango Delta Management Plan (ODMP), the project needed a thorough understanding of the wetland hydrology. We developed a comprehensive integrated model complex based on MIKE Powered by DHI's software components. Our hydrological model, combined with our consultation services, provided results which were successfully applied to the ODMP.

FROM DESERT TO WETLAND

From its source in the highlands of Angola, the Okavango River crosses Namibia through the Caprivi Strip and enters Botswana at Mohembo. After meandering through the panhandle, it reaches the alluvial fan deposits of low topographical gradients. Here, it breaks into many sub-branches, lagoons and back swamps.

The Okavango Delta features a sharp contrast between the wetland and the surrounding Kalahari Desert. In fact, areas at the edge of the delta may shift from completely dry to inundated in a span of one year, in response to the yearly floods. The floods are highly dependent on inflows from the river and thereby on climatic changes as well as in the upstream water management.



The Okavango Delta, river and wetlands from above.

CLIENT

National Conservation Strategy Agency

CHALLENGE

- Threats to the unique and complex ecology of the Okavango Delta (a Ramsar wetland)
- Need to protect the delta and consequently the important tourism industry
- Need to model and evaluate the impacts of dynamic climatic and hydrological conditions to ensure ecological conservation of the region

SOLUTION

- An integrated hydrological model of the Okavango Delta
- Expert consultancy services and scenario analysis
- Capacity building and technology transfer to the Department of Water Affairs (DWA), Botswana

VALUE

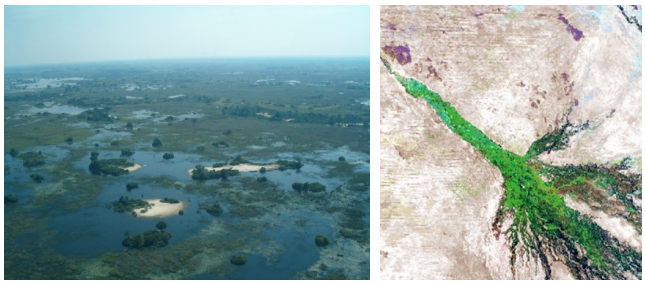
- Application of scenario results in an effective management and protection plan for the delta
- Clear outline of scenario impacts on flood extents, water balances and tourist hot spots in the delta
- Basis for water permitting, development projects and river maintenance
- Basis for Okavango River Basin Water Commission (OKACOM) talks on water resources management and the future of the Okavango Delta
- Enabling the DWA to implement and sustain the solution

LOCATION / COUNTRY

Okavango Delta, Botswana

SOFTWARE USED

MIKE 11
MIKE SHE



Okavango wetlands from a plane and satellite view.

THE OKAVANGO DELTA MANAGEMENT PLAN

The Okavango Delta is vital to the ecology, economy and culture of Botswana. Many people derive their livelihood in the delta and it serves as a source of revenue from tourism.

When the Government of Botswana ratified the Ramsar Convention in April 1997, it listed the Okavango Delta and the surrounding areas as a Ramsar site. In so doing, the area became the world's largest area protected under the convention.

The Botswana government drew up the draft National Wetlands Policy and Strategy in 2001. The provisions of the Policy, in conjunction with the obligations under the Ramsar Convention required Botswana to develop an integrated management plan of the Okavango Delta. Known as the Okavango Delta Management Plan (ODMP), the project needed a thorough understanding of the region's wetland hydrology.

BUILDING A DYNAMIC, DISTRIBUTED WETLAND MODEL

Due to the extent and inaccessibility of the delta, we used remote sensing data extensively for:

- mapping flood extents and vegetation density
- providing specific distributed inputs for the evapotranspiration component

We developed an integrated model complex based on MIKE Powered by DHI's software MIKE SHE and MIKE 11. The model focused on the highly dynamic exchange between the river network and the surrounding flood plains. Capturing the losses to infiltration, groundwater recharge, evaporation and transpiration was equally important in order to account for expanding and retreating flood waters.

We observed significant decadal climate variability – including inter-annual variations, giving rise to large variations in flood extents. We needed to ensure that the model describes the dynamics properly. As such, we compiled multiple years of satellite images and used them to calibrate the model. This was done with respect to the total flooded area as well as the distribution of wetland and flood plains.

WETLAND PROTECTION – A VITAL NEED

The Okavango River and the Okavango Delta represent the largest freshwater resources of the region. Likely exploitation and development imply potential changes in the region's flow and flood regime – the basis for the survival of local ecosystem and wildlife.

Our integrated wetland model was used in scenario impact assessment simulating delta responses to both individual and combined management measures. Our results showed that groundwater abstraction, building of hydropower dams and deforestation in upstream Angola had very limited adverse effects with respect to maintaining current flood extents and duration. On the other hand, climate change and increased water use for upstream irrigation impact the delta profoundly by reducing the flooded area by more than 50% in parts of the Delta.

As part of defining alternative water management scenarios, upstream water use for irrigation, hydropower dams, groundwater exploitation, deforestation, removal of vegetation blocking in the main channels and climate change were taken into account. The model outputs used in scenario evaluation and in support of formulating the ODMP included changes in flood extents in five different zones covering permanent and occasionally inundated area, duration of flooding, water levels, flow velocities, water balances and depth to the ground water table.

As part of the project, we also trained staff at the Botswana Department of Water Affairs. Our study also formed the basis for Okavango River Basin Water Commission (OKACOM) talks on water resources management and the future of the Okavango Delta.

CLIENT TESTIMONIAL

> *The integrated hydrological model is an advanced and powerful tool for showing how changes in water management will likely affect a wetland system assisting both planning and decision making.*
>
> *Department of Water Affairs, Botswana*

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