Integrated data for integrated planning of the Okavango Ramsar site: challenges and prospects.

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University of Botswana
Harry Oppenheimer OKAVANGO RESEARCH Centre
Outline

• Background

• **Okavango Delta Management Plan**

• Okavango Delta Information system

• **Problems**

• Prospects
LIVING WITH ELEPHANTS

Photo: W. Matheson
LIVING WITH ELEPHANTS

ELEPHANT DETERRENT
Wetlands
Conservation
Development
Livelihoods
Wildlife
Tourism

HOW TO GET THE BEST MIX?
ecosystem services of wetlands according to Millennium Ecosystem Assessment, 2005

- 15 of 24 recognised ecosystem services are undergoing degradation worldwide.
  These include typical wetland services such as fresh water provision, water purification and flood regulation.
Wise Use of wetlands implies maintenance of their ecological processes to ensure sustainability of wetland services.

Failure to maintain ecology leads to degradation of ecosystem services affecting people’s well-being (Finlayson, 2003).
Wise Use of wetlands: Africa

- African wetlands: only 1% of continent
- often wildlife habitats and pools of biodiversity.
- sources of water for a growing population,
- THUS: conservation is of great importance
- (Mitsch and Gosselink, 2000).
Need for DATA

• to classify wetland areas accurately for the purpose of conservation (Finlayson, 2002)

• to manage wetlands and to monitor change, for example using different satellite sensor systems (Goward and Williams 1997).

• ‘Wise Use’ of wetlands requires wise management which in turn requires adequate data and information for appropriate decision making (Cassettari, 1993).
Okavango Ramsar site
• The unique Okavango Delta, an internationally important wetland and wildlife concentration in semi-arid southern Africa, was proclaimed as an international Ramsar site in April 1997.

Second largest Ramsar site in the world
Ramsar site

- The Convention on Wetlands of International Importance (or ‘Ramsar Convention’) advocates for the **wise use** of wetlands and their **sustainable utilisation** for the benefit of mankind in a way compatible with the **maintenance of the natural properties** of the ecosystem.

- The **requirements** of the Ramsar convention include the development of a **management plan** that should be **integrated** into public development planning systems at local, regional or national level (Ramsar Convention, 2008).
ODMP
(Okavango Delta Management Plan)

*is Botswana’s response to the Ramsar convention requirements.

*is comprehensive effort to manage in a WISE manner the resources of the Okavango wetlands and surrounding areas.

For sound decisions aimed at WISE USE, sound information and data is needed.
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<th>Component</th>
<th>Responsible Institution</th>
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<td>Policy, planning and strategy - including project management, co-ordination, integration and technical assistance: DEA and IUCN.</td>
<td>Department of Environmental Affairs</td>
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<td>Communication</td>
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<td>Tawana Land Board (TLB) in association with DLUPU</td>
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<tr>
<td>Sustainable livestock management</td>
<td>Department of Animal Health and Production (DAHP).</td>
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**INTEGRATION:** DATA from 11 GOV Departments
Categories of data:

**Literature**: including *grey* reports

**Plants**: the Pete Smith Herbarium.

**Statistical and other Research Data**.

**Community consultations/meetings info**

**Maps, Aerial Photos, Satellite Images**.
VARIABLE ANNUAL INFLOWS AT MOHEMBO (1933 - 2001)

Percentage of mean annual inflow

5-year Moving average

Max.: 16,145 x 10^6 m^3
Mean: 9,863 x 10^6 m^3
Min.: 5,321 x 10^6 m^3
CONSULTATIONS: KGOTLA MEETING
Compiling data into a geographic database allows *integration* of a great variety of data.

and for relationships to be made visible.

e.g.: water–wildlife–tourism

agriculture–wildlife conflicts

population distribution

– bush fires

*tourism: limits of acceptable change*
• **ODIS** was developed to support the Okavango Delta Management Plan by facilitating access to relevant data for planning purposes.

• This was done by:

  • **Providing a central data access point.**
  • **Ensuring compatibility of data formats**
  • **Ensuring data integrity (correct, up-to-date, etc).**
• Central point for data access:

Many data about the Okavango were scattered at various locations making it difficult to use for stakeholders. E.g.: reports in government offices, GIS data with consultants, monitoring data with safari companies.

Most were not unwilling to share; centralizing the data in one place facilitated sharing and access:

E.g. the HOORC library made a collection of all available grey literature: government and consultancy reports. while the HOORC GIS lab collected all available Gis data.

• Access to data was improved by developing a user friendly data interface: ODIS.
Developed by IBIS Technology in Association with BergStan

OKAVANGO DELTA INFORMATION SYSTEM

Managed by HOORC

Version 1.2.0

WINDOWS BASED NON-EXPERT GIS AND DATA FACILITY

USER TRAINING DONE

MANUAL DEVELOPED
PREPARED ISSUE-MAPS

Map Selector
Maps found in 'Default':

Available Maps

- Conservation areas - endangered bird species (Created: 2006/02/16 09:49)
- Distribution of boreholes (Created: 2006/02/16 10:51)
- Human_elephant conflict (Created: 2006/02/16 10:51)
- Map of Botswana (Created: 2006/04/26 09:48)
- Ngamiland Basemap (Created: 2006/04/24 14:49)
- Ngamiland infrastructure map (Created: 2006/04/27 09:48)
- Ngamiland Map with attached documents (Created: 2006/04/27 09:48)
- Ngamiland topographic map (Created: 2006/04/27 09:48)
- Ramsar Site Pilot sites (Created: 2006/04/26 10:11)

Select None  Select All  Delete Selected

Meta Data  Open  Cancel
Figure 1. General table structure of the ODIS Metadata database.
### Data Set

**DataSet_ID:** 9

**Title:** district_area_botswana

**Category_ID:** Boundary

**Description:** District administration boundaries for the whole country (Botswana)

**Contact_ID:** Department of Surveys and Mapping

**GIS_Type:** Arcview

**Spatial_Type:** Vector

**Vector_Object_Type:** Polygon

**Raster_Object_Type:**

**Coordinate_Quality:** Accurate

**Projection_ID:** WGS_84_DD

**Source:** Department of Surveys and Mapping

**Originator:** Department of Surveys and Mapping

**Format:** ShapeFile

**Status:** Complete

**Time_Periods:**

**Data Provider:** Department of Surveys and Mapping

**Data Origin:** Department of Surveys and Mapping

**Use Restrictions:** None

**Credits:** Department of Surveys and Mapping

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<th>Table_Type</th>
<th>Purpose</th>
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### Bibliographic References

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Record: 1 of 1
• Data integration allowed cross-disciplinary issues to be addressed:

- **Bush fires**

- **Human-elephant conflict**

- **Community access to concession areas**
ELEPHANT DETERRENT
ELEPHANT DISTRIBUTION (yellow) & FIELDS (green)
BUSH FIRES (red) & SETTLEMENTS (black)
MULTIPLE USE
Population Distribution in 2001: people are concentrated along ecologically fragile water courses.
ISSUE MAPS, e.g. Wattled cranes

Flagship Wetland Species
Data compatibility was promoted:

1. GIS data was standardised as ESRI shapefiles with common coordinate system (decimal degrees).

2. Standard nomenclature for GIS data was developed based on the SDSFIE.

3. A basic set of metadata was created.
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**DATA STORAGE:** The SDSFIE standard (Spatial Data Standard for Facilities, Infrastructure and Environment) (3)
ODIS DATA PROBLEMS

- Data integrity
- Missing data
- Incorrect data
- Incomplete data
- Outdated data
- Inadequate data
• Data correctness problem:
• Botswana international
• border
DATA PROBLEMS (continued)

• Missing data: e.g. no data on FROG distribution

• Inadequate data: e.g.

• Data on human-elephant conflict did not have coordinate info.

Yet it was important to know where conflicts occurred.
USING THE DATA for MANAGEMENT

requires increasing levels of **data analysis** and thus increasing **quality & detail** of data themselves.

e.g. management of fish stocks through regulation of fisheries requires good data on stocks, on catches, etc.

![Fish Image]

e.g. to determine minimum flow requirements (after water abstraction) for ecological wetland functions requires detailed ecological data to determine ecosystem resilience.

When it comes to applications for management, the **GOALPOSTS are constantly changing**.
Ngamiland Settlement Strategy

USE WAS MADE OF ODIS DATA
DATA NEEDS TO BE MADE INTO KNOWLEDGE that can be used for:

- planning
- management- implementation
- monitoring of change.
NEW CHALLENGE: During implementation we need Environmental Monitoring for ODMP
Some Primary Strategic Objectives of ODRS:

* Secure integrity of water resources;

* Protect, maintain and improve biodiversity;

* Optimise the socio-economic potential through sustainable use of natural resources.
HOW do we know that we are meeting these objectives?

*Secure integrity of water resources;
MONITOR WATER QUALITY

Protect, maintain and improve biodiversity;
MONITOR BIODIVERSITY

Optimise the socio-economic potential through the sustainable use of natural resources.
MONITOR SOCIO ECONOMIC CONDITIONS
recommendations of the ODMP Research Strategy,

emphasize the importance of directed and long-term monitoring activities.

To inform management, & record the state of the environment & list implications for communities that depend on this environment.
• An effective system of monitoring is critically important in providing information to management decision-making processes in the ODMP.

• RESEARCH helps to define the criteria for successful management interventions, MONITORING allows the success or failure of management actions to be evaluated.

(from: ODMP Research Strategy)
THUS e.g.: design a water quality monitoring programme to monitor chemical and biological aspects of water quality.

**Objectives:**

- Measure, assess and report on the ecological state of aquatic ecosystems
- Detect and report on spatial and temporal trends in the ecological state of aquatic ecosystems
- Identify and report on emerging problems regarding aquatic ecosystems
Use Bio-indicators: e.g.

• **Invertebrates**: Indication of wetland condition based on the aquatic invertebrates present at a site.

• **Fish**: Measure of fish diversity deviation from natural.

• **Riparian vegetation**: Measure of the degree of modification of river bank vegetation.

• **Diatoms**: Measure of physico-chemistry
Macroinvertebrates - diverse group of sedentary organisms that react strongly, and often predictably, to human influences on aquatic ecosystems. Include:

- insects (e.g. mayflies, dragonflies, beetles etc.)
- crustaceans (e.g. crabs)
- molluscs (snails)
- oligochaetes (e.g. worms)
- arachnids (e.g. water mites)
Spatial differences need attention

Upper Panhandle - Shakawe

Lower Panhandle (Thaoge Channel)

Nxaraga Lagoon

Xakanaka - Moremi
Habitat differences – wet

Marginal vegetation (Vossia and Cyperus) in Upper Panhandle

Floating vegetation – Trapa natans, Nymphaea spp.

Marginal vegetation (Miscanthus) in Xakanaka - Moremi

Inundated floodplain
Habitat differences – dry

Paradise Pools – Moremi
June 2005

Rain-filled pools

Paradise Pools – Moremi
January 2006

Mopani woodland pool:
June 2005

January 2006
Data management and storage:

- Central depository of data to facilitate data sharing and data access
- Web-based and desktop-based
Developed a biotic index – OKASS (still to be tested)

Expected (Reference) OKASS Scores, number of taxa and ASPT values for different habitats and per site (three habitats combined)

<table>
<thead>
<tr>
<th>Habitat / Site</th>
<th>Vegetation details</th>
<th>OKASS Score</th>
<th>Number of taxa</th>
<th>ASPT</th>
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<td>Floating vegetation</td>
<td><em>Nymphaea</em> sp. and/or <em>Trapa natans</em></td>
<td>64</td>
<td>13</td>
<td>4.9</td>
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<tr>
<td>Inundated floodplain</td>
<td>Areas flooded by water during high flows</td>
<td>71</td>
<td>15</td>
<td>4.7</td>
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<tr>
<td>Marginal vegetation – Upper and Lower Panhandle and Chief’s Island area (Nxaraga)</td>
<td><em>Cyperus papyrus</em>, <em>Vossia cuspidata</em> and <em>Phragmites</em> spp.</td>
<td>63</td>
<td>13</td>
<td>4.7</td>
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<tr>
<td>Marginal vegetation - Moremi Game reserve area (Xakanaka)</td>
<td>Dominated by <em>Miscanthus junceaus</em></td>
<td>111</td>
<td>21</td>
<td>5.4</td>
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<tr>
<td>Site (Sampling of all three habitats)</td>
<td>Floating vegetation, inundated floodplain and marginal vegetation</td>
<td>111</td>
<td>22</td>
<td>4.9</td>
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</table>
## Information dissemination: reporting

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<th>Summary text and tables of data</th>
<th>Technical report with stats and graphs etc.</th>
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</thead>
<tbody>
<tr>
<td>Lay public (schools, parliamentarians, newspapers, etc)</td>
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<td>In simplified form</td>
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ABSTRACTION
Households
Mining
Irrigation

FRESHWATER
PROVISION

WETLAND
ECOSYSTEM
SERVICES

WATER RESOURCE
MANAGEMENT

FISHING

NATURAL
WATER

WILDLIFE
TOURISM

WETLAND
ECOSYSTEM
Management
Conclusion: management of the Ramsar site is to ensure long-term future fresh water availability as well as maintenance of other wetland ecosystem services. **It therefore needs to be an integrated effort at wetland ecosystem management.**

An integrated database such as ODIS can play an important role in supporting such management.
THANK YOU