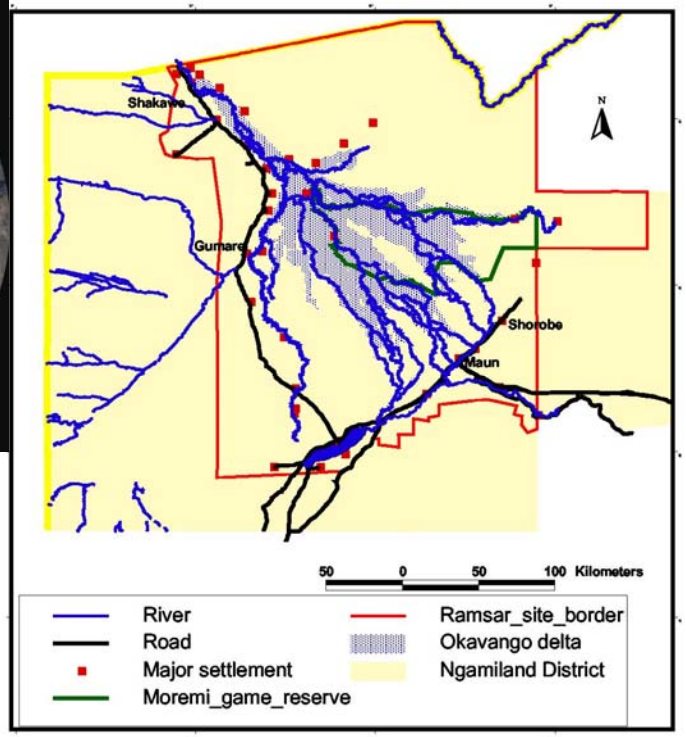
Integrated data for integrated planning of the Okavango Ramsar site: *challenges and prospects*.

Cornelis VanderPost,

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 ??

Wetlands

Conservation

Development

Livelihoods

Wildlife

Tourism

HOW TO GET THE BEST MIX ?

ITS ALL ABOUT

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

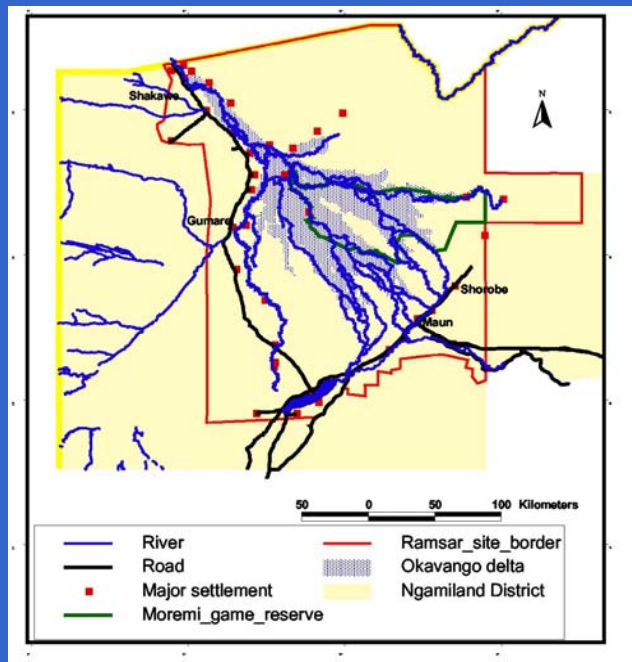
- to classify wetland areas accurately for the purpose of conservation (Finlayson, 2002)
- **to manage wetlands and to monitor change, for example using different satellite sensor systems (Goward and Williams 1997).**
- '**Wise Use**' of wetlands requires **wise management** which in turn requires adequate **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.

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.

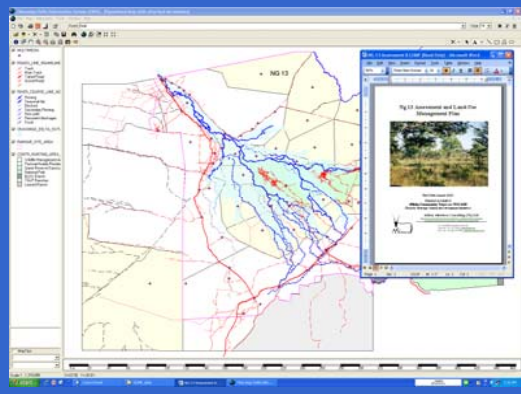
Component	Responsible Institution
Policy, planning and strategy – including project management, co-ordination, integration and technical assistance: DEA and IUCN.	Department of Environmental Affairs
Communication	Department of Environmental Affairs
Research, data management and participatory planning:	Harry Oppenheimer Okavango Research Centre (HOORC).
Hydrology and water resources:	Department of Water Affairs (DWA).
Wildlife management:	Department of Wildlife and National Parks (DWNP).
Sustainable tourism and CBNRM:	Department of Tourism (DoT) and North West District Council (NWDC).
Fisheries management	DWNP, Division of Fisheries
Vegetation resources management	Department of Forestry and Range.
Physical planning	NWDC, Physical Planning Unit (PPU).
Land use planning and land management	Tawana Land Board (TLB) in association with DLUPU
Waste management:	NWDC, Environmental Health Department (EHD).
Sustainable livestock management	Department of Animal Health and Production (DAHP).

Project Components

Source: Dept. of Environmental Affairs, 2008.

INTEGRATION: DATA from 11 GOV Departments

Categories of data:



***Literature*: including *grey* reports**

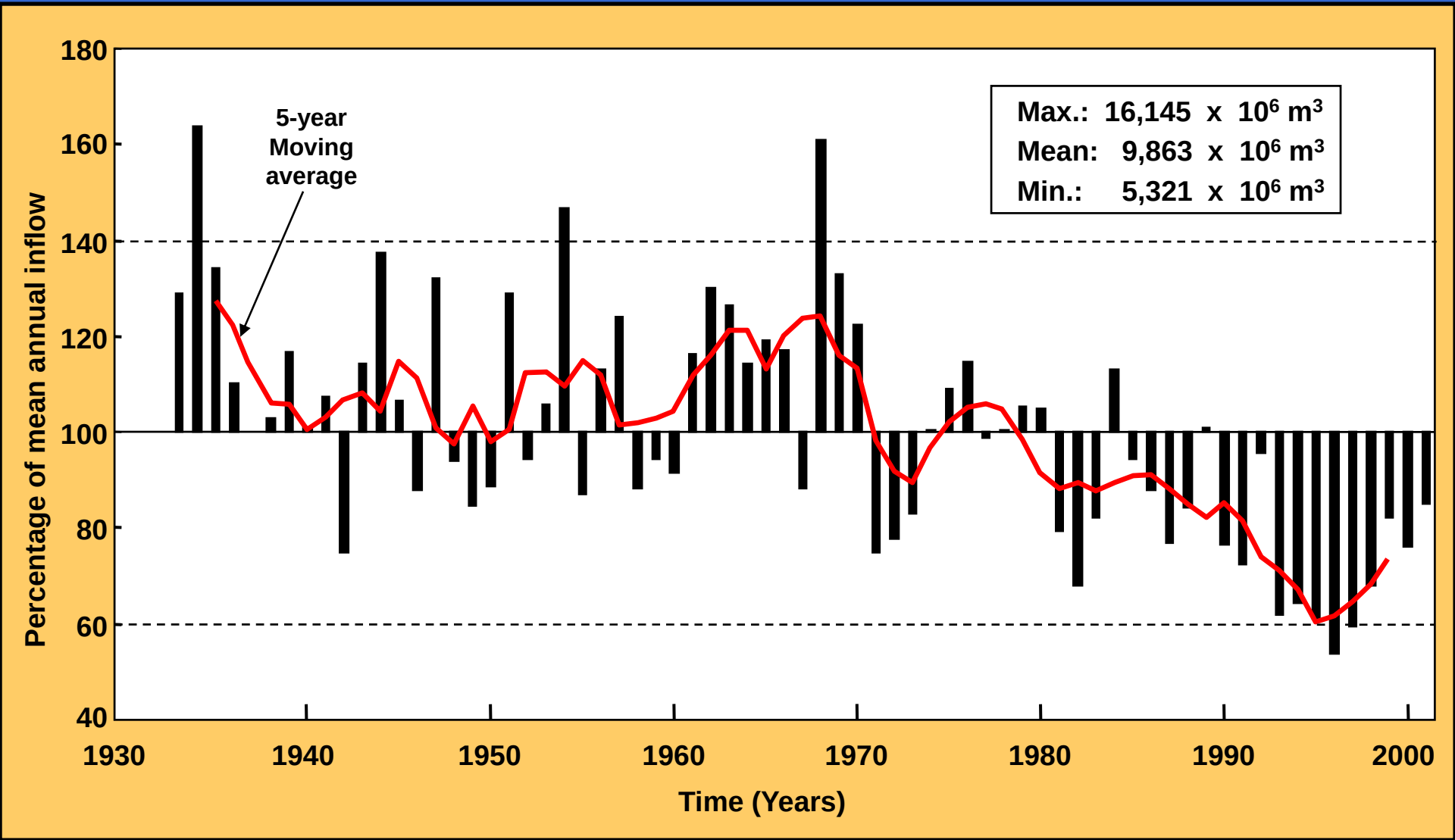
***Plants*: the Pete Smith Herbarium.**

Statistical and other Research Data.

Community consultations/meetings info

Maps, Aerial Photos, Satellite Images.

VARIABLE ANNUAL INFLOWS AT MOHEMBO (1933 - 2001)



CONSULTATIONS: KGOTLA MEETING


Airphoto Panhandle

Compiling data into a geographic database allows ***integration*** of a great variety of data.

and for relationships

to be made visible.

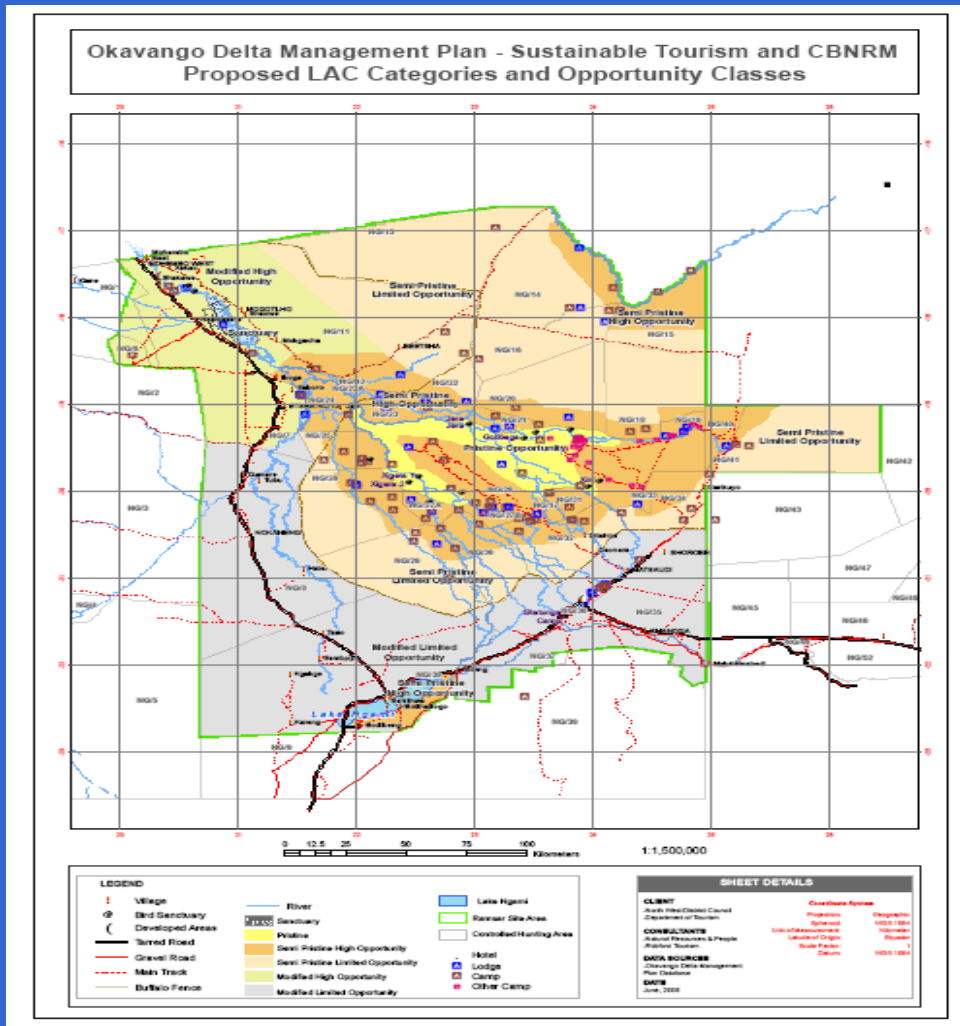
e.g.:water–wildlife–tourism

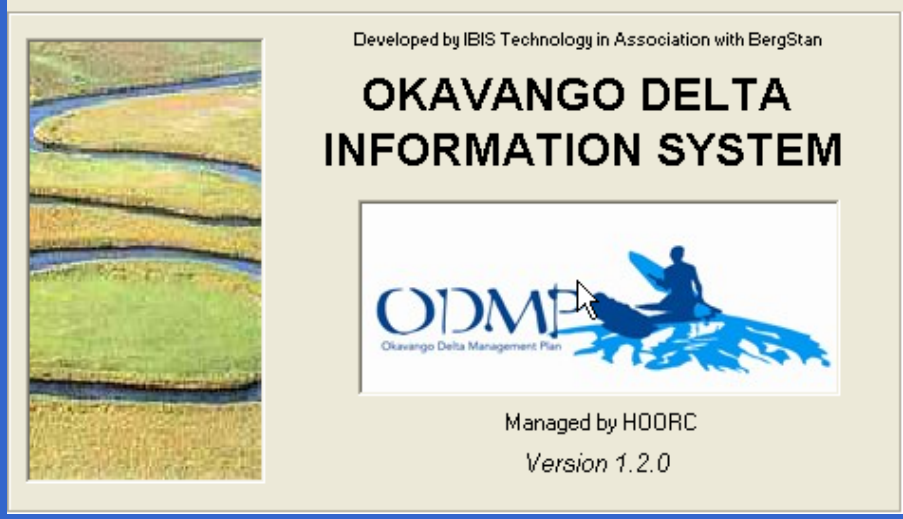
agriculture–wildlifeconflicts

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.

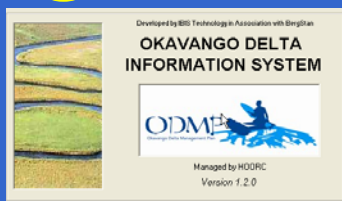
E.g.: reports in government offices, GIS data with consultants, monitoring data with safari companies.

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

ODMP
Okavango Delta Management Plan

Managed by HOORC

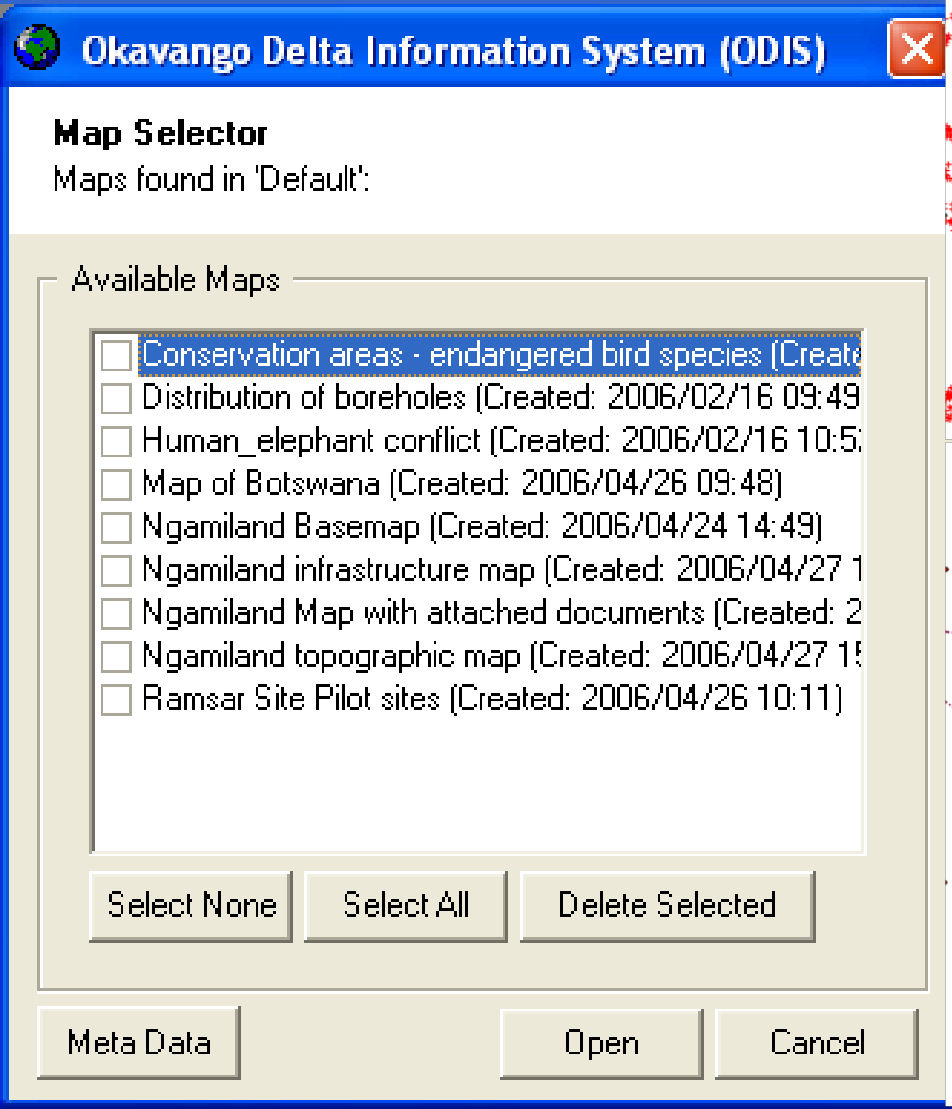
Version 1.2.0

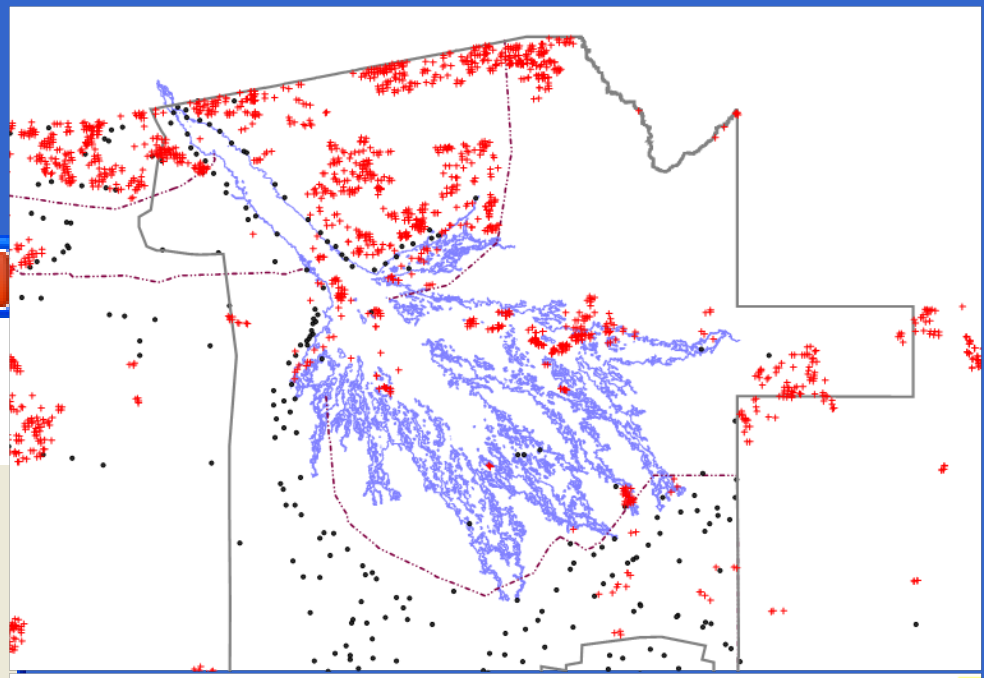
WINDOWS BASED NON-EXPERT GIS AND DATA FACILITY

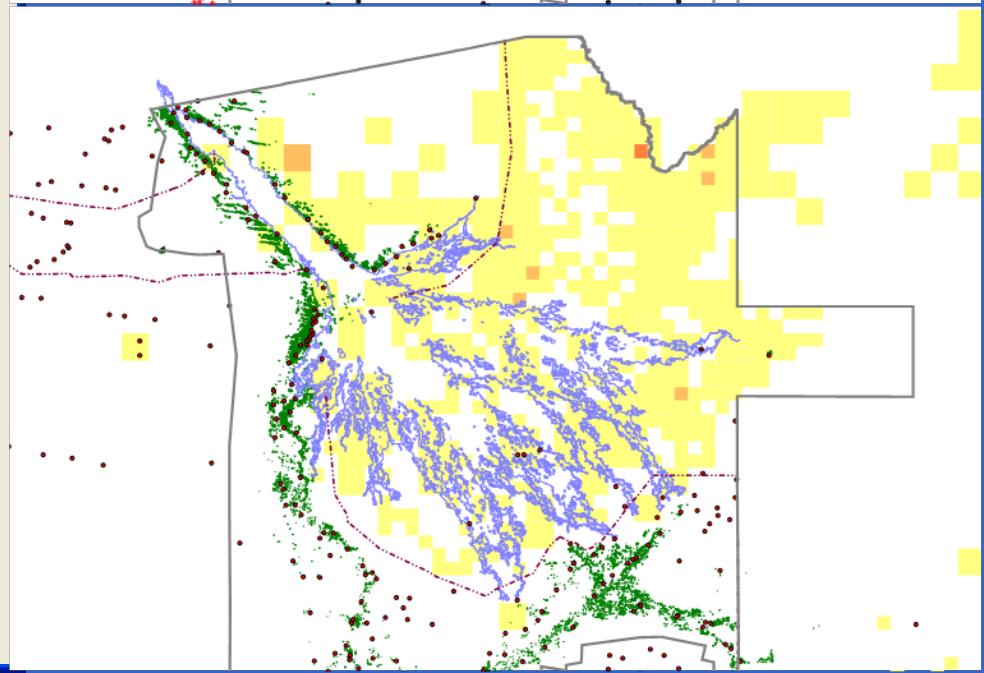
USER TRAINING DONE

MANUAL DEVELOPED

PREPARED ISSUE-MAPS







SIMPLE METADATA AVAILABLE

ODIS MetaData

Edit View Insert Format Records Tools Window Help

Type a question for help

ODIS_Metadata : Database (Access 2000 file format)

Open Design New

Objects

Table

Queri

Forms

Repor

Pages

Macro

Modu

Groups

Favor

Main : Form

Okavango Delta Management Plan

Okavango Delta Information System

Meta Data

Structure

MetaData

Category

Data Set

Tables

Fields

Domains

Contacts

References

Projections

Multimedia

Exit

Reports

Categories

Data Sets

Find References

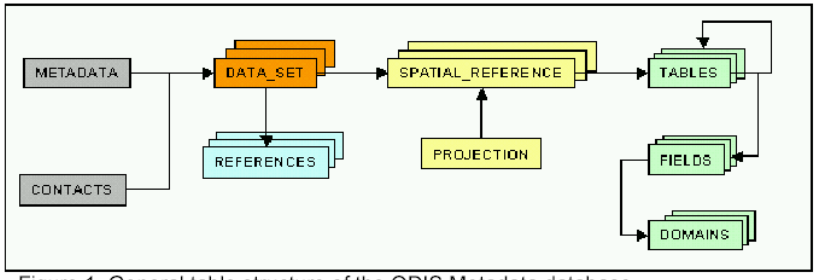
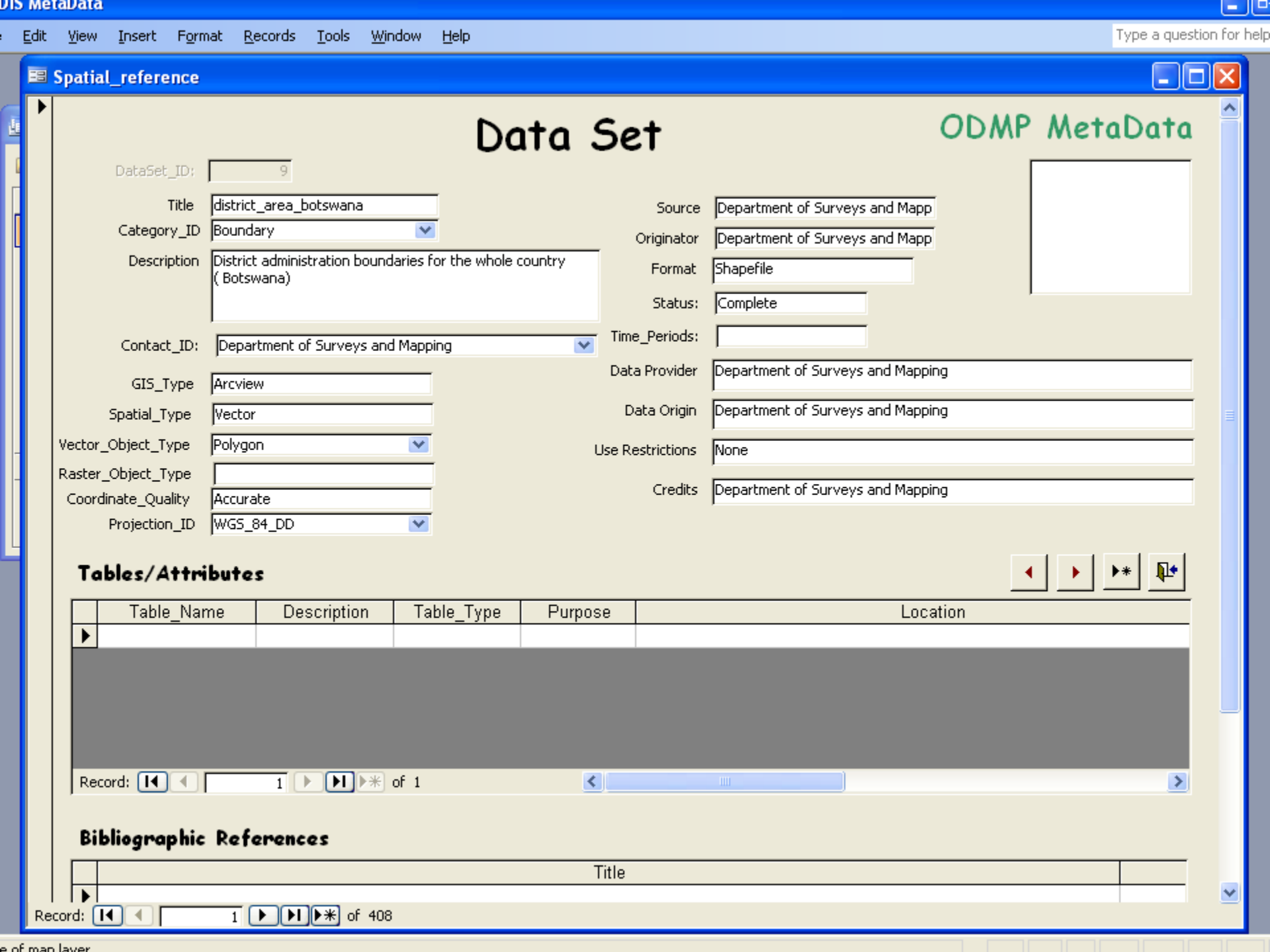
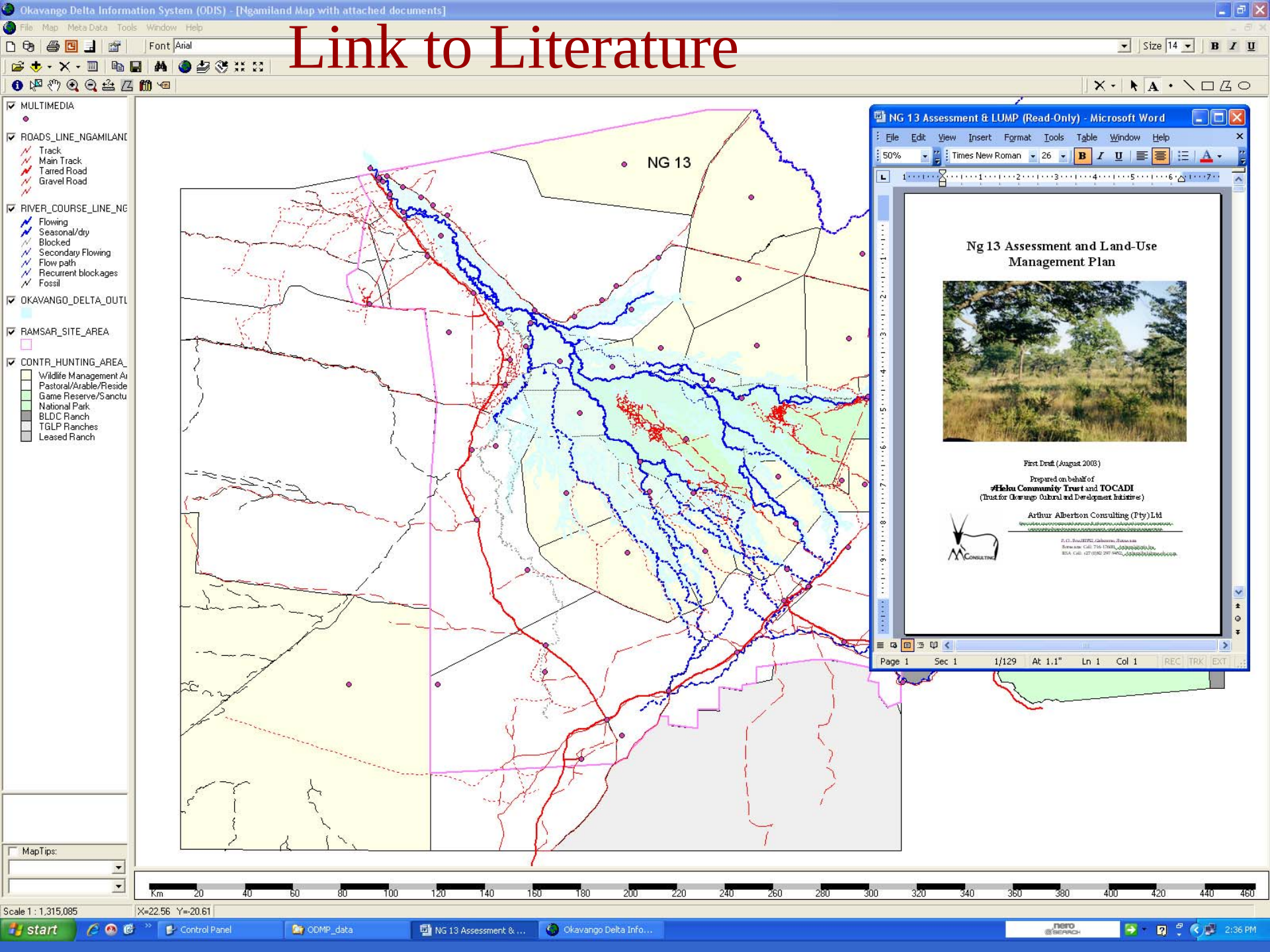


Figure 1. General table structure of the ODIS Metadata database.


DIS MetaData
Edit View Insert Format Records Tools Window Help
Type a question for help
Spatial_reference
Data Set
ODMP MetaData
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 Mapp
Originator Department of Surveys and Mapp
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
Tables/Attributes
Table_Name Description Table_Type Purpose Location
Record: 1 of 1
Bibliographic References
Title
Record: 1 of 408

Link to Literature

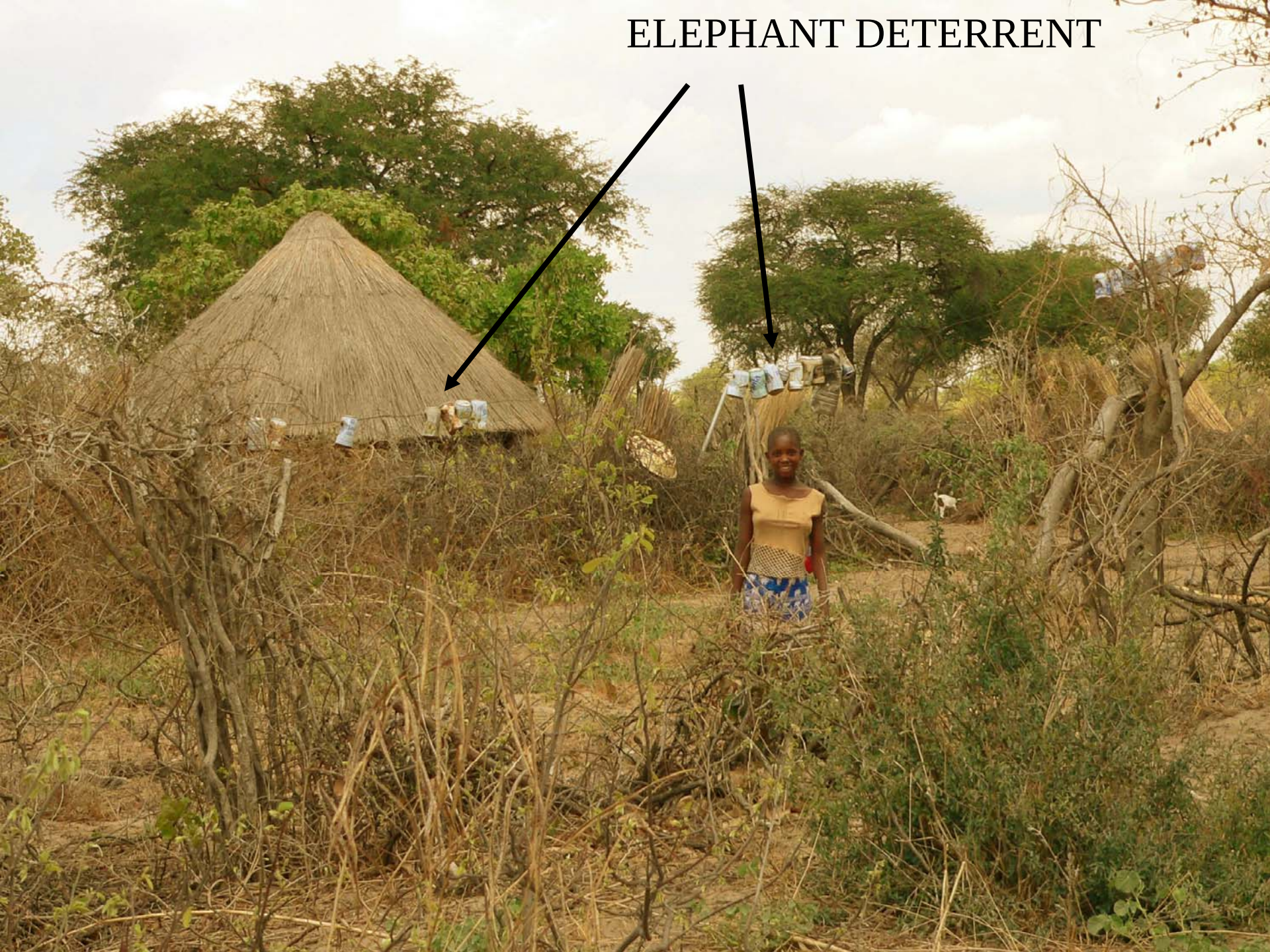


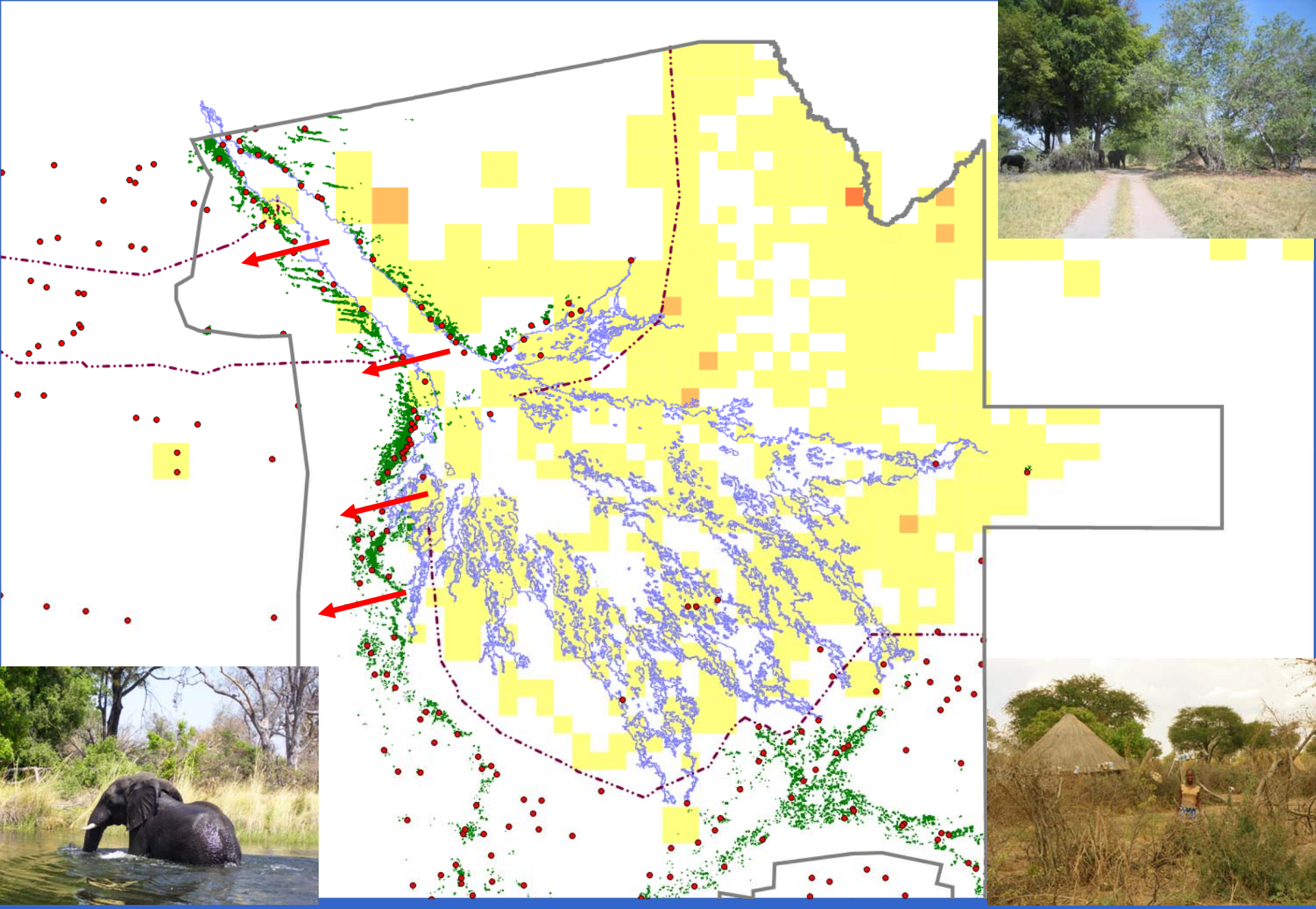
- Data integration allowed cross-disciplinary issues to be addressed:

Bush fires

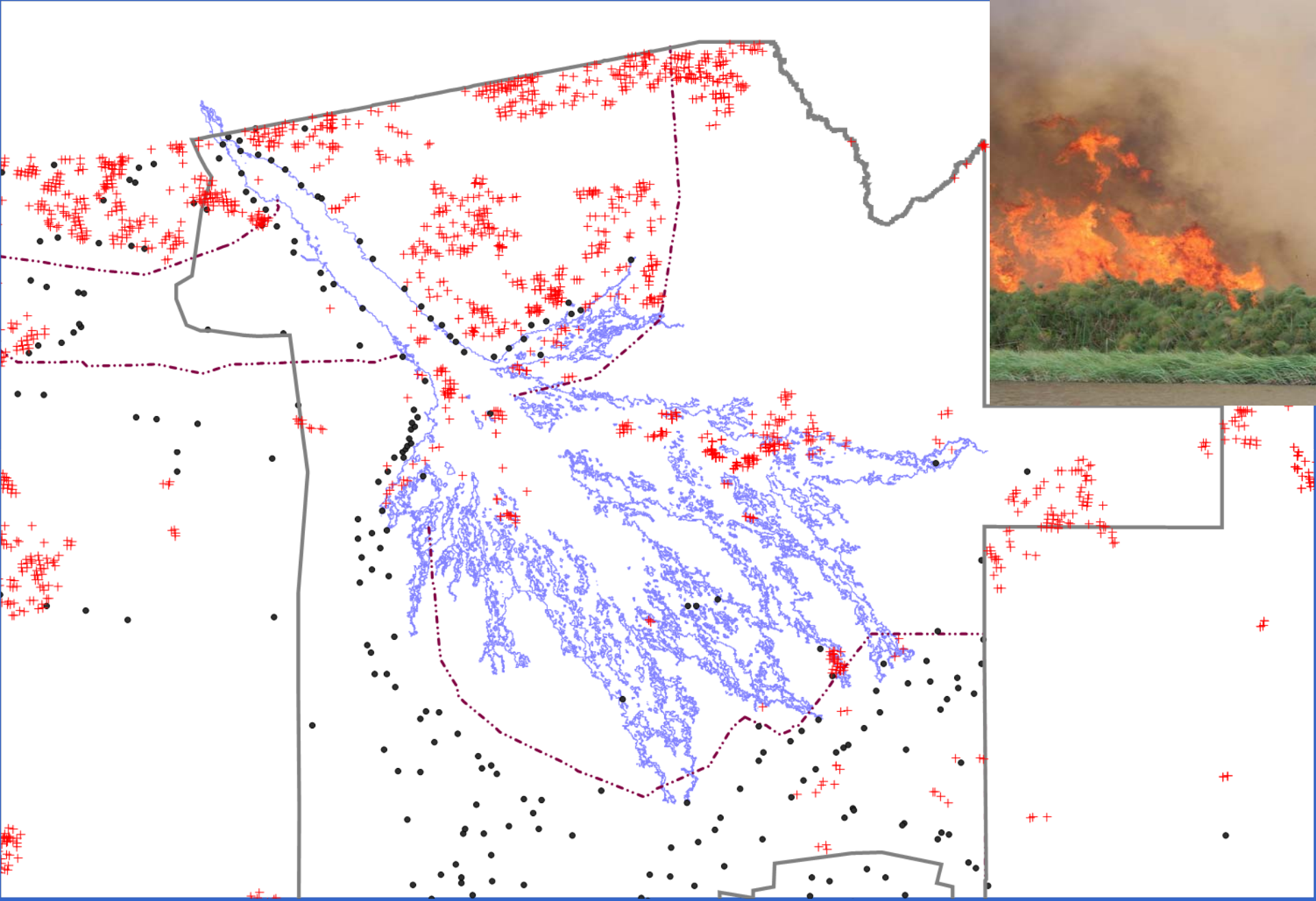
Community access to concession areas

Human-elephant conflict


ELEPHANT DETERRENT



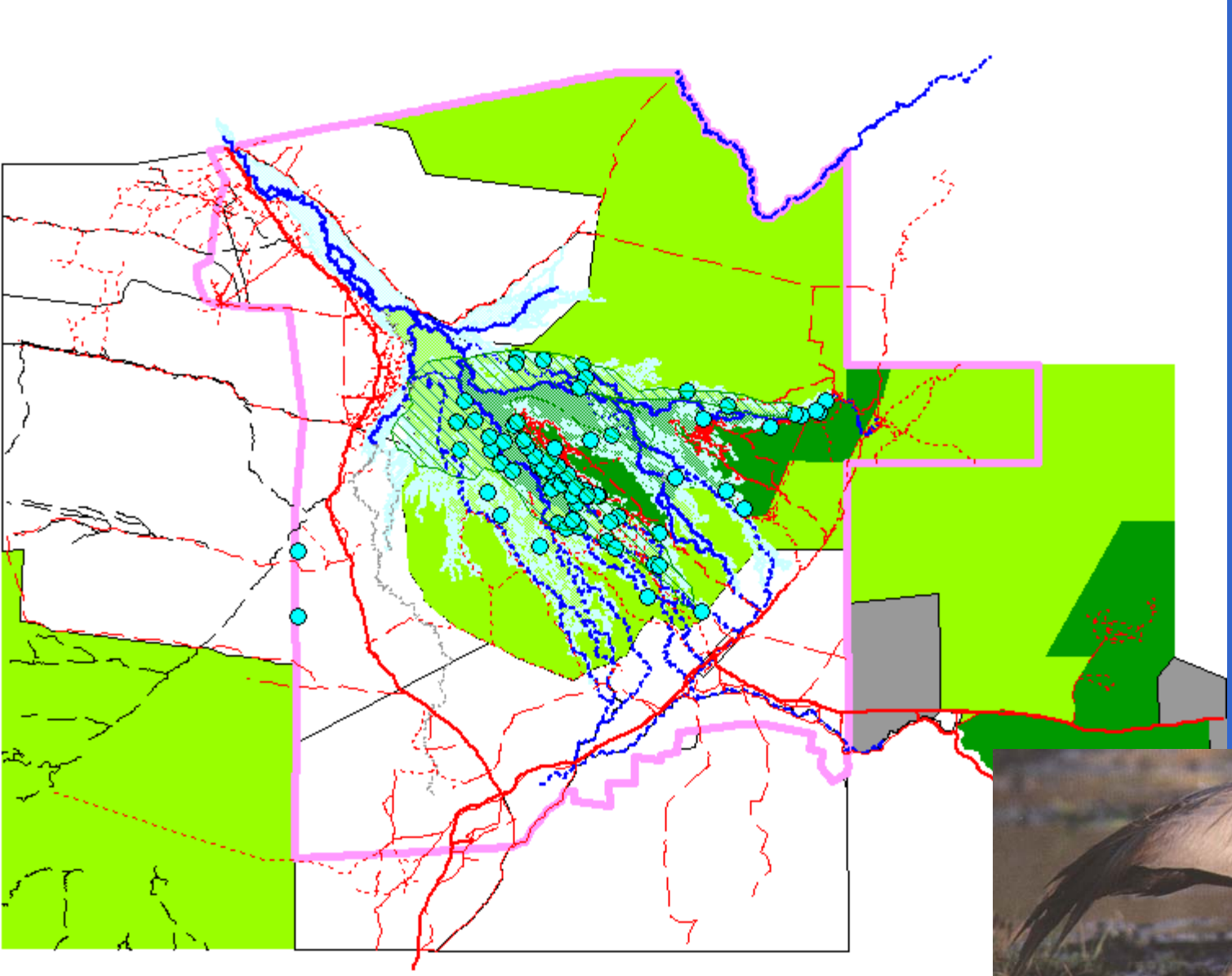
ELEPHANT DISTRIBUTION (yellow) & FIELDS (green)



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

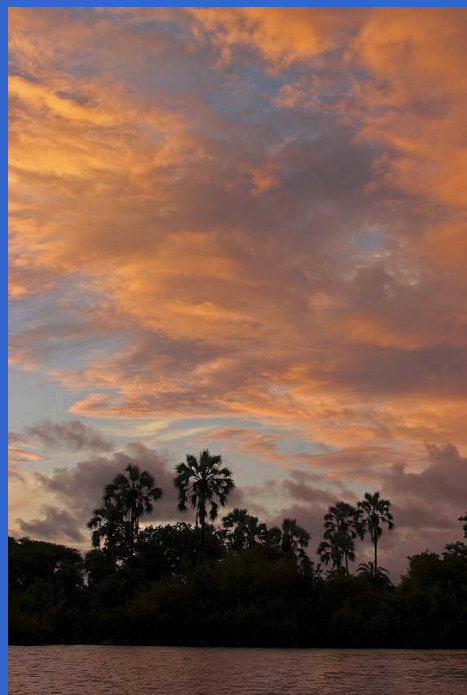
Flagship Wetland Species

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.



ENTITY SET	*example*	*entity set code*	*entity class*	*entity class code*
AUDITORY	noise pollution level	au		
BOUNDARY	district boundary, provincial bound	bd	boundary_national	nat
BUILDINGS	monumental building	bg		
CADASTRE	plot or field	cd	cadastre_property	pty
CLIMATE	temperature rainfall	cl	climate_general	gen
COMMON		cm		
COMMUNICATION	telephone	co	communication_device	dev
CULTURAL	archaeology, history	cr	cultural_archeological	arc
DEMOGRAPHICS	village town populations	de	demographic_enumarea	enu
ECOLOGY	habitat	ec	ecology_habitat	hab
ENVIRONMENTAL_HAZARDS	pollution	eh	envhaz_airpollution	air
FAUNA	wildlife	fa	fauna_amphibia	amp
FLORA	trees	fl	flora_bryoid	bry
FUTURE_PROJECTS		fp		
GEODETIC	survey beacons	gd	geodetic_survey	
GEOLOGY	lithology	ge	geology_lithology	
HYDROGRAPHY	water level, river	hy	hydro_general	gen
IMPROVEMENT		im		
LAND_STATUS	land-use	ls	landstatus_general	gen
LANDFORM	topography	lf	landform_general	gen
MILITARY_OPERATIONS		ml		
OLFACTORY	stink	ol		
SOIL	soils	so	soil_general	gen
TRANSPORTATION	roads	tr	transportation_air	air
UTILITIES	electricity	ut	utilities_electrical	el
VISUAL	aestetic	vs	visual_aestheticview	aes
OTHER				

DATA STORAGE: The SDSFIE standard (Spatial Data Standard for Facilities, Infrastructure and Environment) (3)

ODIS DATA PROBLEMS

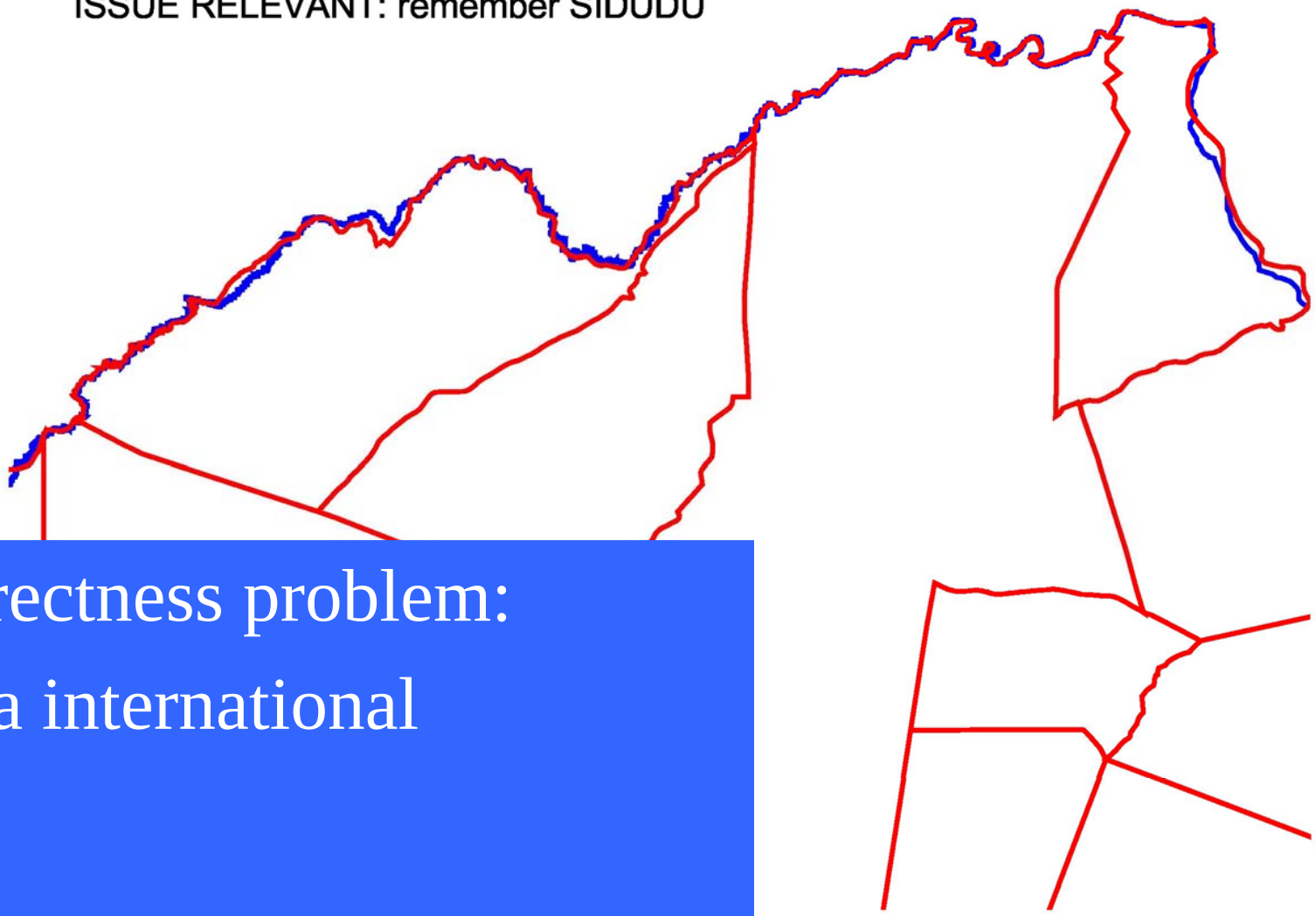
- Data integrity
- **Missing data**
- Incorrect data
- **Incomplete data**
- Outdated data
- **Inadequate data**

BLUE: country border according to border map

RED: country border according to map of controlled hunting areas

WHICH IS CORRECT ? (both from govt !)

ISSUE RELEVANT: remember SIDUDU



- 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.

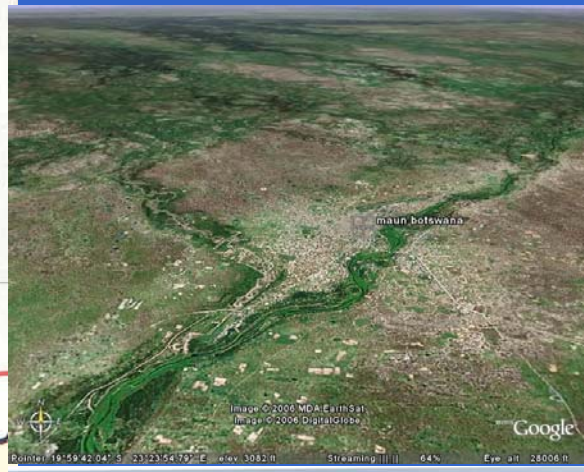
e.g. management of fish stocks through regulation of fisheries requires good data on stocks, on catches, etc.

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*)

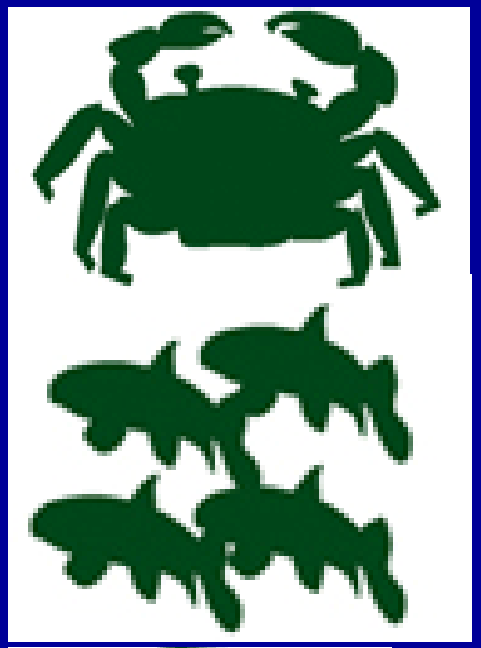
THUS e.g.: design a water quality monitoring programme to monitor chemical and biological aspects of water quality.

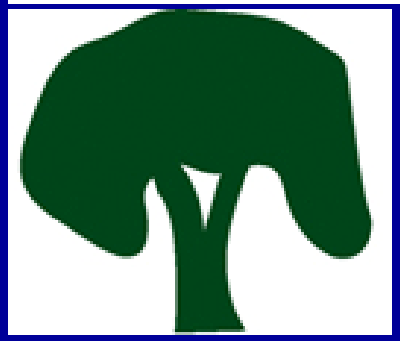
Objectives:

- **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*, *Nymphea* spp.

Inundated floodplain

Marginal vegetation (*Miscanthus*) in Xakanaka - Moremi

Habitat differences – dry

Paradise Pools – Moremi
June 2005

Paradise Pools – Moremi
January 2006

Rain-filled pools

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

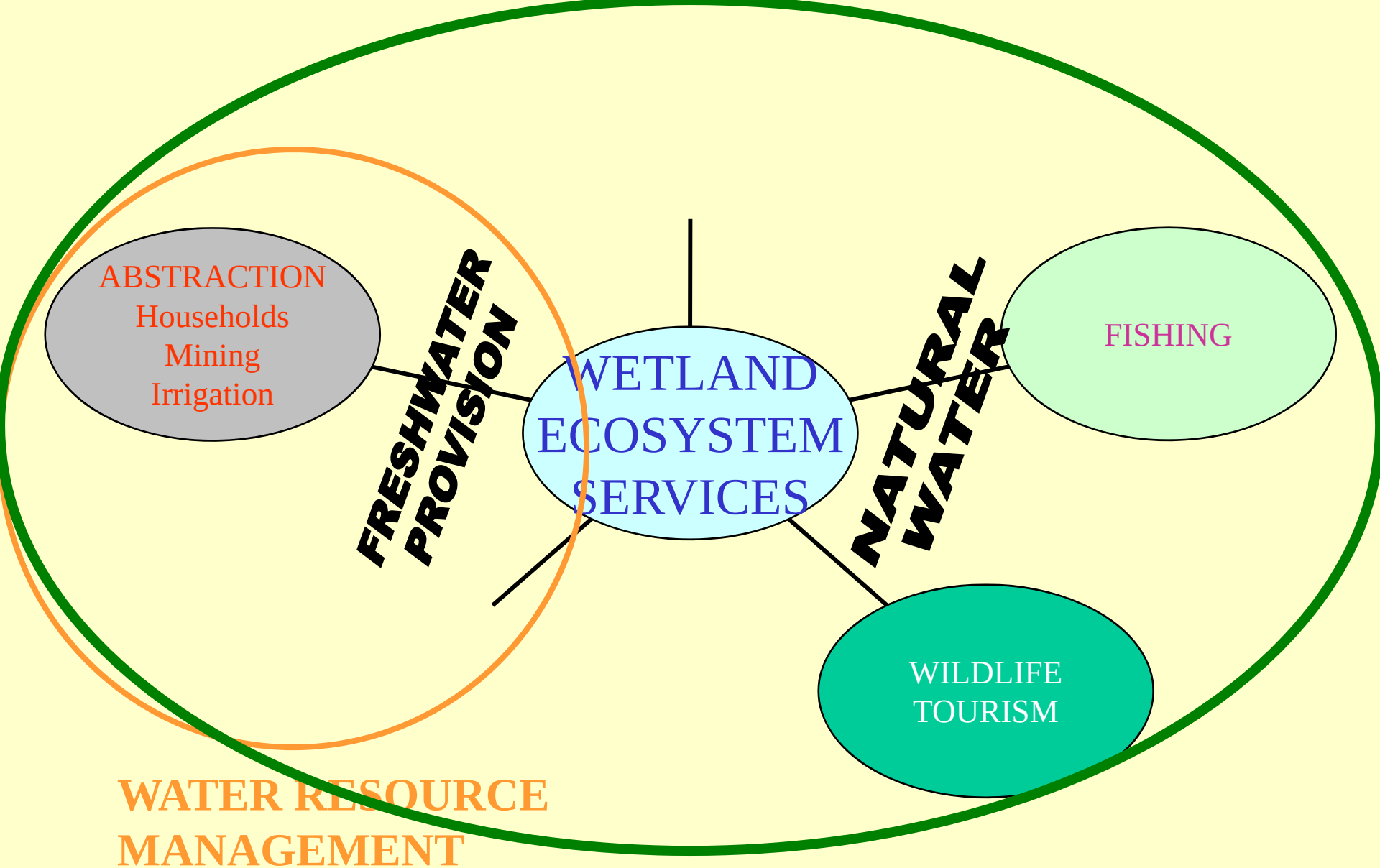
Developed a biotic index – OKASS (still to be tested)

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

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

Information dissemination: reporting

Customer type			Graphics (including pie charts, maps, etc)	Summary text and tables of data	Technical report with stats and graphs etc.
Lay public (schools, parliamentarians, newspapers, etc)				In simplified form	
Informed public (conservancies, NGOs, Conservation mags. etc)					
Water resource / environmental / conservation management information for decision makers					
Technical information for resource managers					
Specialists					


ABSTRACTION
Households
Mining
Irrigation
FRESHWATER PROVISION
WETLAND ECOSYSTEM SERVICES
NATURAL WATER
FISHING
WILDLIFE TOURISM
WATER RESOURCE MANAGEMENT
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.

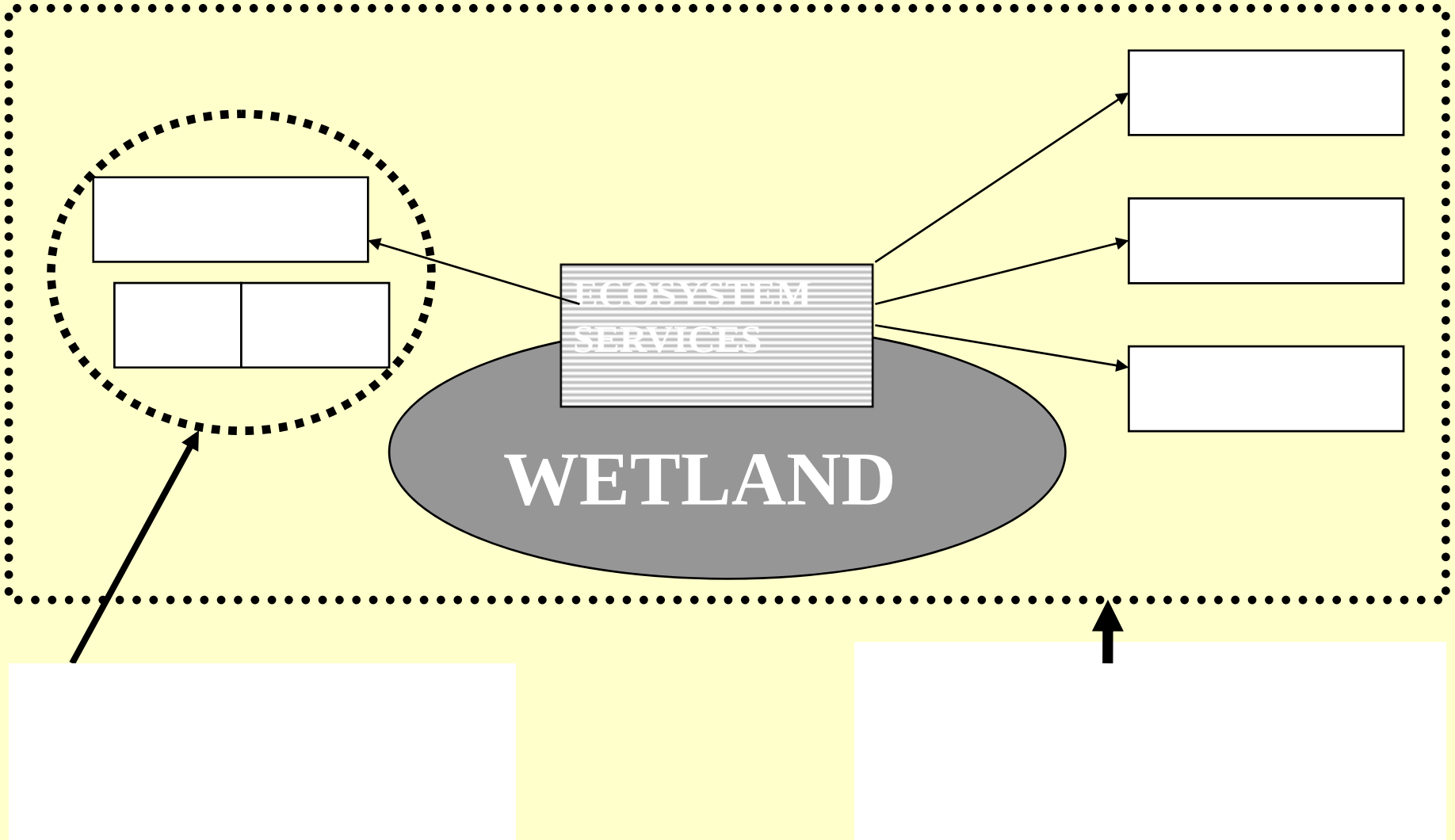
It therefore needs to be an integrated effort at wetland ecosystem management.

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

THANK YOU

THUTO KE THEBE
UNIVERSITY of BOTSWANA

Harry Oppenheimer Okavango Research Centre
University of Botswana


ECOSYSTEM
SERVICES
WETLAND