Autogenous development of habitat heterogeniety in the Okavango Delta, northern Botswana

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SRTM image – Gordon Cooper

Okavango Delta
Comparative sizes of the Okavango and the historic Everglades

FIGURE 2.2
Map of the historic Everglades watershed.
(T E Lodge The Everglades Handbook)
The Okavango Alluvial Fan

Fan gradient: 65 m fall in 250 km

Fan surface extremely smooth
Present climate

Ice age climate

Delta climate is semi-arid:
Evaporation = 5 x rainfall

Source of the water
Only 2% of inflow plus rainfall leaves as surface outflow.
Distribution of swamps

- Channel network
- Permanent swamp
- Seasonal swamp
- Occasional swamp
- Panhandle
- Linyanti
- Ngami
## Important features of Okavango water and sediment

* very low in mud and silt
* very low in dissolved solids – but chemical precipitates are the dominant sediment type
* very low in nutrients

<table>
<thead>
<tr>
<th></th>
<th>INFLOW</th>
<th>SURFACE OUTFLOW</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>WATER</strong></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Rainfall</td>
<td>$6.14 \times 10^9$ m$^3$</td>
<td></td>
</tr>
<tr>
<td>Okavango Inflow</td>
<td>$9.2 \times 10^9$ m$^3$</td>
<td>$0.24 \times 10^9$ m$^3$</td>
</tr>
<tr>
<td><strong>SEDIMENT</strong></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Bedload</td>
<td>170 000 t</td>
<td>nil</td>
</tr>
<tr>
<td>Suspended load</td>
<td>39 000 t</td>
<td>nil</td>
</tr>
<tr>
<td>Solute load</td>
<td>381 100 t</td>
<td>23 450 t</td>
</tr>
<tr>
<td><strong>SOLUTE LOAD COMPOSITION</strong></td>
<td></td>
<td></td>
</tr>
<tr>
<td>CaCO$_3$</td>
<td>114 900 t</td>
<td>5310 t</td>
</tr>
<tr>
<td>MgCO$_3$</td>
<td>19 100 t</td>
<td>1640 t</td>
</tr>
<tr>
<td>SiO$_2$</td>
<td>147 000 t</td>
<td>8300 t</td>
</tr>
<tr>
<td>NaHCO$_3$</td>
<td>67 100 t</td>
<td>5600 t</td>
</tr>
<tr>
<td>KHCO$_3$</td>
<td>33 100 t</td>
<td>2600 t</td>
</tr>
<tr>
<td>Aerosol fallout</td>
<td>250 000 t</td>
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Islands: the main source of habitat diversity

Islands originate mainly from channel inversion and termite activity
Channel inversion

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Water loss

Okavango Inflow: $6.14 \times 10^9$ m$^3$

Rainfall: $9.2 \times 10^9$ m$^3$

Solute load composition:
- KHCO$_3$: 5600 t, 67 100 t
- NaHCO$_3$: 8300 t, 147 000 t
- SiO$_2$: 1640 t, 19 100 t
- MgCO$_3$: 5310 t, 114 900 t
- CaCO$_3$: nil

Table showing sediment load:

- Bedload: 170 000 t, nil
- Suspended load: 39 000 t, nil

Channel inversion diagram.
Channel failure on the fan

Piotr Wolski
Aggrading sediment-bearing channel

New channels nucleating on hippo trails
Termite activity
Soil calcium content

Soil magnesium content

Island growth

Island surface
Merging of islands
Island diversity
Nutrient accumulation on islands
Nutrient accumulation
Continued island growth: Dust accretion

Red – floodplains
Blue – riparian fringe
Green – Island interior
CONCLUSIONS

Initial mound is created by channel inversion or termite activity

Mound is colonized by shrubs and trees – groundwater processing and nutrient accumulation commences

SHORT TERM EFFECTS – DECADES: salinization of soil leads to vegetation zonation

LONG TERM EFFECTS – MILLENNIA:
• calcite and silica accumulation in the island soils causes expansion;
• Island grows as vegetation traps air-borne dust;
• Islands gradually amalgamate