Conservation Development Frameworks - Reservoir Sensitivity Analysis and Zonation Process
CapeNature’s simplified approach

Dr. Donovan Kirkwood
Ecological Planner, CapeNature
Biodiversity Planning and Implementation Forum
Kruger National Park, May 2012
Conservation Development Framework - Sensitivity Analysis and Zonation Process

CBA maps not helpful

Need biodiversity, biophysical, aesthetic and heritage mapping inform use constraints (and opportunities)

= “Sensitivity Mapping”

Public participation, finalisation and formalisation

Scientists, commercialisation/tourism, managers & any other CapeNature stakeholders negotiate zoning including detailed area recommendations

= Draft Zoning scheme (taking reserve context & legal requirements into account)

Add layers describing existing infrastructure, access/use costs, and highlight opportunities
Expert assessment of required key informants

Data production & gathering, synthesis & compilation

Expert Input Layer Verification & scoring/thresholds

Sensitivity Value Analysis. Production of final summary layers

Products for informing reserve-level planning and zonation

AND

everyday management
Building on an earlier approach (SANParks)

THEIR INPUT LAYERS:

Biodiversity
- Habitat Value
- Special Habitat Value
- Topographic Sensitivity
- Soil Sensitivity
- Hydrological Sensitivity
- Vegetation Vulnerability to Physical Disturbance

Aesthetic
- Visual Sensitivity

Heritage
- Heritage Value
Building on an earlier approach (SANParks)
THEIR ANALYSIS / LAYER COMBINATION:
(by summed weighted scores)

<table>
<thead>
<tr>
<th>Name</th>
<th>Field Name</th>
<th>Composition</th>
<th>Notes</th>
</tr>
</thead>
<tbody>
<tr>
<td>Linear summary</td>
<td>Linear</td>
<td>Habitat Value + Special Habitat Value + Topographic Sensitivity + Hydrological Sensitivity + Visual sensitivity + Heritage Sensitivity</td>
<td>Equal weighted summary of all the inputs layers</td>
</tr>
<tr>
<td>Biodiversity Value</td>
<td>Biodiv_val</td>
<td>Habitat Value + Special Habitat Value</td>
<td>Equal weighted summary of biodiversity value layers.</td>
</tr>
<tr>
<td>Biodiversity sensitivity value</td>
<td>Biodivsen</td>
<td>2*(Habitat Value) + 2*(Special Habitat Value) + Topographic Sensitivity + Hydrological Sensitivity</td>
<td>Equal weighted summary of biodiversity value and sensitivity layers.</td>
</tr>
<tr>
<td>Biodiversity Value Driven Summary</td>
<td>BioValHeav</td>
<td>4*(Habitat Value) + 4*(Special Habitat Value) + Hydrological Sensitivity + Visual sensitivity + Heritage Value</td>
<td>Layer which emphasizes the biodiversity value of a site, and hence is strongly influenced by the distribution of rare and threatened habitats and species, as well as by patterns of transformation across the landscape.</td>
</tr>
<tr>
<td>Balanced Summary</td>
<td>Balanced</td>
<td>2*(Habitat Value) + 2*(Special Habitat Value) + Topographic Sensitivity + Hydrological Sensitivity + Visual sensitivity + Heritage Sensitivity</td>
<td>This is the favoured layer which emphasizes biodiversity value and aesthetic considerations, and de-emphasizes biodiversity sensitivities (where some double counting occurs and where certain impacts can be mitigated against).</td>
</tr>
<tr>
<td>Max</td>
<td>Max</td>
<td>Habitat Value + Special Habitat Value + Topographic Sensitivity + Hydrological Sensitivity + Visual sensitivity + Heritage Sensitivity</td>
<td>Select on all input layer fields to get max value for a polygon (not cumulative)</td>
</tr>
</tbody>
</table>
What works in the SANParks approach:

• Systematic framework
• Process and consultation
• Input layers and scoring logic

i.e. the basics are solid, but what can be improved or made more accessible & user friendly?
What doesn’t work so well:

• Some layers scores relativised to 1 – 10 scale for reserve / domain
• Scale context specific
• Sensitivity layers combined by weighted summed score approach, and converted to a min to max range for representation:
  – **Summed scores misrepresent real sensitivity**
  – Managing multiple counting of features.
  – Results are not comparable between reserves.
  – Weighting is difficult and not repeatable
  – Combined and Relative scores don’t relate directly to specific recommendations.
  – Scoring is not always obvious.
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<td>Access</td>
<td>Remote or otherwise difficult to access areas where any infrastructure would incur a high management cost in staff time and/or vehicle running costs, especially for infrastructure requiring regular servicing or maintenance.</td>
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Sensitivity score directly related to management recommendation

- highest sensitivity/conservation importance
- features of global importance
- Features highly vulnerable to impacts from nearly any activity.
- E.g. intact habitat in Critically Endangered ecosystems, or natural wetland systems
- Off limits to any negative impact
- Management must be to the highest standard.
- Infrastructure development and maintenance not cost effective
- Access or infrastructure development is very strongly discouraged and unacceptable unless all negative impacts can be mitigated

- Not sensitive at all
- Not important for biodiversity conservation
- E.g. sites with highly degraded or no natural habitat in well-conserved, least threatened ecosystems
- More suitable for use, infrastructure development
- Habitats likely to be a lower priority for management action.
Robberg Nature Reserve

Sensitivity Analysis
comparison of approaches

MAXIMUM SCORE of:
Slope
Substrate
Hydrological

Combined Physical Sensitivity
MAXIMUM Sensitivity

<table>
<thead>
<tr>
<th></th>
<th>1 - lowest</th>
<th>2 - low</th>
<th>3 - moderate</th>
<th>4 - high</th>
<th>5 - highest</th>
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CapeNature
May 2012
(D. Kirkwood, Ecological Planner)
SUMMED SCORE of:
Slope + Substrate + Hydrological

Robberg Nature Reserve

Sensitivity Analysis
comparison of approaches

SUMMED SCORE of:
Slope + Substrate + Hydrological

Combined Physical Sensitivity
SUMMED Sensitivity

- 0 - 1 - lowest
- 2 - 3
- 4 - 5 - moderate
- 6 - 7
- 8 - 10 - highest

CapeNature
May 2012
(D. Kirkwood, Ecological Planner)
INPUT LAYERS e.g. habitat type + habitat condition
Representivity Sensitivity Scores
- standard rule-set

based on ecosystem status, protection status & habitat condition
(or expert estimation of these for ecosystems that cannot be cross-walked to a regional analysis)
<table>
<thead>
<tr>
<th>Endangered</th>
<th>Natural</th>
<th>Near Natural</th>
<th>Degraded</th>
<th>No Natural</th>
</tr>
</thead>
<tbody>
<tr>
<td>Very Poorly Protected</td>
<td>5</td>
<td>5</td>
<td>3</td>
<td>1</td>
</tr>
<tr>
<td>(0 - 20% of Threshold)</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Poorly - Well Protected</td>
<td>5</td>
<td>4</td>
<td>2</td>
<td>1</td>
</tr>
<tr>
<td>(20 - 100% of Threshold)</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Threshold Exceeded</td>
<td>4</td>
<td>2</td>
<td>1</td>
<td>1</td>
</tr>
<tr>
<td>(&gt;100% of Threshold)</td>
<td></td>
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= Representivity Sensitivity Score
Variable scales depending on context

Very fine scale mapping for likely development or intensive access areas (10m accuracy or better)
### Using standard scales wherever possible e.g. slope

<table>
<thead>
<tr>
<th>Slope angle</th>
<th>Slope percent</th>
<th>Sensitivity Value</th>
<th>Recommendation / notes</th>
</tr>
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<tr>
<td>&gt;30°</td>
<td>&gt;58%</td>
<td>5</td>
<td>Effectively off-limits for infrastructure development due to extreme risk of erosion and instability, or extreme engineering mitigation and associated construction costs required.</td>
</tr>
<tr>
<td>20° – 30°</td>
<td>36 – 58%</td>
<td>4</td>
<td>Strongly avoid for infrastructure development – cut and fill or other difficult and expensive construction methods required. Appropriate engineering mitigation essential to prevent erosion and slope instability. Highest initial and on-going cost due to slope stabilisation and erosion management required.</td>
</tr>
<tr>
<td>10° – 20°</td>
<td>18 – 36%</td>
<td>3</td>
<td>Avoid for road, trail and firebreak construction if possible. Severe erosion will develop on exposed and unprotected substrates. Pave roads and tracks, and ensure adequate drainage and erosion management is implemented. May provide good views.</td>
</tr>
<tr>
<td>5° – 10°</td>
<td>9 – 18%</td>
<td>2</td>
<td>Low topographic sensitivity, likely still suitable for built infrastructure. Use of gentle slopes may provide improved views or allow access to higher areas.</td>
</tr>
<tr>
<td>0° – 5°</td>
<td>0 – 9%</td>
<td>1</td>
<td>Preferred areas for any built infrastructure, lowest risk of erosion or instability, lowest construction and on-going maintenance costs.</td>
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Put together all input data to get overall biophysical sensitivity.

Union

For synthesis layers: just use MAXIMUM SCORE for each polygon
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Dyer Island Nature Reserve

Biodiversity Sensitivity

Combined Sensitivity:
- Ecosystem Representivity
- Special Habitats
- Species of Conservation Concern

Legend:
- CapeNature boundary *
- Island High Water Mark

Biodiversity Sensitivity
- 1 - lowest
- 2 - low
- 3 - moderate
- 4 - high
- 5 - highest

* Proclaimed CapeNature boundary is 500m below the High Water Mark of Dyer Island shoreline

CapeNature
April 2012
(D. Kirkwood, Ecological Planner)
Dyer Island Nature Reserve

Heritage Sensitivity

Combined Sensitivity:
Heritage buildings and structures
(No historically important shipwrecks are mapped)

- CapeNature boundary *
- Island High Water Mark

Heritage Sensitivity
1 - lowest
2 - low
3 - moderate
4 - high
5 - highest

* Proclaimed CapeNature boundary is 500m below the High Water Mark of Dyer Island shoreline

April 2012
(D. Kirkwood, Ecological Planner)
ZONING must take into account biophysical sensitivity, management needs AND public and business needs, including tourism experience.

E.g. viewshed analysis to determine which areas can be true Wilderness.
Cederberg Wilderness
Zonation

Algeria and Bosherberge Cottages

Zone name
- Wilderness Zone
- Primitive Zone
- Nature Access Zone
- Development - Low Intensity Zone
- Development - High Intensity Zone
- Development - Management Zone

CapeNature
December 2011
(D. Kirkwood, Ecological Planner)
Kogelberg is the most important hotspot of plant endemism in the Cape Floristic Region.

It is also the most attractive and accessible tourism site within a 50km radius of the major metropolitan area of Cape Town.
Using zoning and sensitivity: Kogelberg Nature Reserve Tourism

Suitable sites were determined by a planning exercise for the entire Boland Mnt complex

Followed up by very detailed on-site habitat mapping within identified development zones.
Using zoning and sensitivity: Kogelberg Nature Reserve Tourism

Including detailed consideration of alternative layouts
Using zoning and sensitivity: Kogelberg Nature Reserve Tourism
Detailed consideration of Sensitivity

Sensitive features:
- Visual impact
- Fire-prone wetland environment

Design and mitigation
- Site restoration / Landscaping
- Appropriate construction
- Sanitation and waste
- Water supply
SUSTAINABLE CONSTRUCTION
Oudebosch cabins at Kogelberg Nature Reserve

CapeNature’s flagship tourism facility, the Oudebosch cabins at Kogelberg Nature Reserve, was launched in early February 2012. The reserve, known for its extraordinary botanical wealth and views, is considered to be the heart of the Cape Forest Region and as a World Heritage Site – and with its history of previous good management and declaration as a reserve in 1897, its natural wealth has been protected.

The Kogelberg Biosphere Reserve, within which the nature Reserve is the “core zone” was the first biosphere reserve to be declared in South Africa, and is part of UNESCO’s world-wide network.

An element of CapeNature’s Tourism Strategy is the commitment to environmental best practice in all new tourism developments and upgrades. This involves the avoidance or mitigation of negative impacts, whilst optimising the use of “green” building technology. Oudebosch received an Acknowledgement Award at the 3rd International Awards Regional Awards for sustainable construction with archival excellence at a public education facility for designers Justin Dixon and Jessica Cohen of Architecton Co-op.

The judges’ citation was as follows: “The Kogelberg Nature Reserve is home to the most complex biodiversity on the planet and as a contextually relevant Oudebosch is a commendable example of good practice – balancing tourism needs and preservation aspects. The project offers a thoughtfully approach to building design and showcases durable, recyclable and renewable materials and through energy efficient design provides the visitors’ experience of the reserve to the structural level.”

Biosphere Reserve

The biosphere reserve concept incorporates local communities, farmers, conservation agencies, and local government in the protection of priority, irreplaceable and bioregionally Important, sustainable actions in the core area and surrounds the nature reserve. This Kogelberg Biosphere Reserve is some 100 000 ha in extent and ranges from the sea to the mountain tops, with the highest peak at 2 365 m.

The core area within which the core zone is Kogelberg Nature Reserve is an undisturbed, biologically rich and geologically diverse area. This biological diversity is a concern but recreational activities that do not impact heavily on the environment, and educational initiatives and research, are acceptable in this zone. Visitor numbers need to be limited. Recreational activities at Kogelberg Nature Reserve include trails for hikers at several levels of fitness; kayaking during the winter season on the Freshwater River for experienced kayakers; tubing and silex rafting on the River; and two mountain biking trails.

The buffer zone of a biosphere reserve comprises key ecologically sensitive but still mostly natural areas where sustainable use activities occur. Here the combined efforts of land owners are crucial to securing the buffer function. The transition zone allows a variety of more intense and uses but hikers need to observe the building of a conservation ethic within communities and activities need to be undertaken with ecological processes in mind.

Sustainable conservation cannot happen without the involvement of local communities and the Kogelberg Biosphere Reserve has invested almost R500 000 in working with them for the surrounding local communities. This has culminated in activities like alien plant clearing, fire fighting, sheep grazing and erosion prevention and clearing, as well as the provision of gate services at the reserve. The reserve also helps to stimulate social economic development by supporting local initiatives within the area. The People and Parks Programme is an initiative of the National Department of Environmental Affairs and it was established to ensure compliance with the Protected Areas Act. Its objective is to promote the sustainable use of protected areas for the benefit of people.