Place-based adaptation solutions for South African settlements

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Urbanisation challenges in South Africa

- Air pollution
- Climate change
- Urban poverty
- Unaffordable housing
- Exclusion & inequality
- Congestion
- Insufficient public transport
- Unplanned city extension
- Lack of infrastructure
- Lack of capacity
- Lack of participatory process
- Surging youth
- Ageing population
- Insanitary water
- Informal settlement
- Urban sprawl

Based on UN-Habitat (2018)
Natural disaster risk in South Africa

Summary of the impacts of recorded climate-related events in South Africa between 1977-2017 (source: EMDAT CRED, 2018)

<table>
<thead>
<tr>
<th>Climate event</th>
<th>No. of events</th>
<th>No. of deaths</th>
<th>No. of homeless</th>
<th>No. of injured</th>
<th>Total population affected</th>
<th>Total damage in US$</th>
</tr>
</thead>
<tbody>
<tr>
<td>Drought</td>
<td>8</td>
<td></td>
<td></td>
<td></td>
<td>20.17 million</td>
<td>1.25 billion</td>
</tr>
<tr>
<td>Extreme temperature</td>
<td>3</td>
<td>63</td>
<td></td>
<td>20</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Flood</td>
<td>33</td>
<td>1 198</td>
<td>30 885</td>
<td>370</td>
<td>580 356</td>
<td>1.96 billion</td>
</tr>
<tr>
<td>Landslide</td>
<td>1</td>
<td>34</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Storm</td>
<td>27</td>
<td>260</td>
<td>16 200</td>
<td>1 357</td>
<td>651 451</td>
<td>1.37 billion</td>
</tr>
<tr>
<td>Wildfire</td>
<td>10</td>
<td>137</td>
<td>11 350</td>
<td>530</td>
<td>12 880</td>
<td>8.6 million</td>
</tr>
<tr>
<td>Total</td>
<td>82</td>
<td>1 692</td>
<td>58 435</td>
<td>2 277</td>
<td>21.41 million</td>
<td>5.43 billion</td>
</tr>
</tbody>
</table>
future risk trajectory
- the western cape
Projected population change (2050 relative to 2011)
Medium growth scenario
Western Cape population growth projection

Projected population change (2050 relative to 2011)
Medium growth scenario
1. High % of population have no secondary education
2. High % of HH live under Minimum Living Level
Western Cape climate change projections

Increased in no. very hot days
2050 relative to 2011
Low mitigation scenario
Western Cape hazard exposure: Wildfire

Increase in no. of fire danger days 2050 relative to 2011
Low mitigation scenario
Western Cape hazard exposure: Drought

Drought Index (SPI)
2040-2060 relative to 1995-2024
Low mitigation scenario
Western Cape hazard exposure: Coastal flooding

Estimated 10,751 people exposed to coastal flooding. Medium growth scenario & IPCC sea-level rise estimate.

Coastal Flooding Index & percentage people uninsured

Coastal Flooding Index & percentage people exposed

Western Cape

Future Coastal Flooding Index

dark red: very high
light red: high
brown: medium

Settlement Footprints
Local Municipality Boundaries

Western Cape

1% people insured

Future Coastal Flooding Index

dark red: very high
light red: high
brown: medium

Settlement Footprints
Local Municipality Boundaries

The Green Book
Western Cape climate change impact: Agriculture

Hotter & drier
#3 Chickens

Increased production costs (and increased investment will be required in ventilation and cooling) to maintain optimal seasonal temperatures and reduce the risk of heat stress. Heat stress on birds will reduce body weight gain, reproduction efficiency and egg quality.
good practice
Adaptation actions for the Western Cape

- Inland Flooding
- Heat Stress
- Drought
- Wildfire
- Increased Wind Speed

Adaptation Actions

- Spatial Planning
- Identify
- Land Use Management
- Protect
- Win-win

Environmental Planning

- Retrofit/design
- Maintain
- Protect

Engineering Services
- Water, Energy, Stormwater, Sanitation, Solid Waste, Mobility, & Transport

Landscape & Urban Design

- Design
- Protect
- Maintain

The Green Book

Land Use Management

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The Green Book
Determine coastal management lines

**Description**
Identify coastal management lines for coastal settlements at risk of rising sea levels and coastal flooding. Coastal management lines are used as planning tools for coastal retreat and define the amount of open space between the shoreline and infrastructure (buildings, houses etc.). Management lines allow room for the average high water mark to naturally move inland by sea level rise throughout the economic lifetime of the property. Demarcation of coastal management lines should be informed by wave action, erosion, dune migration and the location of existing developments. The historic erosion rates or extreme weather levels need to be taken into account and should be specific to area implemented. Once coastal management lines have been determined, they need to be reviewed every five years. The coastal management should be included in the SDF.

**Goals**
To provide information in support of protecting coastal public and private property from risk, and protecting environmentally sensitive coastal areas from development.

**Benefits**
Once coastal management lines are identified and subsequently reviewed, every five years, it allows local government to better manage their coastal areas, protect infrastructure, and ensure public safety. They can also be used to complement other coastal adaptation options such as dune rehabilitation and wetland restoration.

**Costs**
Consultation services would be required to assess erosion rates and water levels, and to model coastline evolution. If an area is classified as a no-build zone, this could be problematic if the land has been privately purchased or there are existing structures in the area.

**Example**
Protect coastal dunes from development

Description
This involves the conservation and restoration of dunes by supporting the reestablishment of stabilizing vegetation. Plant species used for restoration should be native and adapted to the harsh conditions present in dune environments. Soft physical structures such as wooden fences or nets can be used to reduce wind speed across the sand surface and increase sand deposition to facilitate the establishment of a stable vegetation cover. Involve the community through local awareness raising campaigns to assist in protecting the dunes.

Goals
To prevent adjacent land, infrastructure and developments from inundation

Benefits
• Beach nourishment can complement hard protection measures such as seawalls and provide additional protection. This will reduce maintenance cost of any hard protection measures.
• Promote recreation and tourism through beach widening.
• Provide increased capacity for coping with coastal flooding.
• Natural dune systems are more aesthetically pleasing than hard defence measures and structures.

Costs
Reduced maintenance costs of hard infrastructure. Low resource option. Involves initial establishment (purchasing, planting and initial care) costs. Dunes require more space than conventional, ‘hard’ engineering structures. This can be problematic when in highly populated coastal areas, and conflicts of interest may arise, especially if coastal sand dune restoration takes place in areas primarily used for residential or tourism purposes.

Example
Management and rehabilitation plan for the Hout Bay Dunes (Cape Town):
Description
Natural sand dunes provide effective defence against coastal flooding, wave surges, and erosion. They are, however, in decline due to developments and are at increased risk from erosion caused by sea level rise and more energetic wave climates and storm surges. Dune rehabilitation refers to the process of restoring /returning natural or artificial dunes that are degraded by active interventions to match, as closely as possible, pre-disturbance conditions and functions. Dune rehabilitation methods include building fences on the seaward side of an existing dune to trap sand and help to stabilise bare sand surfaces, planting vegetation to stabilise natural and artificial dunes, and construction of artificial dunes. This action also includes measures of beach nourishment, which refers to the practice of adding large quantities of sand or sediment to beaches to combat erosion and increase beach width. It can also be referred to as beach recharge, beach fill, replenishment, re-nourishment and beach feeding. Nourishment material should be compatible with the existing natural (or native) beach material.

Goals
Regular maintenance and rehabilitation of coastal dune systems will ensure the greatest coastal protection benefits, including storm protection and decreased erosion, for both infrastructure and settlements located along the coastal boundary.

Benefits
• Beach nourishment can complement hard protection measures such as seawalls and provide additional protection. This will reduce maintenance cost of any hard protection measures.
• Promote recreation and tourism through beach widening.
• Provide increased capacity for coping with coastal flooding.
• Natural dune systems are more aesthetically pleasing than hard defence measures and structures.

Costs
Compared to the construction of hard measures such as seawalls the costs of rehabilitation and maintenance are substantially lower. Costs include that of depositing the dredged material onshore and then the cost of reshaping with bulldozers. Additional costs could include dune grass or other plants, costs of fencing and notice boards, and costs of transporting beach material. Costs would be higher where more complex operations are required, detailed designs needed, and when more supervision or management is required during planning and implementation. Costs of continued monitoring and periodic re-nourishment to be done to maintain the effectiveness of the dune system need to be considered.

Example
Management and rehabilitation plan for the Hout Bay Dunes (Cape Town):
conclusion
Climate change is expected to amplify the extreme weather events in South Africa, particularly floods, droughts, wildfires and storms. High exposure and vulnerability of settlements will transform even small-scale and slow-onset events into disasters. Recurrent, small or medium-scale events affecting the same communities may have cumulative effects.

Given these risks, there is a great need for investment in adaptation actions in South African settlements. Local government is a critical role-player that can build climate resilience through “planning human settlements and urban development; the provision of municipal infrastructure and services; water and energy demand management; and local disaster response, amongst others” (NCCRP, 2011).

The Green Book project aims to provide local government with a decision support tool to prioritise the integration of climate change adaptation into their budgeting and planning instruments.

Conclusion
Thank you

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