Savanna and Thicket Biome Ecosystem Guidelines
Introduction

• Thicket and Savanna biomes – biodiversity importance + ecosystem services
  – Under threat – needs management!
• Land use planning and management – NB for sustainable development (socio economic needs and biodiversity persistence)
• Ecosystem approach to land-use planning:
• SANBI – BLU Project: Ecosystem Guidelines for Savanna and Thicket Biomes – use as decision support tool
• Existing Guidelines:
  – Fynbos Forum Ecosystem Guidelines for Environmental Impact Assessment in the Western Cape
  – Grassland Ecosystem Guidelines
• Plan: develop guidelines for all biomes, thereafter produce provincial guidelines (gazetted)
• Timeframes: August 2017 – August 2018
• The Guidelines aim to fulfil the following requirements:
  – to identify and describe the characteristics and functioning of the biomes (as per ecosystem groups);
  – to determine key ecological drivers of the biomes on a local and landscape level;
  – to identify threats and risks to persistence and optimal functioning of the biomes; and
  – to provide practical recommendations for land use management, planning and regulation in the biomes

• Aim:
  – User friendly, implementable guideline
  – Style/language: specialist and non-specialist

• Key: stakeholders are part of developing guidelines from the start –
  – Well informed, strong scientific basis
  – Give effect to implementation
  – Process:
    • Project introduction and invitation to participate letters
    • Testing ‘8 questions’
    • Draft ecosystem groups as shapefiles
    • Ecological/environmental specialist workshops
    • Targeted engagement: SANParks, ECPTA, DEDEAT quarterly environmental forums, WG meeting at DEA, Thicket Forum, Biodiversity Planning Forum
Guidelines for whom?

• Fynbos Forum Ecosystem Guidelines: “…to assist all stakeholders in the Western Cape who are involved in land-use planning and environmental assessment to take biodiversity concerns into consideration.”

• Grassland Ecosystem Guidelines: “…providing non-scientists with easy-to-use, practical guidelines on how to take better account of biodiversity in land-use planning and decision-making.”

• Management means different things for different groups of people:
  – Spatial planners / Environmental assessment practitioners / Specialists / Landowners / General public / Authorities / Agricultural extension officers / Land use advisors / Private sector (farmers, mining companies, tourism companies, developers etc.)
How specific / detailed should the guidelines be?

• Guideline only: should refer user to appropriate resources for determining specific parameters.
• Should provide as many possible solutions as possible for specific issues without being prescriptive – each case may require specific solutions that may not be appropriate in another case.
• Should not conflict with local or regional plans or specific legislation.
• Different users may have different requirements and would prefer alternative solutions or have different options.
Area covered by biomes
Western Cape: 7 units
- Coastal ecosystems
- Lowland fynbos
- Midland & mountain fynbos
- Renosterveld
- Succulent karoo
- Thicket
- Freshwater

Grassland: 5 units
- Dry highveld
- Mesic highveld
- High-altitude
- Sub-escarpment
- Coastal

Thicket: 6 units
- Thicket (incl. dune vegetation mosaics)
- Mesic Thicket (incl. mosaics with Forest)
- Valley Thicket
- Arid Thicket (incl. mosaics with Nama- and Succulent Karoo)
- Thicket mosaics with summer rainfall biomes (Grassland, Savanna)
- Thicket mosaics with winter rainfall biomes (Fynbos, Renosterveld)

Savanna: 7 units
- Kalahari duneveld
- Kalahari bushveld
- Central plains bushveld
- Mopane Bushveld
- Arid lowveld
- Moist sour lowveld
- Sub-escarpment
ALBANY THICKET BIOME
ECOSYSTEM GROUPS / UNITS
VegMap vs STEP thicket units

• SANBI VegMap **not used**: combine functionally and floristically different ecosystems (e.g. Arid and Valley Thicket) into single units.

• **Used STEP classification**: takes into account floristic and functional characteristics, and is hierarchical.

• STEP: 112 units – too detailed for these guidelines.
• Four main ecosystems (solid thicket types): (1) Dune Thicket, (2) Mesic Thicket, (3) Valley Thicket, (4) Arid Thicket.

• Mosaics: (1) Forest, (2) Nama- and Succulent Karoo, (3) Grassland and Savanna, (4) Fynbos and Renosterveld.

• Review of SANBI VegMap’s Albany Thicket map currently in progress (NSBA) – preliminary outcomes taken into account for these guidelines.
## STEP Thicket types

<table>
<thead>
<tr>
<th>Type</th>
<th>No. of STEP units</th>
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<tr>
<td>Dune Thicket</td>
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<tr>
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<tr>
<td>Valley Thicket</td>
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<td>Dune Thicket Mosaics</td>
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<tr>
<td>Mesic Thicket Mosaics</td>
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<tr>
<td>Valley Thicket Mosaics</td>
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<tr>
<td>Arid Thicket Mosaics</td>
<td>14</td>
</tr>
</tbody>
</table>
- Dune Thicket
- Mesic Thicket
- Valley Thicket
- Arid Thicket
- Thicket – Grassland / Savanna mosaics
- Thicket – Fynbos / Renosterveld mosaics
- Thicket – Forest mosaics
- Thicket – Karoo (NK & SK) mosaics
- Thicket – dune vegetation mosaics

- Solid Thicket
- Fire-prone mosaics
- Fire-free mosaics
Albany Thicket Biome: Ecosystem Groups

1. Dune Thicket (incl. dune vegetation mosaics)
2. Mesic Thicket (incl. mosaics with Forest)
3. Valley Thicket
4. Arid Thicket (incl. mosaics with Nama- and Succulent Karoo)
5. Thicket mosaics with summer rainfall biomes (Grassland, Savanna)
6. Thicket mosaics with winter rainfall biomes (Fynbos, Renosterveld)

• NOTE: these are conceptual units, based on STEP and NSBA – boundary changes to individual units and transfer of individual units between major groups will not affect the validity of the guidelines.
Key questions per unit

- General characteristics (including key areas of biodiversity importance)?
- Key ecological ‘drivers’ maintaining ecosystem function, pattern and structure?
- Key pressures and threats?
- Recommended non-negotiables? (either ecological ‘bottom lines’, or minimum set of management actions needed to avoid or minimise negative impacts).
- Best spatial approaches (at a landscape scale) to avoid or minimise impacts and risk in these ecosystems?
- Critical things (ecological drivers / processes) to maintain for biodiversity to persist?
- What indicators should be used to assess and monitor ecosystem health?
- How reversible are impacts within a period of 5 to 10 years?
- Acceptable compensation measures or offsets for biodiversity loss?
Dune Thicket
(incl. thicket mosaics with other dune vegetation)

• Narrow strip on coastal dunes and in fire- and frost-protected valleys that extend inland from river mouths.

• Key ecological drivers:
  – Coastal processes:
    • Wind
    • Sand movement and stabilization
    • Dune successional dynamics
    • Deposition and decomposition of organic material
  – Fire (generally fire-resistant)
  – Rainfall (mesic form of thicket with low succulence)
  – Seed dispersal & regeneration
  – Spatial linkages to other vegetation
Mesic Thicket
(incl. thicket mosaics with forest)

• Main pressures and threats:
  – Clearing of thicket for cultivation and urban / industrial development, leading to loss of habitat, fragmentation and loss of connectivity.
  – Over-stocking, leading to loss of standing biomass, loss of keystone species and change in fire dynamics, and associated with active clearing and burning to increase carrying capacity of the field layer.
  – Bush encroachment by indigenous woody species
  – Invasion by woody alien plants.
  – Incorrect use of fire as a management tool.
  – Wood cutting for firewood and other uses.
  – Illegal collection of threatened / protected flora species.
Valley Thicket

- Non-negotiables:
  - Avoid over-grazing. Stocking rates must not exceed the carrying capacity of the specific habitat, which should be determined using appropriate methods.
  - Avoid introduction of extra-limital, non-thicket game species, as follows: x, y, z. Appropriate species are the following: a, b, c.
  - Retain appropriate grazer-browser ratios in game species.
  - Retain appropriate fire-regime.
  - Avoid disturbance to riparian areas, steep slopes, rocky outcrops, substrate boundaries and islands of thicket habitat.
  - Avoid ground and surface water abstraction if it might impact on thicket vegetation. Any water use is governed by Regulations of the National Water Act.
  - Avoid clearing or fragmenting intact thicket. Be aware that there are legal requirements prior to clearing any area of natural vegetation larger than a specific size that applies to all land.
Arid Thicket
(incl. mosaics with Nama- & Succulent Karoo)

• Best spatial approaches to avoid or minimize impacts:
  – Prevent further fragmentation, reconnect intact expanses, rehabilitate degraded corridors. This can be achieved through application of regional development plans.
  – Encourage stewardship and the formation of conservancies to attain formal protected status at appropriate locations.
  – Maintain boundaries between thicket and non-thicket by minimizing artificial disturbance.
  – Manage grazing, including stocking rates and rotation. Appropriate stocking rates should be determined by appropriate methods and by experienced practitioners.
  – Ensure coordinated grazing and fire management.
  – Manage alien plants according to measures that are appropriate for the species and the location.
  – Prevent soil erosion through appropriate soil protection measures.
Thicket mosaics with Grassland & Savanna

• Critical things to maintain for biodiversity to persist:
  – Maintain larger areas of thicket habitat across the range of thicket types, especially those in better condition, as well as mosaics of different plant communities. This can be achieved through application of regional development plans.
  – Protect rare and special habitats from loss or destruction by implementing formal environmental management processes.
  – Maintain corridors and rehabilitate degraded corridors.
  – Maintain appropriate fire regimes. These should be determined by appropriate methods and by experienced practitioners.
Thicket mosaics with Fynbos & Renosterveld

- Indicators to monitor / assess ecosystem health:
  - Thicket growth and spreading using field and remote-sensing approaches.
  - Tree / shrub density in areas prone to bush encroachment.
  - Invasion by woody plants.
  - Presence and health of keystone species.
  - Change in species composition / vegetation structure measured through vegetation monitoring in different vegetation types measured against benchmarks.
  - Persistence of species of concern / listed species.
  - Fire frequency and intensity.
  - Monitor erosion using field and remote sensing approaches.
SAVANNA BIOME
ECOSYSTEM GROUPS / UNITS
Identification of management units – Using VegMap
86 vegetation types
Bioregions

6 bioregions

Legend
- Provinces
- Local Municipalities 2016
- Savanna Biome
  - Central Bushveld Bioregion
  - Eastern Kalahari Bushveld Bioregion
  - Kalahari Duneveld Bioregion
  - Lowveld Bioregion
  - Mopane Bioregion
  - Sub-Escarpment Savanna Bioregion
Lowveld Bioregion was divided into Arid Lowveld Bushveld, that occurs on the lowveld plains, and Moist Sour Lowveld Savanna.
Kalahari Duneveld

**Characteristics:**

- Very dry landscapes in the northern parts of the Northern Cape
- On plains with fixed parallel or loose dunes that rise 3-8 m above the aeolian sandy plains.
- Rainfall is characteristically very low: ~120-260 mm per annum, significant annual variability and regular drought.
- Frost is frequent during the dry winters.
- Vegetation: open shrubveld with *Vachellia haematoxylon* (Grey camelthorn), *Senegalia mellifera* (Black thorn) and *Rhigozum trichotomum* (Driedoring) locally prominent. Scattered *Vachellia erioloba* (Camelthorn) trees and a scanty field layer with the prominent endemic grass *Stipagrostis amabilis* on the dune crests are characteristic.
- Other woody trees and shrub species generally found within the Kalahari Duneveld include the woody *Grewia flava* (Velvet Raisin), *Lycium bosciiolium* (Slender honeythorn), *Lycium villosum* (Hairy honeythorn), *Boscia foetida* (Stink Shepherds tree), *Vachellia luederitzii* (False Umbrella Thorn), *Searsia tenuinervis* (Kalahari Currant), *Terminalia sericea* (Silver cluster-leaf) and *Lebeckia linearifolia* (Blue pea bush). The field layer is scanty with few perennial grasses e.g. *Aristida meridionals* (Giant Three-awn), *Stipagrostis obtuse* (Small Bushman Grass), *Stipagrostis ciliata* (Tall Bushman Grass), *Centropodia glauca* (Gha Grass) and some annual grasses, e.g. *Schmidtia kalahariensis* (Kalahari Sour Grass).
- Veld: sweet and palatable, and can support animals throughout the year, though due to the low and unpredictable rainfall the grazing capacity and therefore stocking rates should be low.
- Many (salt) pans, often bare but the characteristic pan edges with specific species composition, occur in the areas covered by Kalahari Duneveld ecosystems.
Kalahari Bushveld

Ecological Drivers:

- Climate: primary factor in savanna ecosystems - rainfall main driver in Kalahari Bushveld.
  - Rainfall: Variation from the drier west (300 mm per annum) to the relatively moister east (550 mm per annum), particularly significant annual variability and regular extreme droughts.
  - Temperature: Due to cold winter temperatures and frequent frost only frost hardy perennial plant species or annual ephemeral species can survive. Given climate change dictates, the number of frost days experienced may decline appreciably.
  - The associated role of higher CO$_2$- levels experienced in the historic development of the savanna biome, which may aggravate bush thickening.

- Soil type, particularly soil depth and underlying limestone and rockiness, drainage regime and soil nutrients

- Grazing and browsing, with marked differences in historical natural grazing by game (that assisted in maintaining or even enhancing biodiversity) and current variation in utilization by domestic livestock and game farming (that may be positive or negative for maintaining biodiversity, depending on management strategies applied by different land managers).

- Fire, also with marked differences in historical fire regimes that maintained biodiversity and current use (locally with marked differences) of fire in veld management
Main pressures and threats:

• **Overgrazing:**
  
  – Stocking rates of domestic livestock and game that exceed the grazing capacity of the particular vegetation lead to a reduction in aerial and basal vegetation cover; changes in species composition, replacement of nutritious perennial grasses (decreasers) by non-palatable annual grasses (increasers) and weeds.
  
  – Reducing the cover and vigor of the grass layer: thickening of indigenous woody species, encroachment of alien woody invaders, and accelerated soil erosion.
  
  – This continuous over-grazing: loss in biodiversity (though there may be a gain in the number of weedy and pioneer species), loss of productivity of the vegetation, reduction in quantity and quality of farming products and a loss of income to the farmer.
    
    • When combined with the incorrect application of fire, the undesired results of overgrazing are enhanced
Central Plains Bushveld

- **Incorrect fire regime**
  - Historic natural conditions: fire needed to maintain biodiversity and vegetation structure. Applying fire as a management tool to reduce dormancy and stimulate production or to control bush encroachment is therefore necessary for biodiversity maintenance and productivity.
  - Incorrect seasonality, frequency of burning, type of fire (hot or cool) and even exclusion of fire: undesired changes in species composition, enhancement of bush encroachment, decline in (basal) cover and soil erosion.
  - Fine-leaved central savanna systems: mostly sweetveld - whole year grazing occurs resulting in lower fuel loads and less likelihood of fire.
  - Broad-leaved savanna: relatively more, sour, long-lived bunch grasses - less grazed in winter and the fuel loads are consequently higher therefore higher likelihood of fire. Consider when designing burning programs.
  - On eastern mountains with higher rainfall with sour veld the high production of biomass and therefore fuel by the dense grass layer and lack of grazing during winter (due to the sour veld) enhance the likelihood of fire.
Central Plains Bushveld

- **Bush thickening (indigenous woody) and bush encroachment (alien invasive woody)**
  - Climate change: favour woody species, mainly due to increased CO$_2$-levels and higher temperatures.
  - Decrease in the cover of the herbaceous layer (caused by overgrazing and/or incorrect fire regime): create the space and opportunity for certain indigenous woody species to become established and increase in density to form dense (often impenetrable) stands.
  - Species composition of the herbaceous layer changes and the cover and productivity decreases accordingly.
  - Resulting lower biomass and fuel load reduces the probability and intensity of fire, which in turn reduces the possibility to kill woody seedlings.
  - Situation is exacerbated if woody alien species invade into the natural Savanna. Alien invaders include *Cereus jamacaru* (Queen of the Night), and *Melia azedarach* (Seringa), and invasive plants tend to invade the riparian zones and areas where humans have developed
Central Plains Bushveld

Threats continued...

• Illegal hunting, collecting, harvesting and trade in rare, threatened and protected faunal and floral species
• Habitat fragmentation: industrial, residential and mining
• Vegetation clearing for agriculture and forestry
Mopane Bushveld

Non-negotiables:

• Stocking rates of grazers and browsers must not exceed site/area ecosystem specific carrying capacity

• Prevent overgrazing and over-browsing
  – Based on known rainfall, Large Herbivore Biomass should preferably, not exceed ~5 000 kg/ km²
  – Specific grazing and browsing capacities to be determined by a specialist – can consult general guidelines (e.g. ARC maps)

• Preferably no exotic grazers and browsers.

• Development proposals in CBA’s and ESA’s and other sensitive habitats detailed specialist investigation - flora and fauna biodiversity, presence of rare and threatened or protected flora and fauna species and sensitive or protected habitats on the sites and to ensure protection of connecting corridors between intact patches.
Mopane Bushveld

• Keep all dambos, vleis, spruits and river systems and smaller hills and ridges systems, including their buffer zones in a natural and undisturbed condition to ensure connectivity and protect faunal migration routes.

• No illegal or uncontrolled hunting, collection of live fauna or plant species of conservation concern.

• Harvesting of bark: remove side branches or longitudinal strips.

Education and awareness

• Old, and dead wood (for fuel use), should be removed in zoned off blocks that are rotated annually - will prevent removal of wood from the same areas constantly, i.e. allowing old wood decomposition to occur.
• **Best spatial approaches to avoid or minimize impacts:**
  – Prevent fragmentation of large tracts of natural bushveld.
  – Ensure co-ordinated grazing and fire management over large regions.
  – Ensure wide application of regional development plans for residential and agricultural land
Critical things to maintain for biodiversity to persist:

• Maintain large areas of natural vegetation that are in fair to good condition, and the mosaic of different plant communities that occur in these areas, to ensure protection of habitats for flora and fauna species.

• Protect all special and rare habitats from any possible destruction or unplanned development

• Protect all wetland and river systems

• Encourage landowners to form conservancies and become involved in stewardship sites.

• Local plant communities, ecotypes or ecosystems (i.e. seep-lines, vleis, granite outcrops) need specific management treatment to reduce area-based selective utilisation by herbivores.

• Development in CBA’s and ESA’s: ensure biodiversity specialist studies are done with strict recommendations
Sub-Escarpment Savanna

Indicators to monitor / assess ecosystem health:

• Monitor vegetation regularly at various localities within different vegetation types and compare with specifically chosen benchmarks. Large trees are of specific interest in these Sub-Escarpment Savanna ecosystems.

• Monitor tree/shrub density in areas prone to bush thickening.

• Monitor the presence and abundance of weedy/pioneer herbaceous species.

• Obvious browse line – indicates browse capacity exceeded, i.e. 1.5 m for impala (*Aepyceros melampus*), and higher for others, i.e. 2 m for kudu and over 4 m for giraffe, depending on their occurrence.

• Monitor selected populations of species of conservation concern and protected species, (e.g. *Vitellariopsis dispar*, *Aloe prinslooi*, *Orbea woodii*, *Encephalartos cerinus*, *Encephalartos msinganus*, *Euphorbia pseudocactus*, *Gasteria thukelensis*, *Ceropegia cycniflora*).

• Monitor species composition at selected sites and compare to historical information, baseline data, or reference sites in similar ecological conditions to the target sites.

• Monitoring gully and rill erosion extent.
Kalahari Duneveld:

How reversible are the impacts within next 5 to 10 years:

- Recovery of the woody layer will certainly take longer than 10 years, though pioneers such as *Senegalia mellifera* and *Rhigozum trichotomum* may establish on denuded sites and may exist as dense monospecific stands for a long time.
- As the herbaceous layer in Kalahari Duneveld ecosystems is event driven (non-equilibrium) the grass layer may change over short periods of time from almost bare during dry spells (linked with grazing during winter) to well-covered by grass during wetter cycles.

Acceptable compensation measures of offsets for biodiversity loss:

- The identification and acceptance of acceptable offsets for biodiversity loss in spatial planning and authorisation of EIAs should be done by independent specialists.
- Biodiversity off-sets can best be achieved by replacing an impacted area by the purchase of a relatively pristine area, preferably in the same vegetation type.
Way forward

• Draft document to scientific editor: end June
• Send to stakeholders for 30 day review period: July/August 2018
• Update and submit to SANBI