LAND CAPABILITY
&
THE PRESERVATION AND DEVELOPMENT OF AGRICULTURAL LAND BILL (PDALB)

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FOOD SECURITY

- **Defined as**: “all people, at all times, have physical and economic access to sufficient, safe and nutritious food that meets their dietary needs and food preferences for an active and healthy life (World Summit, 1996)

- Access to food is a basic human need

- Planning plays a significant role in addressing threats to food security

- Commonwealth Heads of Government 2009:
  - Poverty a fundamental cause of food insecurity
  - Importance of a coherent, multidimensional approach to sustainable agricultural development and food security
  - Call for an increase food production
FOOD SECURITY

• In 2011
  – Current population 7 billion
  – 925 million people undernourished

• By 2030
  – Population of 8.2 billion
  – +120 million ha for crop production

• By 2050
  – Increase of world population
    – Population of 9 billion
  – Increase in annual agricultural production:
    – 1 billion tons of cereal
    – 200 million tons of livestock products

• South Africa 2008 – 20% of households has inadequate access to food
• South Africa 2012 – 32% of SA’s children are hungry / at risk of hunger
PDALB

PRESERVATION AND DEVELOPMENT OF AGRICULTURAL LAND BILL, 2016

- Preservation
- Avoidance
- Minimisation
- Mitigation
- Resilience

*High value agricultural land = Protected agricultural areas*
RECOMMENDATIONS OF THE BILL

• Protected Agricultural Areas

• Land Classification System (based on the agricultural production value)

• Agricultural Sector Plans- guide agricultural land uses

• Agricultural Land Register

• Agro-ecosystem Reports

• Tax rebates and Incentives scheme
TERMINOLOGY

Land capability” means the most intensive long-term use of land for purposes of rainfed farming, determined by the interaction of climate, soil and terrain.

Agricultural potential
(a) is a measure of potential productivity per unit area and unit time achieved with specified management inputs; and
(b) for a given crop or veld type and level of management, is largely determined by the interaction of climate, soil and terrain;

(Productivity as an indication of the agricultural potential for a given crop under a management level and for an identified portion of land as being dependent on precipitation, temperature, soil conditions, terrain and crop characteristics (Schoeman & Scotney, 1987)).
LAND CAPABILITY 2016

Building blocks
- Soil Capability  - Climate Capability  - Terrain Capability

A Spatial Modelling Approach

A spatial modelling approach is used to ultimately model land capability and agricultural suitability. Spatial models are created to understand complex problems. There are probably as many approaches to modelling as there are modellers (Strydom, 2009).

For solving environmental hypotheses, spatial models are often used to (Yue-Hong Chou, 1996):

i. Describe the spatial pattern in the distribution of a phenomenon under investigation.
ii. Second, they explain relationships between the distribution of a phenomenon and variables that are significantly correlated with the distribution.
iii. Third, once explanatory models are built and parameters estimated, predictive models can be used to estimate changes in the distribution in response to the alteration in any significant variable.
iv. Fourth, if necessary, normative models can be formulated for developing the most cost-effective spatial strategies for management of system planning.
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In building spatial models, key issues include delineation of geographic units, specification of both the dependent variable and explanatory variables, formulation of the model, testing the statistical significance of the model, differentiation of significant variables from insignificant ones, and interpretation of the results. In summary, the following process tasks are followed:

i. Identify all of the issues at stake. Examine the issues closely as the model can only consider issues that have a measurable spatial component.

ii. The issues are then used to develop a hierarchy of goals.

iii. Define the overall goal and break down into lower-level goals until an entity is reached that may be directly measured.

iv. Identify the data needs.

v. Convert all data to common units of utility with respect to the goal.

vi. Define data / goal relationships and map each set of data values to a pre-defined scale.

vii. Define weights to impart relative importance to the goal objective measures when they are combined. Weights are therefore used to indicate the relative importance of the different objective measures and place them on the same ratio measurement scale of utility for the goal.

viii. Create and run the model:

<table>
<thead>
<tr>
<th>Variable</th>
<th>Value</th>
<th>Utility</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
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<tr>
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<td>9</td>
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<tr>
<td></td>
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<td>9</td>
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</tbody>
</table>

Equation: \( y = -0.0009 + 0.1901x - 0.8108 \)
Agricultural Soil Suitability

Agricultural soil suitability is calculated as a function of:

1. The potential of the soil to hold and supply moisture to a plant;
2. The sensitivity of the soil to factors affecting productivity and;
3. The inherent potential of the soil to be fertile.

Data sources:
- Landtype data base linked to terrain units
- Fixed site monitoring points
- Additional soil point data (DAFF & PDAs)
- Field verification
Climate capability involves the impact of climatic factors per geographic area on the capability to grow an agricultural crop within a growth season.
(i) Slope gradient;
(ii) Slope direction (aspect);
(iii) Slope shape (curvature);
(iv) Solar radiation;
(v) Ground roughness;
(vi) Altitude;
(vii) Streams (drainage networks).
TERRAIN CAPABILITY
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- M10: Soil (30%)
  - Plant available water (80%)
  - Soil sensitivity (17%)
  - Soil fertility (3%)

- M5: Climate (40%)
  - Moisture supply capacity (50%)
  - Physiological capacity (20%)
  - Climate constraints (rainfall / temperature) (30%)

- M6: Terrain capability (30%)
  - Moisture accumulation (20%)
  - Photosynthesis (15%)
  - Sensitivity (65%)

- Slope
  - 0 - 3%  3 – 12%  12 – 20%
  - 20 – 25%  25 – 35%  >35%
RESULTS

• National raster land capability evaluation data set
• Land capability Evaluation Values = 15
• Pixel size of 91.88 X 91.88 m
• No national data set for vector – provincial based
  • Terrain polygons = 5 ha
  • Land capability polygons = 25 ha

<table>
<thead>
<tr>
<th>Land capability class 2016</th>
<th>Area - ha</th>
</tr>
</thead>
<tbody>
<tr>
<td>Very low capability: 1</td>
<td>1 014 421.11</td>
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<tr>
<td>2</td>
<td>3 567 903.24</td>
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<tr>
<td>3</td>
<td>6 138 643.35</td>
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<td>9 902.47</td>
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<td>Very High capability: 15</td>
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</table>
RESULTS: LAND CAPABILITY EVALUATION 2016 TO CLASSIFICATION VERSION 2002
RESULTS: LAND CAPABILITY EVALUATION TO CLASSIFICATION

LAND CAPABILITY 2016
FREE STATE - ZOOM IN RASTER / VECTOR

Legend
- Provinces
- Towns
Land capability Evaluation Description
- 1. Very low
- 2. Low-Very low
- 3. Low
- 4. Low-Very low
- 5. Moderates
- 6. Low-Moderate
- 7. Low-Moderate
- 8. Moderates
- 9. Moderates-Moderate
- 10. Moderates-Moderate
- 11. Moderates-Moderate
- 12. Moderates-Moderate
RESULTS: LAND CAPABILITY EVALUATION TO CLASSIFICATION
CONSTRANTS / FUTURE IMPROVEMENTS

• Data
  • Availability
  • Correctness
  • Level of detail

• Scale of use
  • 1:50 000 – 1:100 000
  • Raster pixel: 91m X 91m
  • Not for farm level planning
  • Gives an indication of the larger land capability value per geographic area as guidance for future planning and identification of priority areas

• Do not replace local level assessments
The End