SA Geospatial Analysis Platform (GAP)
Methodology*, collaborators & data sources

**Mesoframe**
*CSIR, dti, the Presidency & GTZ*
Demarcation of South Africa into a grid of 50 Km² “mesozones”, nested within important boundaries

**Data and data mining methodology**
*CSIR & StatsSA*
Urban function index, land cover & other spatial distribution variables

**Global Insight**
“Control totals” per Magisterial District

**Strategic road network & related analysis tools**
*CSIR & L Zietsman*

* The underlying Mesoframe methodology was developed by CSIR, funded by the DST Parliamentary Grant
Preview: What is GAP?

= a common, mesoscale spatial data assembly and analysis platform for:

1. Developing an enhanced, more balanced understanding of South Africa’s human/economic geography and the associated interactions with the built and natural environment.
Physical/ environmental geography

**Human/ economic geography**

- Understanding of population-related *needs* & pressures
- Understanding of economic base/ development potential
- Understanding of transport/ economic linkages and accessibility (to markets & services)

Understanding of human activity/ ecosystem interactions
What is GAP?

= a common, mesoscale spatial data assembly and analysis platform for:

1. Developing an enhanced understanding of SA’s human/economic geography and the associated interactions with the built and natural environment

2. Profiling and comparing local development magnitudes (needs, potentials, service and economic accessibility levels) from a strategic, district/ regional perspective

3. Providing a basis for addressing key development planning questions

How much (of population/ economic activity) is where?

Where are the main concentrations/ hot spots to be targeted?

What (proportion of population in need) can we reach from where?
Limited data and model inter-operability

Wrong scale of data: Need for more localised/ disaggregated data

Differing analysis units: Economic model cannot ‘talk’ to ecosystem model

Mpumulanga’s economic statistics (per Magisterial District, 2001)

Mpumulanga’s ecosystem statistics (per water catchment)
The problem of differing analysis units & scales

“Gordonia problem”: Zone-size distortions of quantity maps – i.e. maps indicating “how much is happening where”

<table>
<thead>
<tr>
<th>Gordonia District</th>
<th>Zone is very large and internally heterogeneous</th>
</tr>
</thead>
<tbody>
<tr>
<td>Wynberg District</td>
<td>Zone is too small to see at this scale</td>
</tr>
</tbody>
</table>

Map of districts with high levels of labour-intensive economic activity (2002 NSDP)
Example of “distorted picture” (population per SAL area)

New GAP-based picture (population per mesozone)
The solution (1): Mesoframe demarcation:
A demarcation of South Africa into more than 25 000 “mesozones”/Standard Local Economic Areas: 1) each approximately 50 km$^2$ big, and 2) nested within important administrative & physiographic boundaries.
The solution (2): “Data mining”

“Mining” and integration of:
- Aggregate area statistics
- Point data (e.g. facilities per town)
- Land cover data (e.g. derived from satellite images)
G-Econ output: similar method applied to world
Population densities
The Island Approach to spatial profiling (e.g. of needs/opportunities) and targeting (e.g. of service delivery)

- The increasing availability of sub-place, ward-level, and local municipality data gives quite good indicators of service demand and available facilities, services and jobs per local area.
- But this does not necessarily provide a good basis for assessing accessible services and other opportunities, some of which might just across the ward or municipal border.

![Diagram showing available services and potentially accessible "cross-border" jobs, services, and other livelihood resources.](image-url)
The solution (3): “Geo-linking”, concentration and accessibility mapping

- Link each zone to the road network and to other zones in relevant wider regions
- Calculate quantities of economic & other human activities within specified distance or travel time ranges

Accessibility of employment (numbers of jobs) within a 20 min travel distance range
Economic concentrations

Proximity counts are sums or counts of local or “own” quantities (such as the total volume of local economic activity within a 4km radius or 50km2 mesozone) and the quantities within surrounding zones or wider regions.
Second calculation method

Population concentrations

Weighted sum of near and further magnitudes
Third calculation method
Example of using different features of GAP

Combining “quantity mapping” (maps of how much is where) with “accessibility mapping” (maps of what can be reached from where)
The part of South Africa where it is really possible and/or desirable to sustain significant levels of human activity*

54.7% of surface area
99.2% of population
99.9% of GVA

* Economic activity of more than R 10 000 per sq km, and thus able to sustain more than one very small enterprise (with turnover of R500 000) per 50sq km standard local econ area
Percentage surface area, population and economic activity

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<table>
<thead>
<tr>
<th>Category</th>
<th>Surface Area</th>
<th>Population</th>
<th>Economic Activity</th>
</tr>
</thead>
<tbody>
<tr>
<td>High density high accessibility</td>
<td>7%</td>
<td>4%</td>
<td>9%</td>
</tr>
<tr>
<td>High density low accessibility</td>
<td>9%</td>
<td>24%</td>
<td>7%</td>
</tr>
<tr>
<td>Low density high accessibility</td>
<td>6%</td>
<td>2%</td>
<td>2%</td>
</tr>
<tr>
<td>Low density low accessibility</td>
<td>2%</td>
<td>2%</td>
<td>23%</td>
</tr>
<tr>
<td>Sparse South Africa</td>
<td>45%</td>
<td>0%</td>
<td>1%</td>
</tr>
</tbody>
</table>
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"Populated" South Africa:

- High density high accessibility: 88%
- High density low accessibility: 71%
- Low density high accessibility: 6%
- Low density low accessibility: 2%
- Sparse South Africa: 45%
<table>
<thead>
<tr>
<th>Achievements thus far</th>
<th>Remaining/new challenges</th>
</tr>
</thead>
<tbody>
<tr>
<td>Solution for “Gordonia problem” &amp; associated distortions of geo-statistical indicators &amp; comparisons (of “how much is where?”)</td>
<td><strong>APPLICATIONS</strong></td>
</tr>
<tr>
<td>Good utilisation of data-mining tools to address critical spatial data gaps</td>
<td>Demonstrate extended range of applications (from pattern analysis to interaction/ dynamics modelling)</td>
</tr>
<tr>
<td>High profile applications and good responses from clients and other stakeholders</td>
<td><strong>DEPLOYMENT/ SUSTAINABILITY</strong></td>
</tr>
<tr>
<td></td>
<td>Get user feedback, pilot and develop Web-linked Version 3</td>
</tr>
<tr>
<td></td>
<td>Explore wider applications in rest of Africa</td>
</tr>
</tbody>
</table>
Version 2 upgrade & new form of dissemination

GAP data updating and analysis server

DBSA’s LGNet

Mini GIS with on-and offline capabilities

“Smart Board” for interactive sketch planning

GAP data

Google Earth

GIS

GIS specialist

Planner with enhanced analysis capabilities

Planner
Longer-term linkage & deployment plan

1. Spatial Analysis/Modelling infrastructure
   1a. “Planning SDI”, & Geospatial Analysis Platforms
   1b. Multi-scale geo-modelling & spatial decision support

2. GeoICT support services
   (focussed on spatially intelligent rural collaboration & service delivery)

3. Urban & regional dynamics modelling

Geoportals & Web mapping / Geoprocessing Services

Sensor-webs

Remote sensing & processing
- Land cover
- Land Use
Basis for: 1) “upscaling” (from meso-level to a variety on macro-levels) & 2) analysis of spatial linkages

- **Analysis of macro-scale trends/quantities**
  - District municipalities & metros
  - Provinces
  - Municipalities
  - Water catchments & other ecosystem analysis areas

- **Analysis of spatial distribution & proximity**
  - 50km² Mesoframe zones
  - Proximity measures
    - 15/30/60km

- **Geo-assembly & geo-computation**
  - 100m² Reference Grid
  - Distance matrices
    - $d_1, \ldots, d_n$