Urban Simulation Model

The implications of simulated growth scenarios for investment, service delivery, land use demand and governance in city regions

Louis Waldeck
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Presentation to DST

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science & technology Department: Science and Technology REPUBLIC OF SOUTH AFRICA

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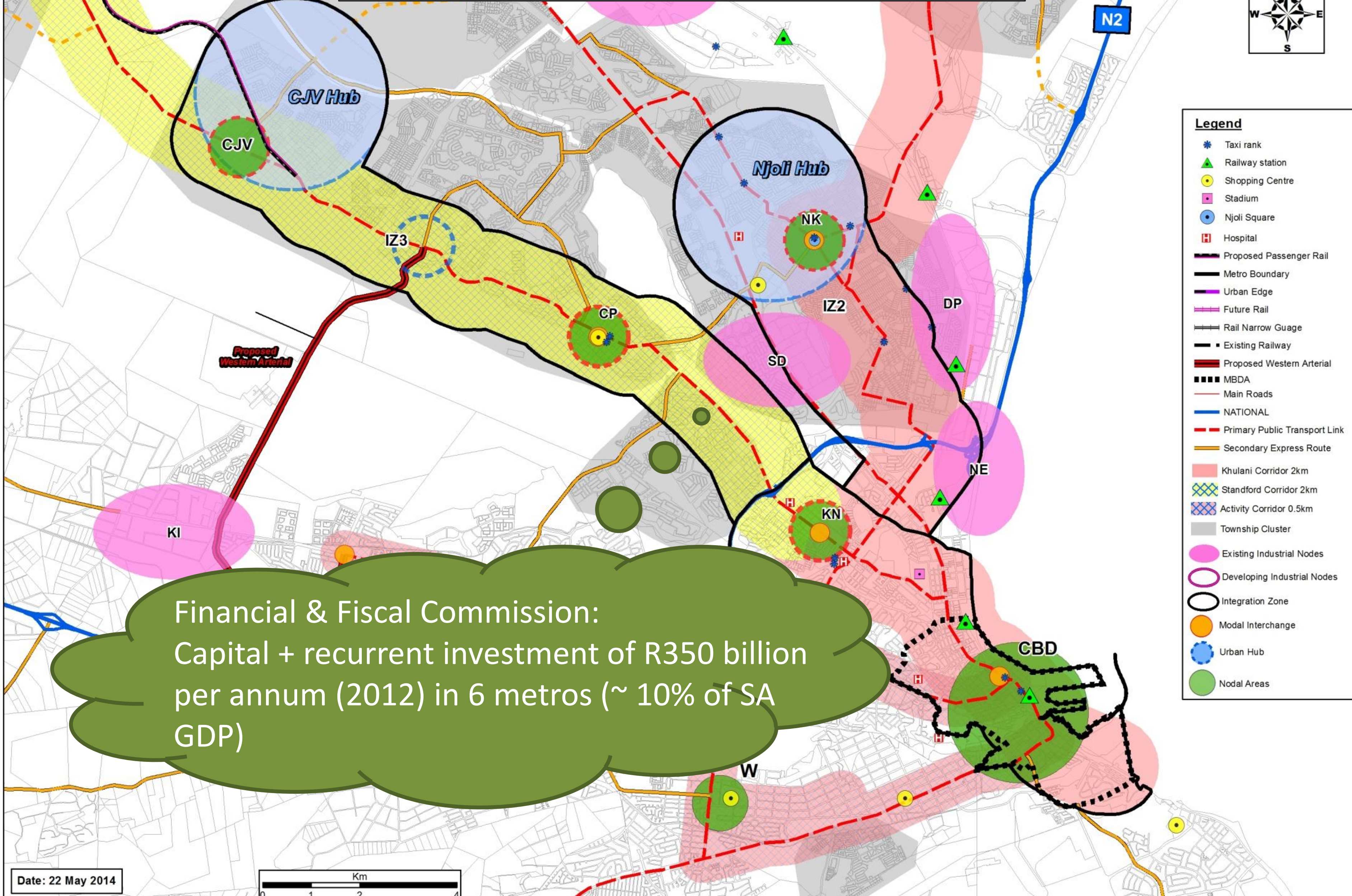
UNS : INTEGRATION ZONES AMENDED



Financial & Fiscal Commission:
Capital + recurrent investment of R350 billion per annum (2012) in 6 metros (~ 10% of SA GDP)

Source: Nelson Mandela Bay Metro Urban Network Strategy

Simulating the future

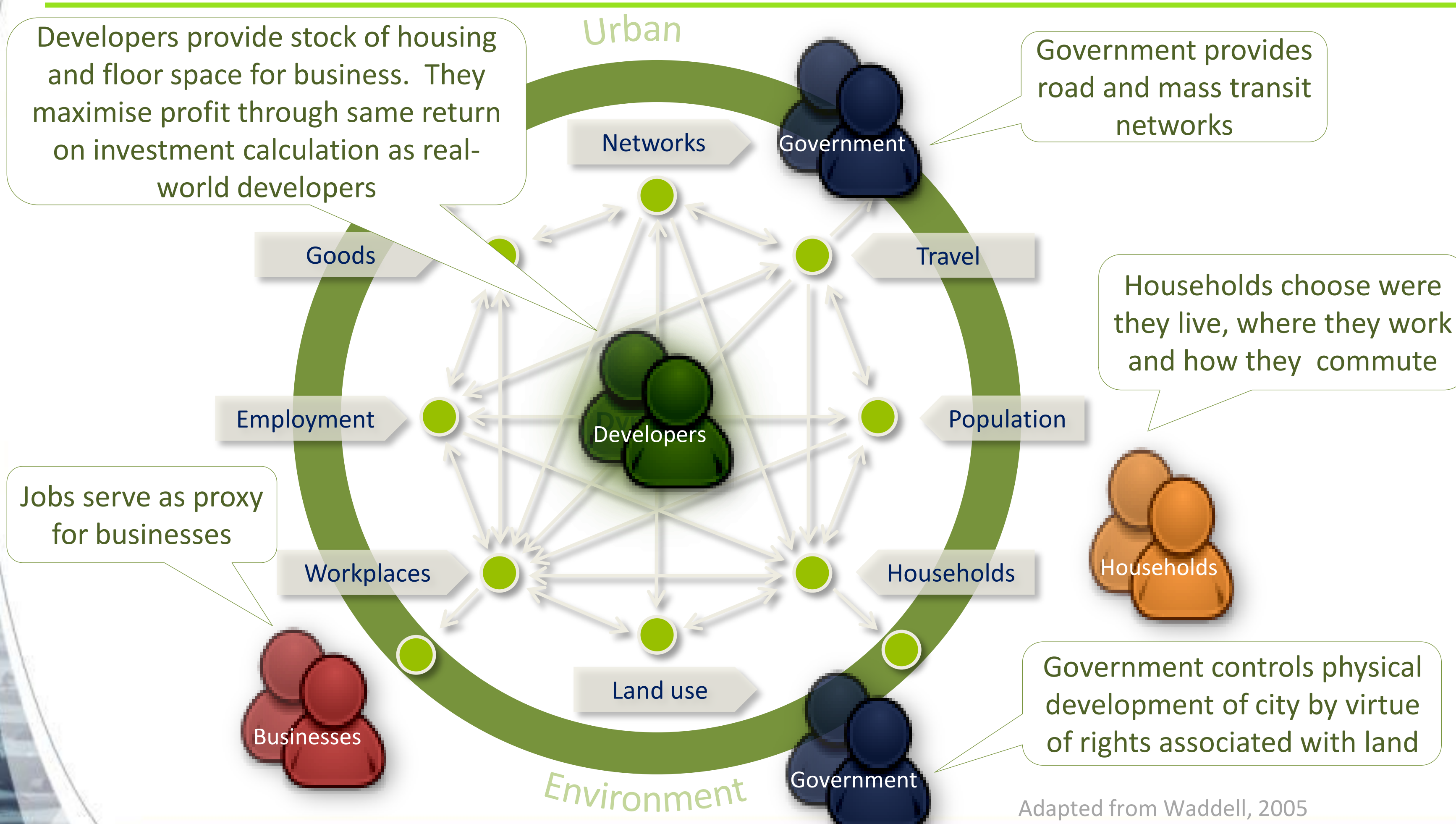
Simulate spatial growth patterns 30 years into the future, to better understand:

- Future **demand for infrastructure, facilities and services** such as water, electricity, sanitation, schools, clinics and hospitals.

Risk free means of assessing the likely outcome of major policy decisions:

- Ideal for development and refinement of Capital Investment and Spatial Development Frameworks
- Reflecting on the potential impact and market uptake of specific investments such as mass transit

A model of the urban system



Adapted from Waddell, 2005

The software

UrbanSim (Open Source)

Based on discrete choice theory: Simulates the choices made by various agents

- For example the probability of a household agent buying a particular house
- Sub-models allow for different behaviour of different income groups

Open Trip Planner (Open Source)

Used to determine lowest cost trips

- Considering all available modes of transport, distance limited walking and cycling, private vehicles, minibus taxis and mass transit

Data required

From a variety of data sources:

Control Totals

Households by income, age, children, cars …
Employment by Standard Industry Classification

STATSSA

Synthetic population

From 10% sample of enumerator forms from census and control totals for sub places and main places

STATSSA

Land and buildings

Cadastral parcels (~2 300 000)
Classify by typology of ~50 classes derived from Knowledge Factory
Type of building and market value

Other

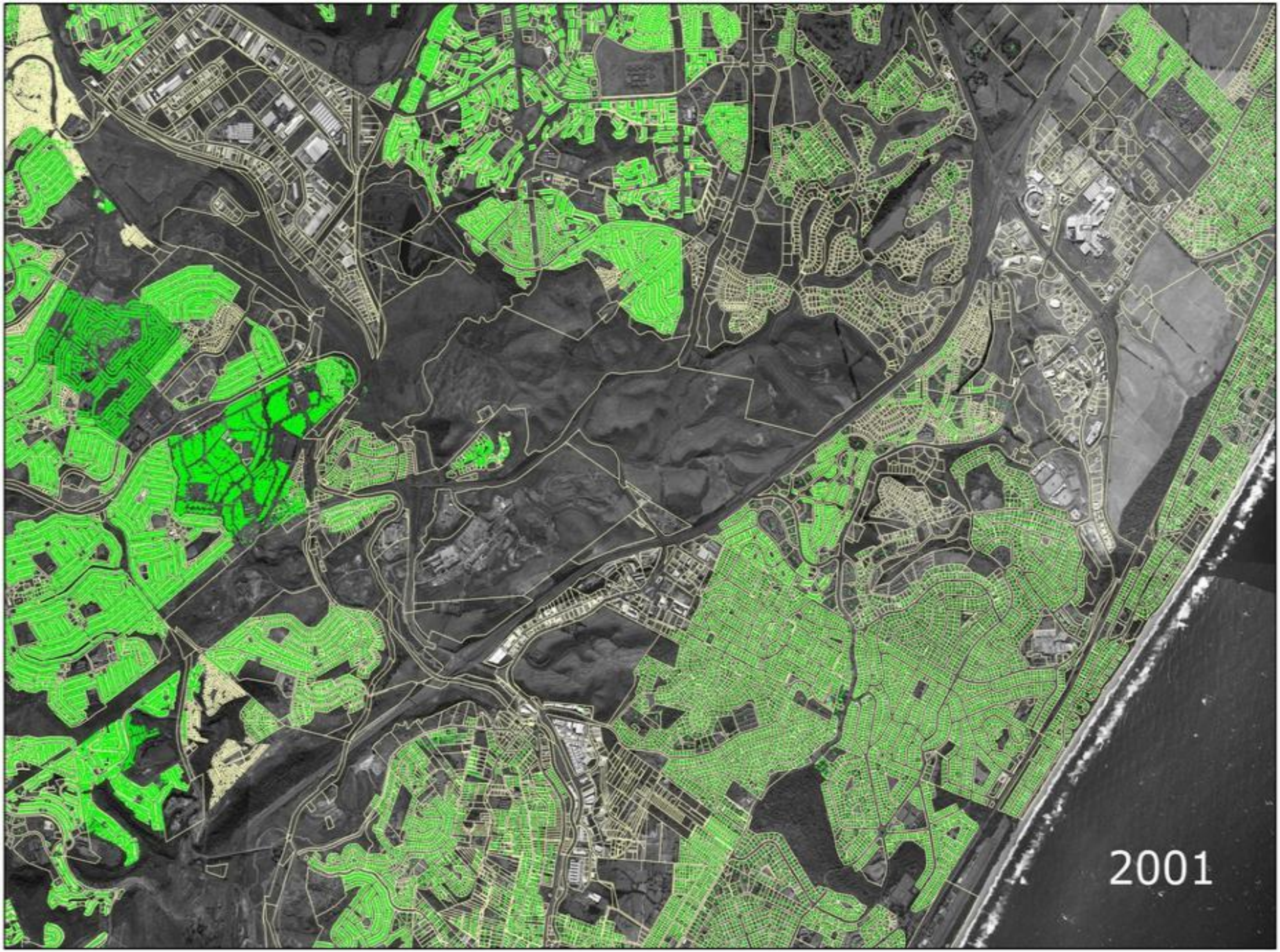
Environmentally sensitive, undermined, dolomitic areas …
Developments in the pipeline …

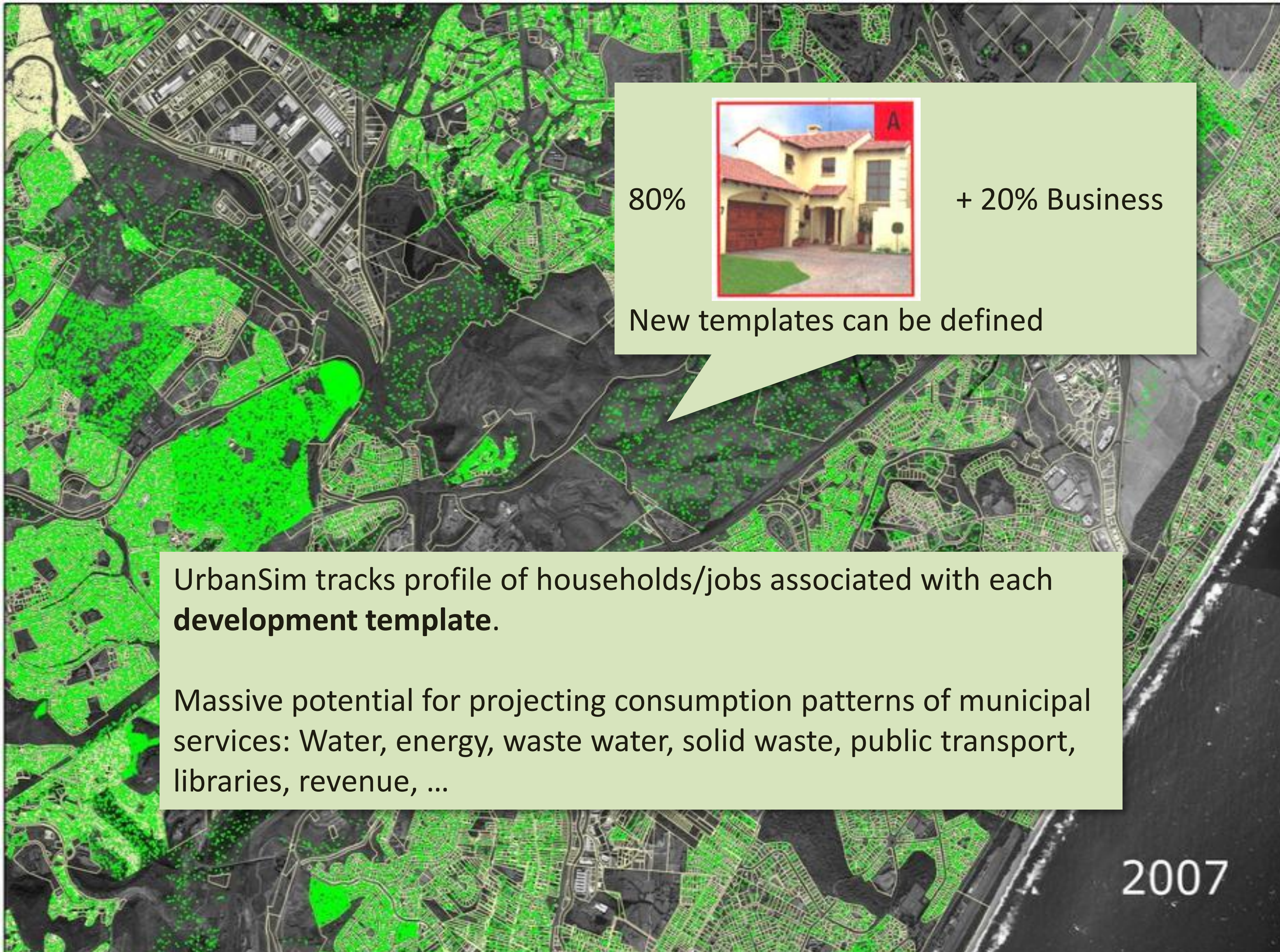
Study area

Previously: Metro boundaries. Currently: Whole Gauteng.

Example results

Cities of eThekwini and Nelson Mandela Bay


2001



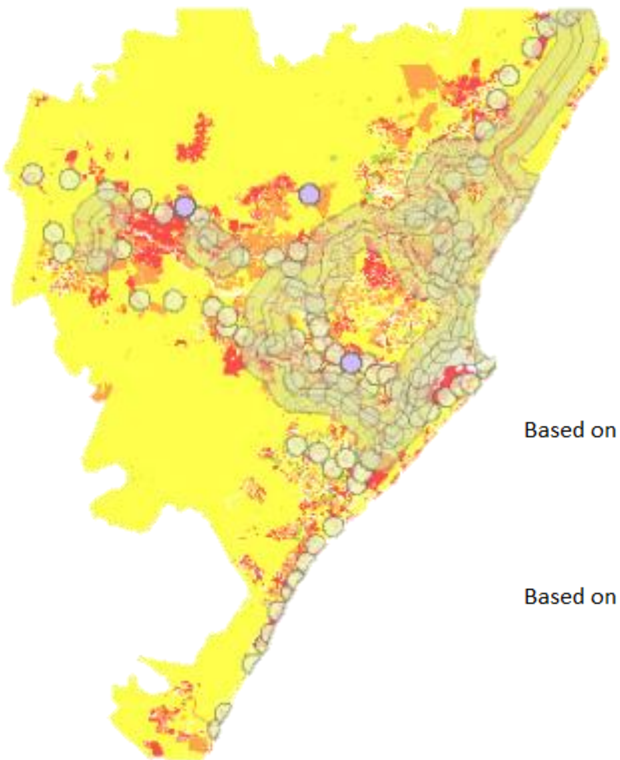
80% + 20% Business

New templates can be defined

UrbanSim tracks profile of households/jobs associated with each **development template**.

Massive potential for projecting consumption patterns of municipal services: Water, energy, waste water, solid waste, public transport, libraries, revenue, …

eThekwini mass transit scenario 2001 - 2030



Based on total HPPTN area

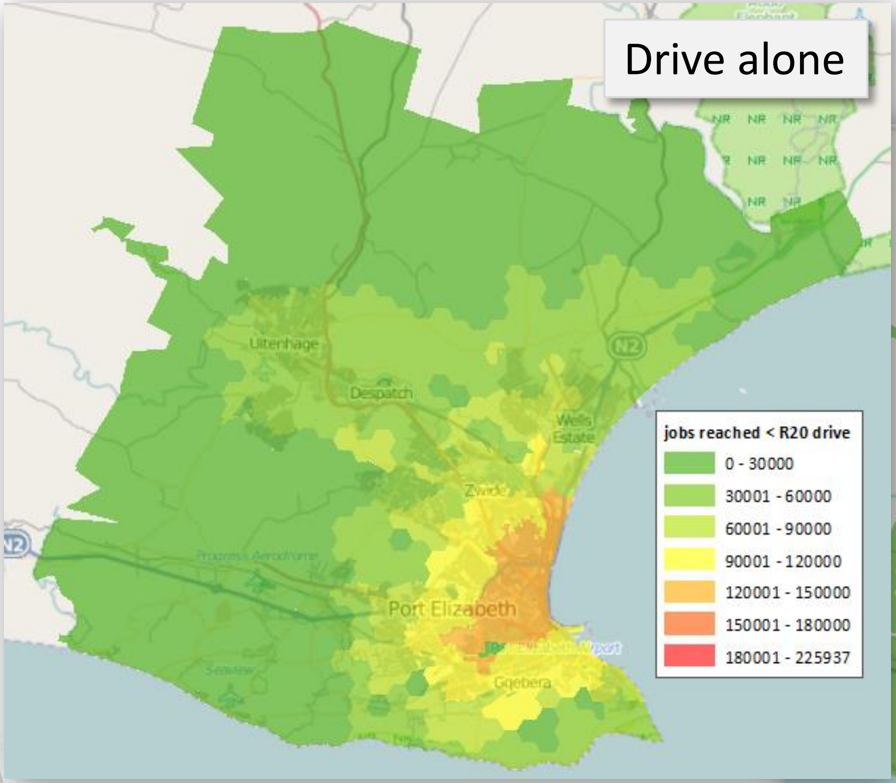
	Households	Area (ha)	Gross density (hu/ha)
Base Scenario	555 779	73 618	7.5
Blue Sky Scenario	595 238	73 618	8.1

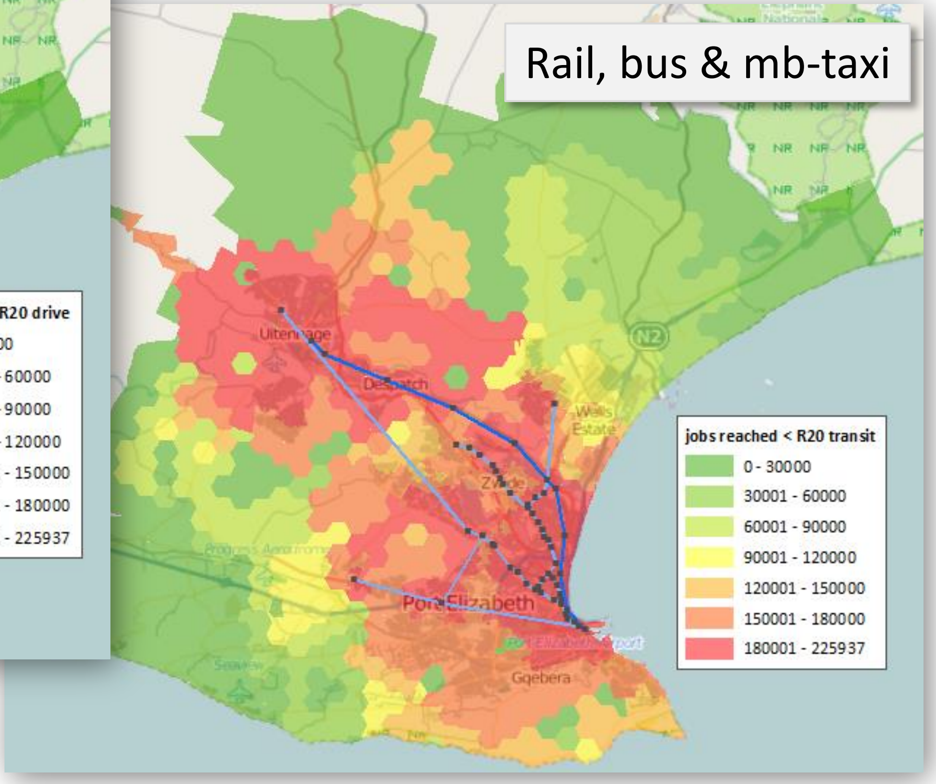
Based on area of residential land uses in HPPTN

	Households	Area (ha)	Gross density (hu/ha)
Base Scenario 2030	555 779	63 192	8.8
Blue Sky Scenario 2030	595 238	63 192	9.4

	Households	Area (ha)	Gross density (hu/ha)
All development 2008 - 2030 inside HPPTN	742 778	63 192	11.8

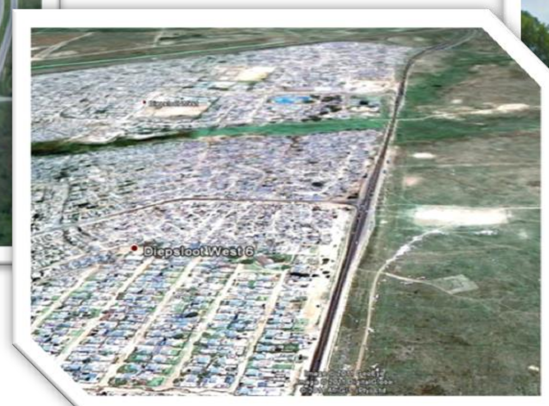
Jobs that can be reached < R40 pd

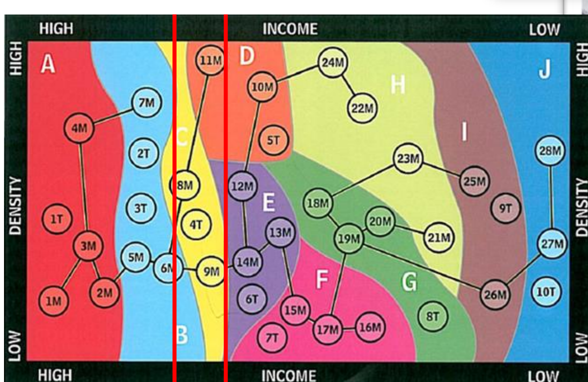




Innovations required

Sparse data





10	9	8	7	6	5	4	3	2	1	0	0
R 204 801 or more	R 102 401 - R 204 800	R 51 201 - R 102 400	R 25 601 - R 51 200	R 12 801 - R 25 600	R 6 401 - R 12 800	R 3 201 - R 6 400	R 1 601 - R 3 200	R 801 - R 1 600	R 401 - R 800	R 1 - R 400	no income
R 2 457 601 or more	R 1 228 801 - R 2 457 600	R 614 401 - R 1 228 800	R 307 201 - R 614 400	R 153 601 - R 307 200	R 76 801 - R 153 600	R 38 401 - R 76 800	R 19 201- R 38 400	R 9 601- R 19 200	R 4 801 - R 9 600	R 1 - R 4 800	no income
H5	H5	H5	H5	H5	H4	H4	H3	H2	H1	H1	H1

2M: Pearl Strings

Closely related to the Upper Crust, the Pearl Strings are crowning lifetimes of achievement with refined, slightly understated style – in fact, they may well frown on flash. While their incomes are only outstripped by those of the Upper Crust, properties

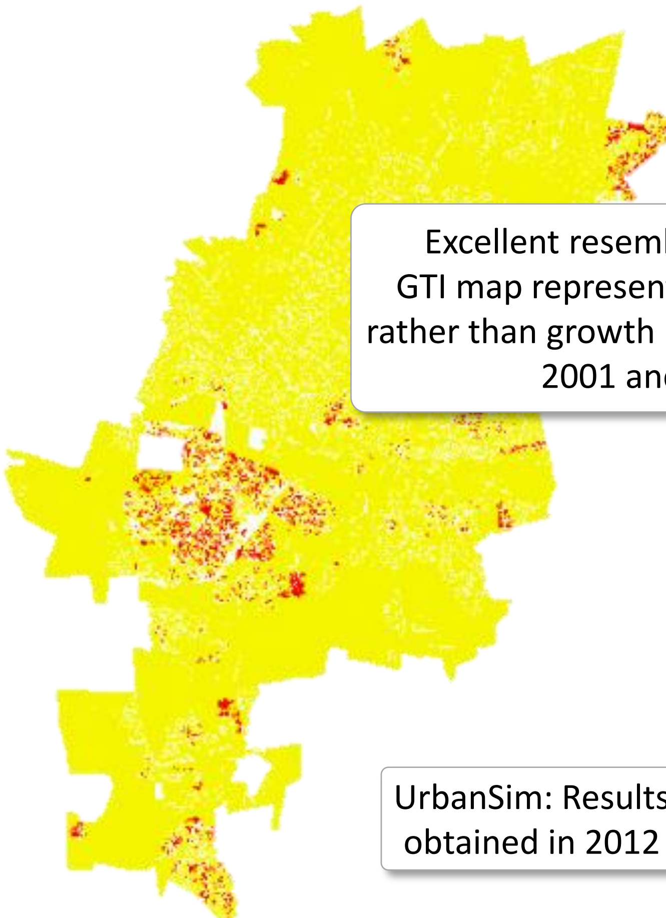
25M: Chakalaka

Chakalaka clusters (named after a spicy vegetable relish/dish developed in the townships of Gauteng) were meant to be orderly locations – much like the eKasi clusters, however, all open spaces in this cluster have been crammed full with a wide assortment of shacks and structures. The result is a lively community that is,

26M: Poor Neighbours

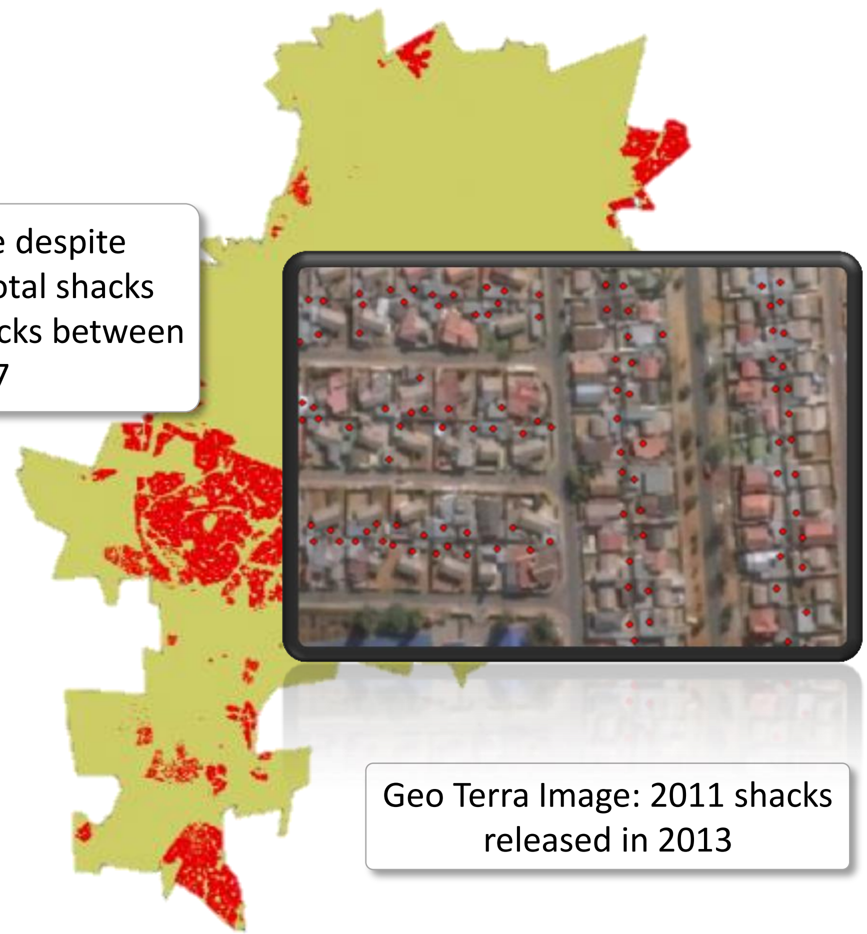
The residents of the Poor Neighbours cluster, too, have outgrown the old 'matchbox' houses originally built in the area. As a result, the cluster is typified by numerous shack dwellings erected amongst the permanent structures or nearby. Dwellings are basically standard four-room or three-room

CoJ: Backyard dwellings 2001-2007



Excellent resemblance despite GTI map representing total shacks rather than growth in shacks between 2001 and 2007

UrbanSim: Results obtained in 2012



Geo Terra Image: 2011 shacks released in 2013

NMBM: Backyard dwellings

Excellent results also obtained in Nelson Mandela Bay

Outcomes

DST investment

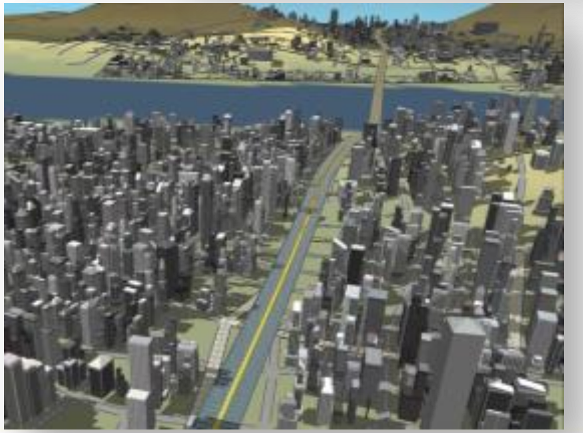
- Used to establish a capability:
  - Unique in SA (GCRO Occasional Paper 6)
  - Available to metros to guide major infrastructure investment decisions (10% GDP)
  - Compact cities benefit the poor (FFC). Now based on OpenTripPlanner to better model access to public transportation
- Process
  - Collaboratively with metros
  - Greater than means of individual metros. Not possible without DST investment
  - Takes many years to develop trust in new technologies and to gain traction

Traction and uptake

- NMBM: Long Term Financial Sustainability Strategy
- City of Tshwane: Capital Investment Framework
- GPDRT modelling centre
  - Possible future home when Transportation Authority established to oversee integrated transport planning for Gauteng metros
- Being evaluated by DRDLR to forecast land-use change for implementation of SPLUMA
- Putting the I back into IDP
  - Unintended consequences

Thank you

3D extensions being released



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