Implementing land use change models in the developing world

-Reshaping cities through urban land use modeling-

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2013 Esri International User Conference
July 8–12, 2013 | San Diego, California

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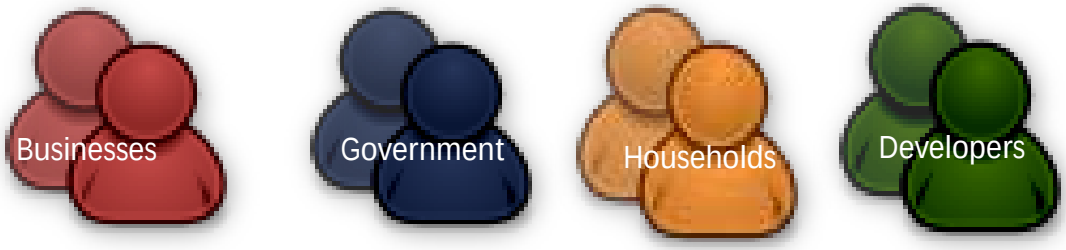
Presentation outline

1. Urban land use change models
2. Value of these models
3. Developing world context
4. Application
    - Developing vs developed countries
    - South African case studies
5. Results
6. Success/Pitfalls
7. Conclusions

Urban land use change models

1. Cities are complex systems
2. Not new concept: Academia 50's, Internationally 80's
3. Simplifications of reality
4. Underpinned by various theories
5. Build on 3 key building blocks
6. Classes of models
7. Modelling techniques
   - Equations, Statistics, Expert knowledge, Systems, CA, Hybrid, ABM



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Value of urban land use change models

1. Land use policies have a lasting impact on cities
2. Policies have direct impact on livelihoods
3. Planners need to understand their ‘unintended’ consequences
4. Quantify the effect of policies on land use patterns
5. Offer a unique opportunity to study the system
6. Need scientific evidence to support policy debates
7. Don’t predict land use change
8. Monitors and evaluates ‘What-if’ scenarios
9. Simulate future land use change to evaluate spatial patterns
10. Planning Support tool advising planners

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Developing world context

1. **Multifaceted social problems**
   - **Informal economy**
   - **Policy interventions e.g land reform, housing etc.**
   - **Lack of planning**
   - **Inequalities, income disparities**
   - **Informal settlements**
   - **Backyard shacks**
   - **Unprecedented growth: In-migration, Urbanisation and Natural growth**

Current applications

1. Developed countries
   - Good working examples (UrbanSIM, Clue-S)

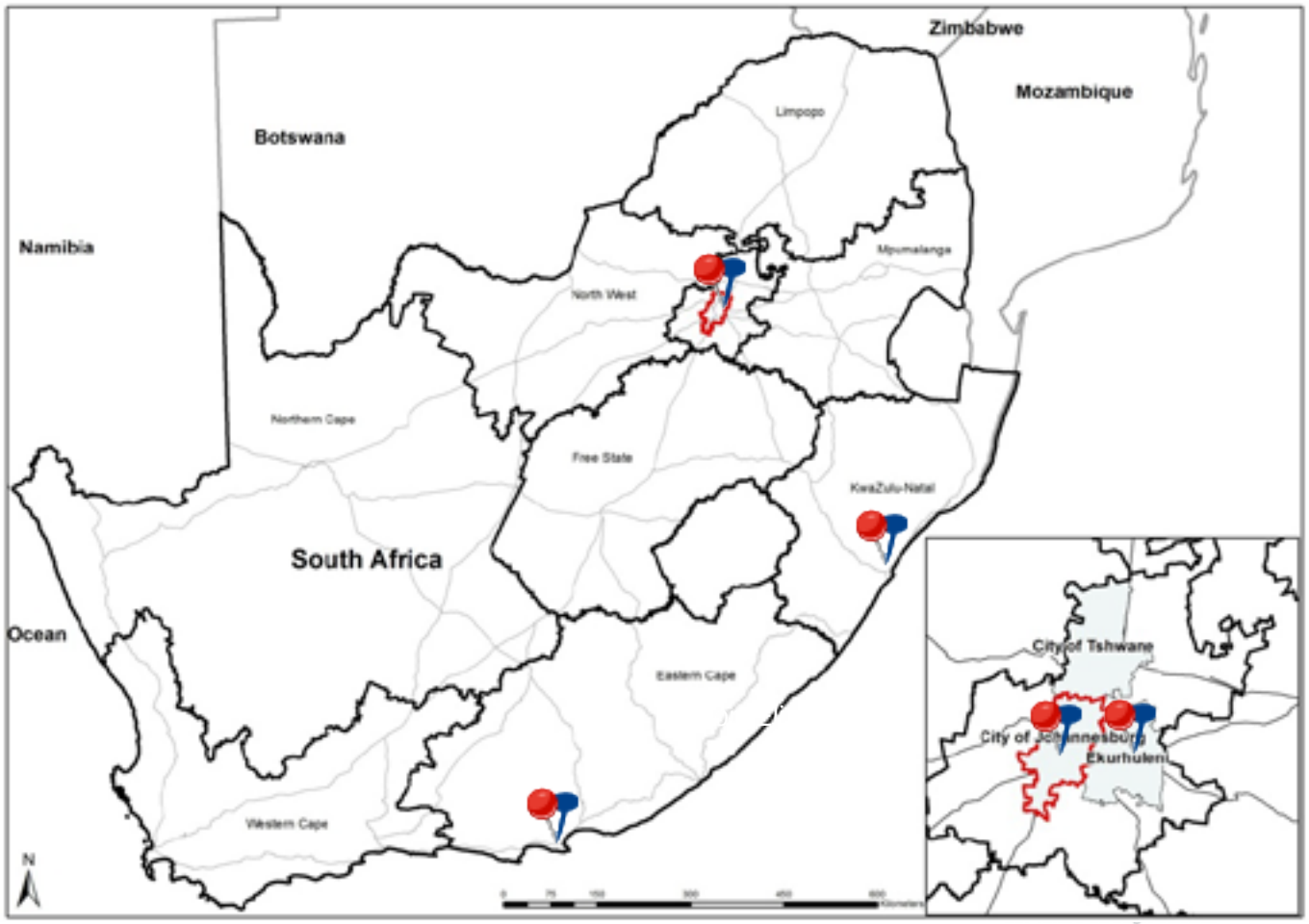
2. Developing countries
   - Development and research but few implementations
   - Many models omitted growth of informality
   - Many models just focus on informality (Tanzania, Cameroon)
   - Focus on sprawl and urban growth (India, China, etc.)

Current applications in South Africa

Case studies

- 4 Metro’s
- 1 Province

- Nelson Mandela Bay Metropolitan Municipality (UrbanSIM)
- Johannesburg Metropolitan Municipality
- UrbanSIM and Dyna-Clue)
- eThekwini metropolitan municipality (UrbanSIM)
- Ekurhuleni metropolitan municipality (UrbanSIM)



Johannesburg example

What we decide today will inherently shape our cities years from now

1. **Use land use models to *investigate*, *quantify* and *compare* the long-term (spatial) consequences of two planning policies on the City of Johannesburg.**
2. **Will the proposed policies restore the land use patterns of the city by 2030?**
3. **City worried about**
   - **Spatial inequality**
   - **Density**
   - **Commuting distances**

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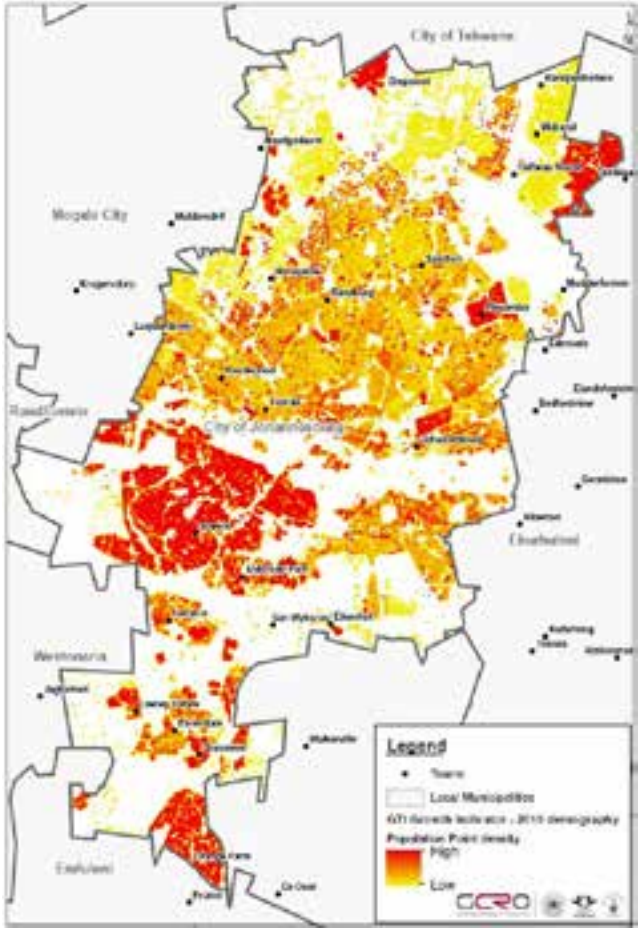
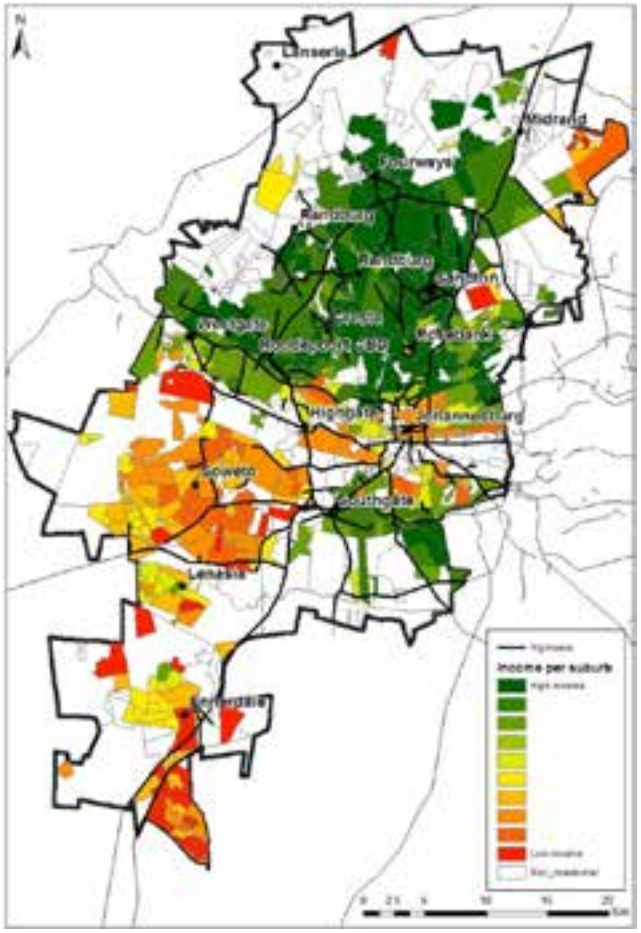
Johannesburg's spatial inequality

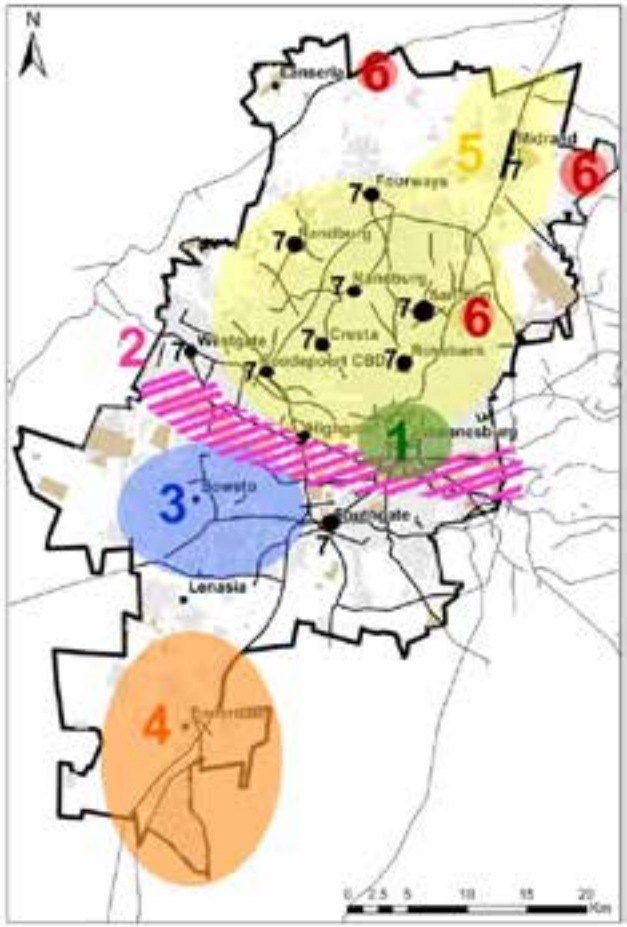
Population distribution



Income distribution

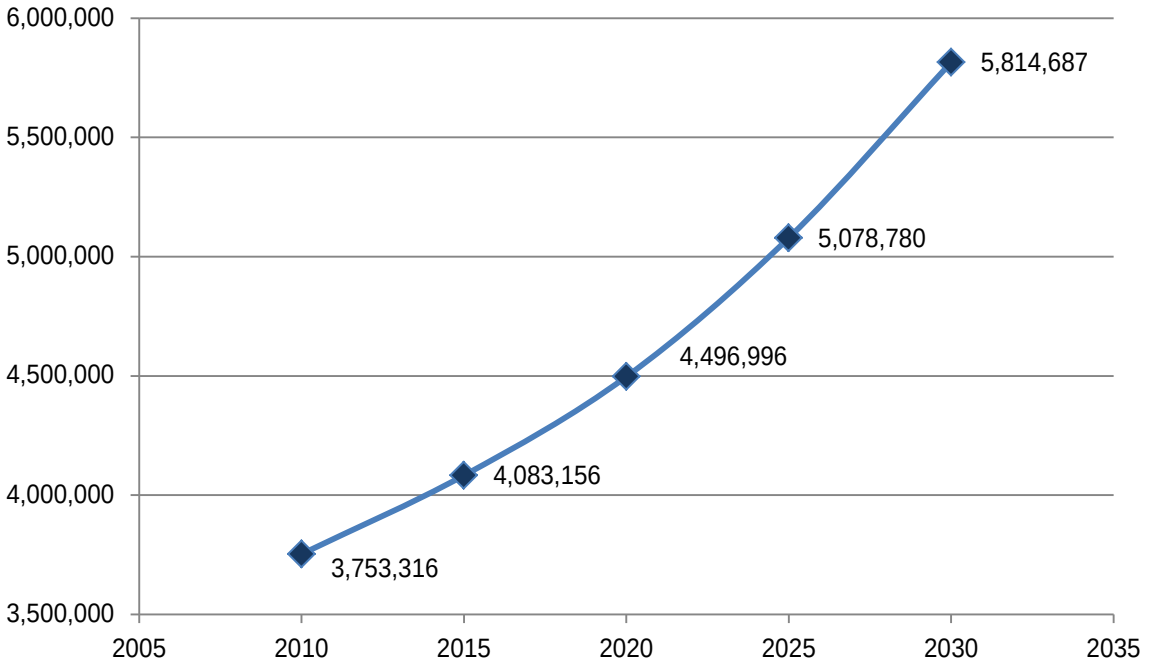


Spatial form



Johannesburg's future pressures

Rapid urbanisation, immigration and population growth



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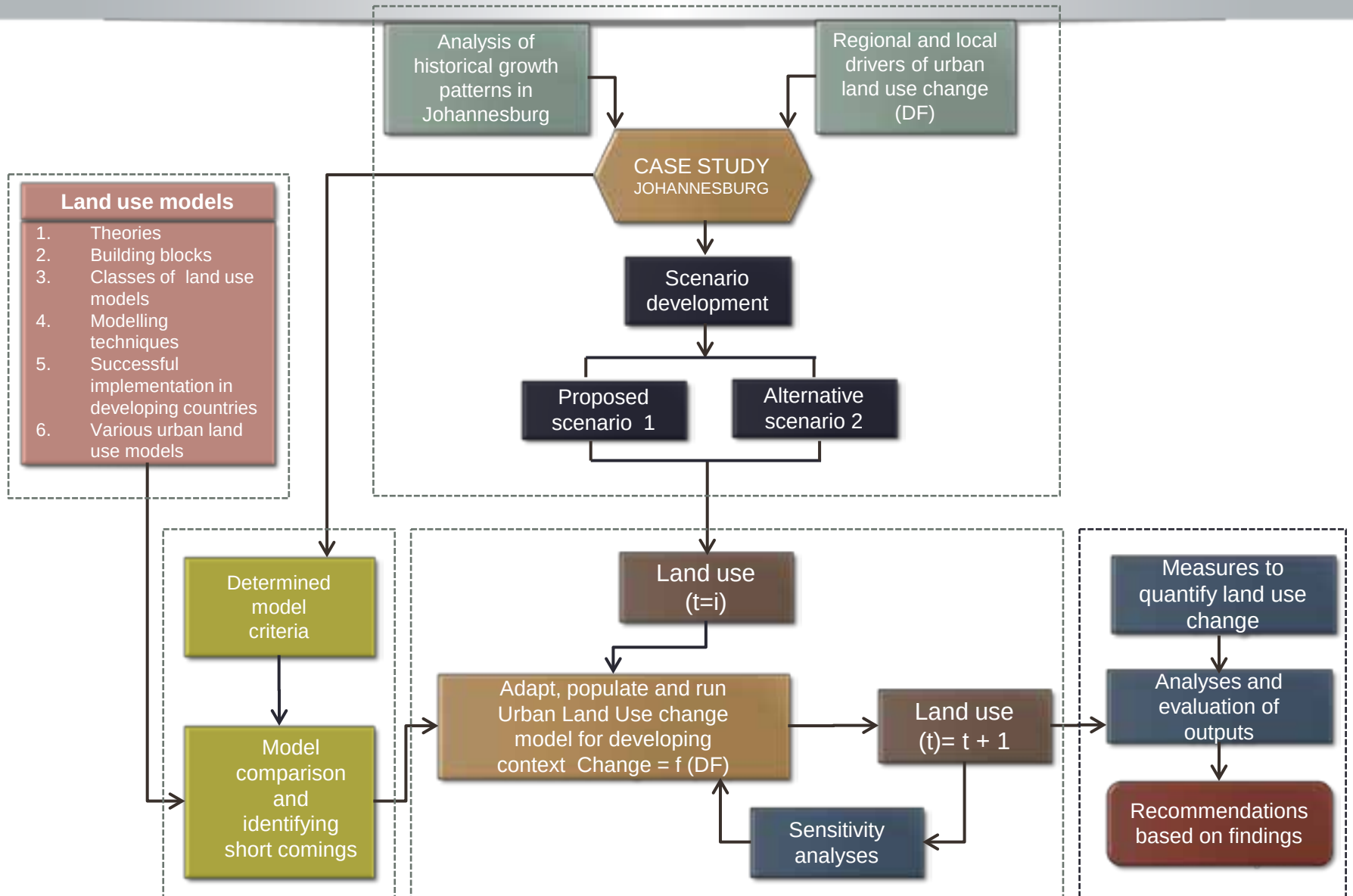
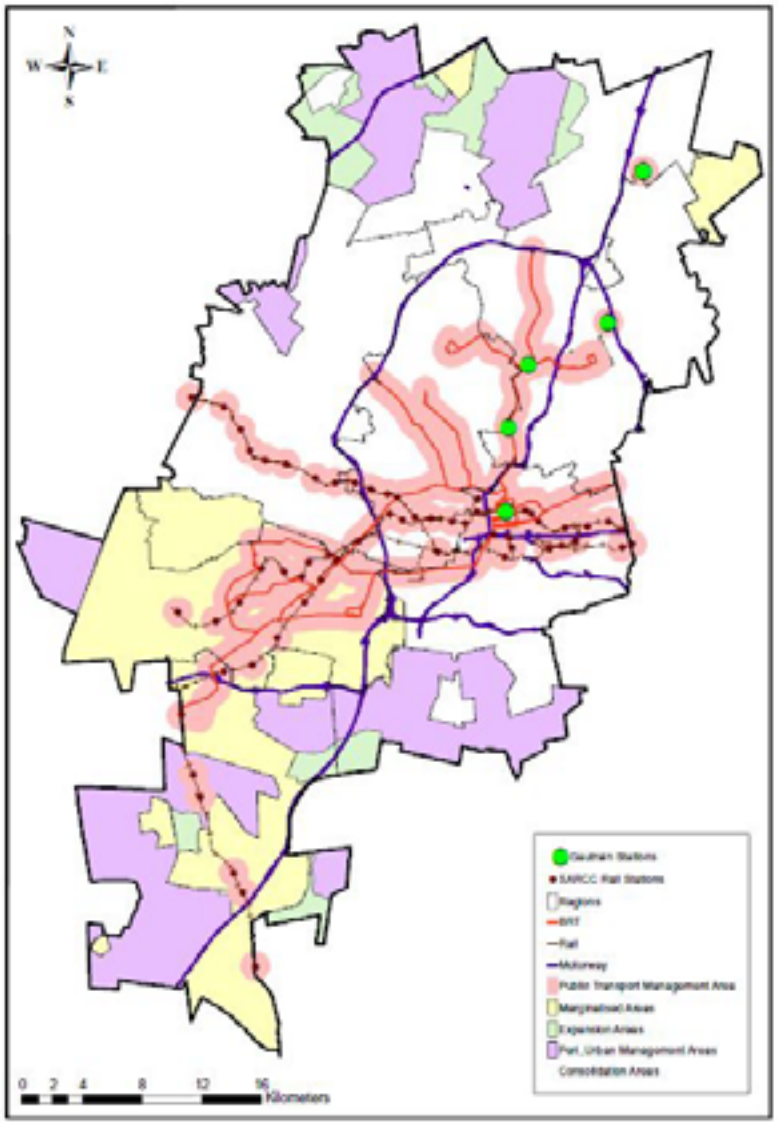
Modelling process

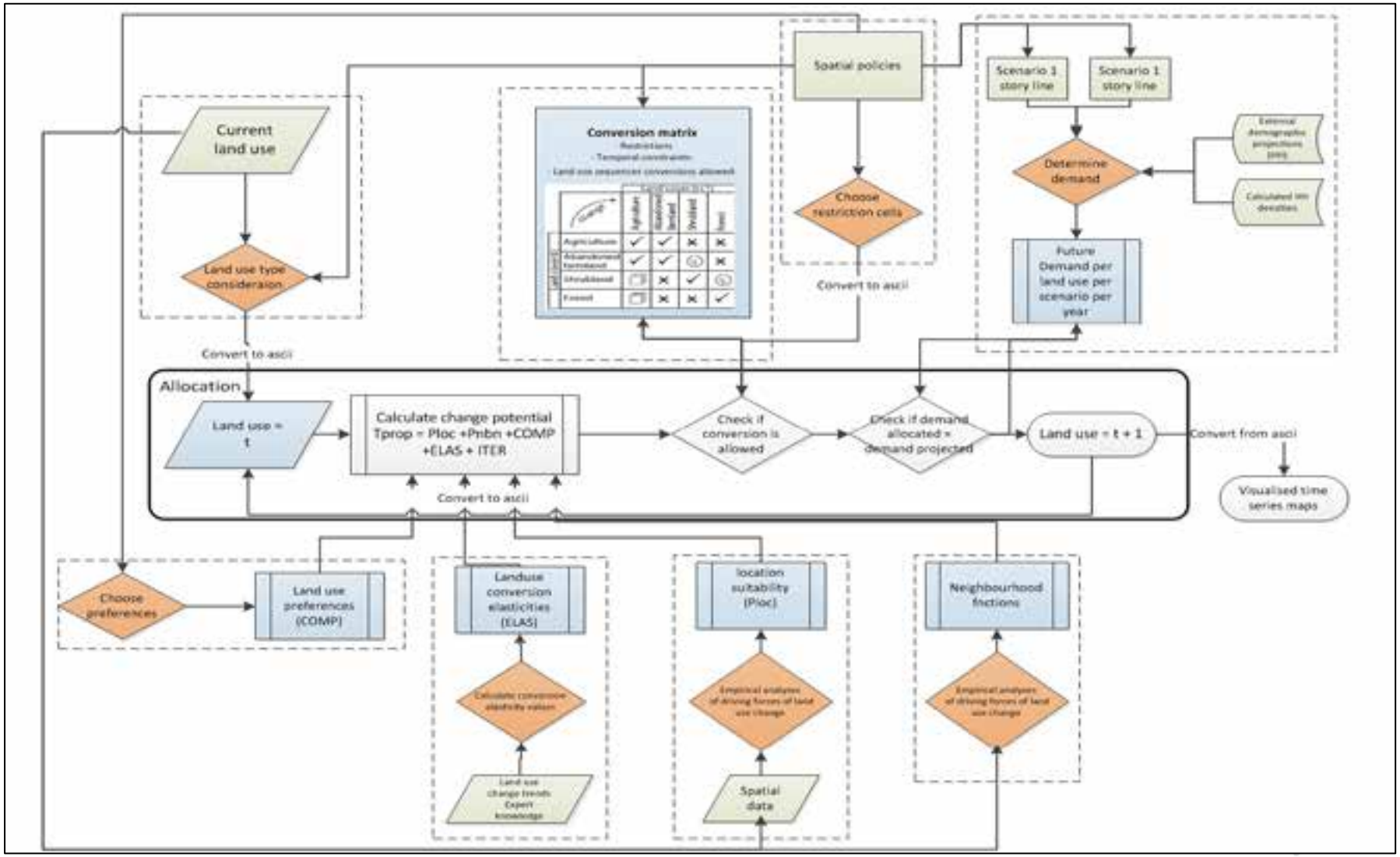


Scenario development

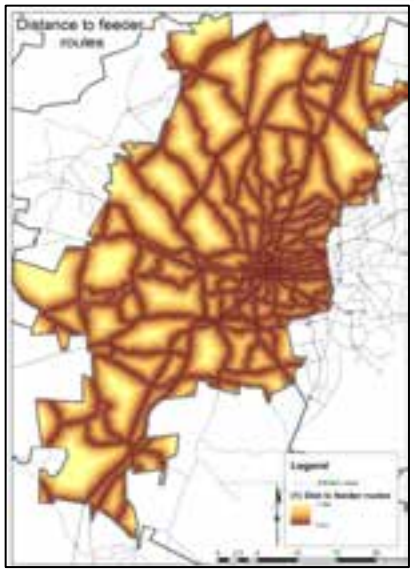
1. Densify key priority areas
2. Densify transport corridors
3. Protecting nature areas
4. Limit urban sprawl
5. Government low-cost housing in accessible areas

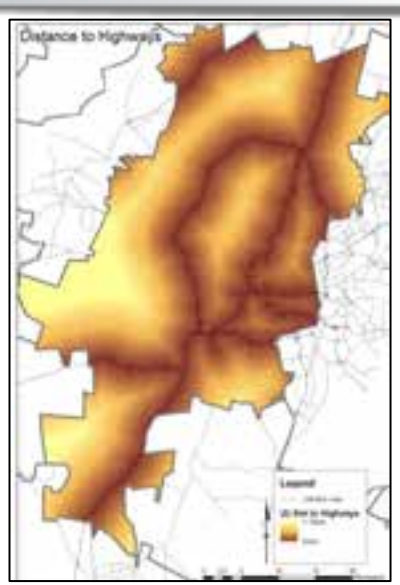


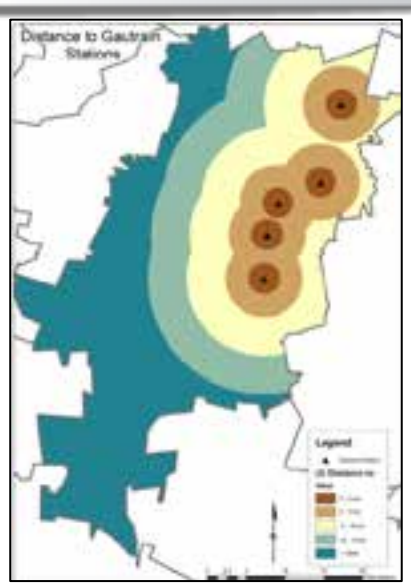
Populating the model (Dyna-Clue)

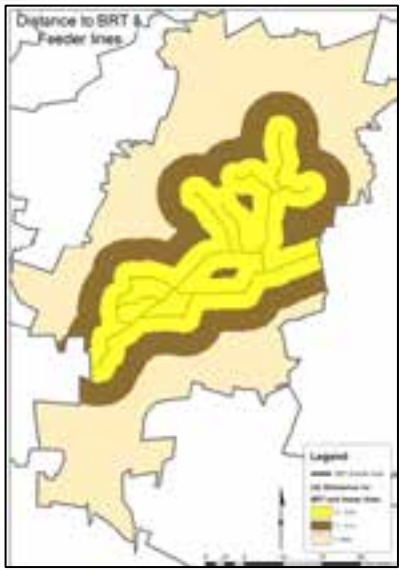


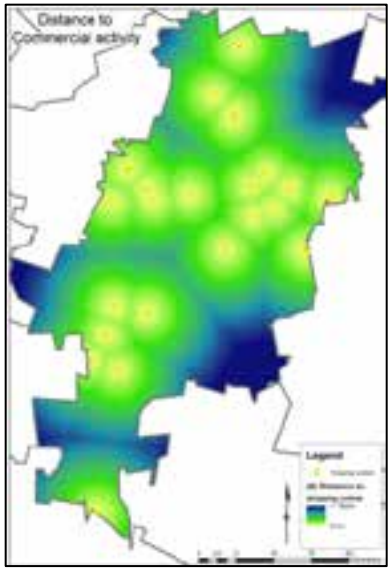
Drivers of land use change

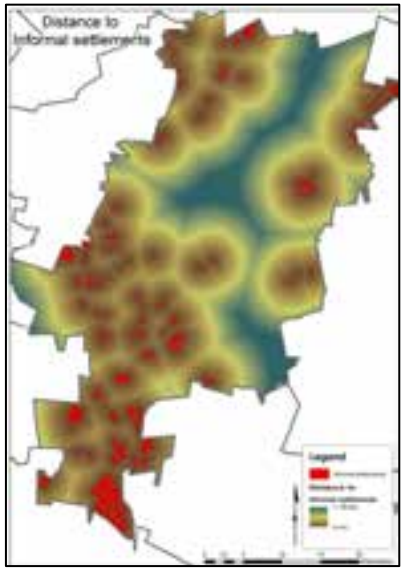












1. **Regional (influence land demand)**
   - **Demographics, Economy, Political events, Policies and strategies**
2. **Local (influence spatial distribution)**

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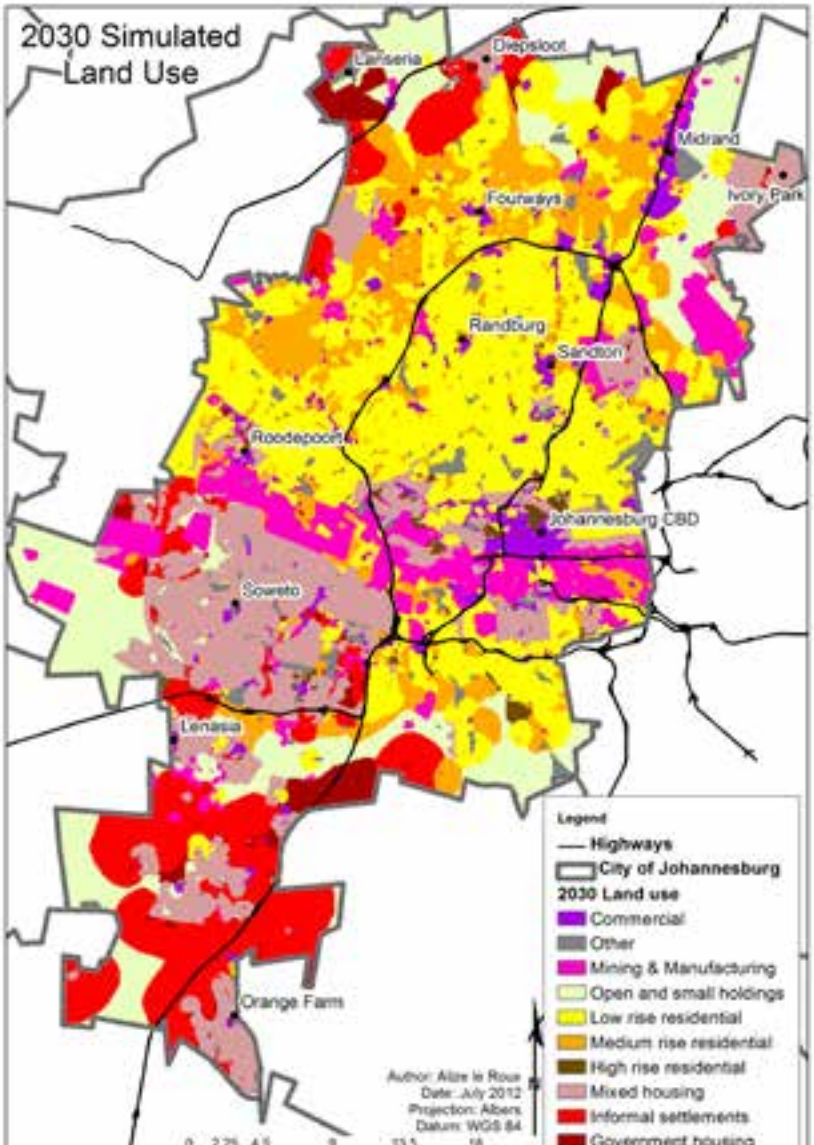
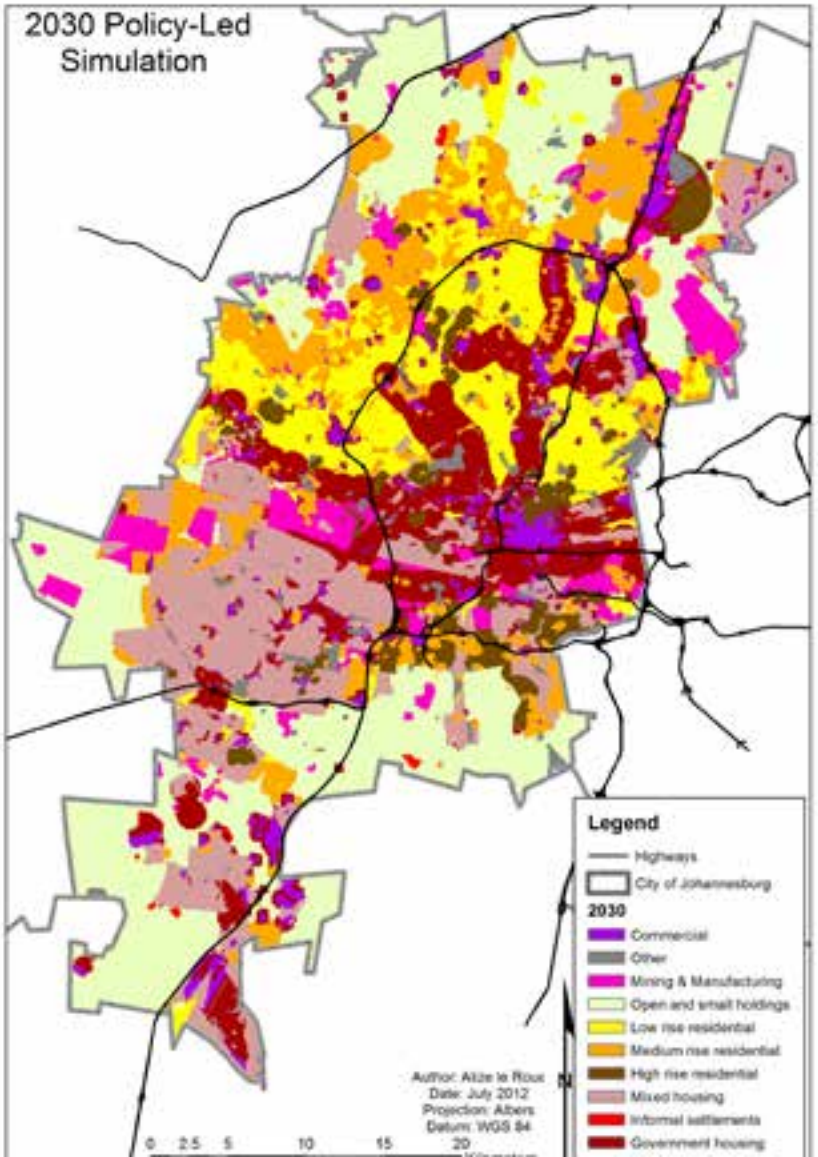
AS-IS Scenario

Policy-Led Scenario





Results - Indicators

1. Spatial inequality
    - Wealth segregation
    - Distribution and quantity of economic nodes and centres
    - Spatial allocation of demand (Growth patterns and trends)

2. Density patterns
    - Amount and location of change (Urban sprawl)
    - Densification of transport management nodes (transport sustainability)

3. Commuting distances
    - Access to public transport

Results – Spatial inequality

Indicators	2007 Base	AS-IS Scenario	Policy-Led Scenario
Wealth segregation	61% pop South 91% Low-income	60% pop South 90% Low-income	52% pop South 78% Low-income
Distribution and quantity of economic nodes and centres	82% com North 312 patches 127 HH/Ha 18% com South 143 patches 903 HH/HA	80% com North 325 patches 191 HH/Ha 20% com South 144 patches 1152 HH/Ha	67% com North 371 patches 221 HH/Ha 33% com South 221 patches 489 HH/Ha

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Success vs Pitfalls

1. Envisioned
   - War room with real time scenario development
   - Policy support and evidence
   - Municipalities will jump at the opportunity

2. Reality
   - Getting buy-in and confidence in model takes a long time
   - Significant investment
   - Need champion
   - Getting a shared vision is the hardest part
   - Scenario development is time consuming
   - Large investments and policies are driven by agendas
   - Evidence not always considered if in conflict with municipal vision
   - Well matured technology accepted
   - Policies will not restore spatial income inequality

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Conclusions

1. Raised valuable questions and concerns
2. Stimulated debate
3. Specifically between planners and implementing agencies
4. Models are data hungry
5. Massive potential for municipal consumption projections
    - Water, energy, waste water, solid waste, public transport, libraries, revenue, …

Q & A

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