The Effects of Heterogeneous Development Density Regulations on Exurban Development

An Agent-Based Model of Developer and Homebuyer Decision-Making

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Project SLUCE
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Presentation Outline

- Background: Project SLUCE
- Objectives
- Research questions
- The model: Components
- The model: Processes
- Experiments
- Results
- Conclusions
- Future work
SLUCE: Spatial Land Use Change and Ecological Effects

http://www.cscs.umich.edu/sluce/

- Modeling and evaluation of alternative policies and intervention
- Participating groups:
  - Institute of Social Research
  - Center for the Study of Complex Systems
  - School of Natural Resources and Environment
- Previous work:
  - Residential models
  - Policy effects: greenbelts, zoning
  - Validation methods
Objectives

- Interacting scales of decision-making
  - Developers
  - Townships
- Landscape
  - Exurban
  - Natural features
  - Roads
- Feedback mechanisms
Research Questions

- What are the effects of zoning policies on:
  - total tax base?
  - forest cover?
- Does this effect depend on:
  - landscape variance?
  - residents’ demographic characteristics?
- To what degree is this a game or a decision problem?
The Model: Components

- Landscape
  - Water
  - Forest
  - Elevation
  - Roads
- Farmers
- Residents
  - Preferences (demographics)
- Developers
  - Remnant subdivisions
  - Horticultural subdivisions
  - Country subdivisions
- Townships
  - Zoning policy
The Model: Processes

**Farmers**
Random selection of farms for sale

**Developers**
Evaluate landscape
Determine subdivision type
Develop (demand)

**Subdivision**
Water, forest, elevation, roads
Cut forest (horticultural or country)
Create lots

**Residents**
Income, kids, environmental
Selection of potential lots
\[ U = f(\text{subdivision type} \times (\text{panoramic view} + \text{forested area} + \text{presence of water} + \text{nearby development})) \]
Selection and location

**Townships**
Determine permissible development
Measures tax base and forest cover
Experiments

**Zoning policies**
- minimum lot size
- high density $\rightarrow$ low density

**Demographics**
- proportion of residents with high income
  - low $\rightarrow$ high

**Landscape**
- water, forest, elevation
  - homogeneous $\rightarrow$ heterogeneous
  - no water/forest

**Township level**
- Tax base = total income level
- Total area of forest
Results: Variable Landscape and Demographics with Fixed Policy

Tax base

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<th>Landscape</th>
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Total forest

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Results: Variable Policy and Demographics with Fixed Forest

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Results: Variable Policy and Demographics with Fixed Amenities

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Conclusions

- Basic processes of developer-homebuyer-policy interaction
- Population income distribution
- Abundance of amenities and policy control
- Interacting effects: Game problem
Future Work

- Test different landscapes/assumptions
- Add rural lots
- Use real data
- Change probabilities of farm sale with time
- Include adjacency factor (NIMBYism)
- Test other utility functions
- Apply of open space preservation policies at different scales
- Aspatial model