
The Effects of Heterogeneous Development Density Regulations on Exurban Development

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

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Presentation Outline

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

<http://www.cscs.umich.edu/sluc/>

- 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
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Objectives

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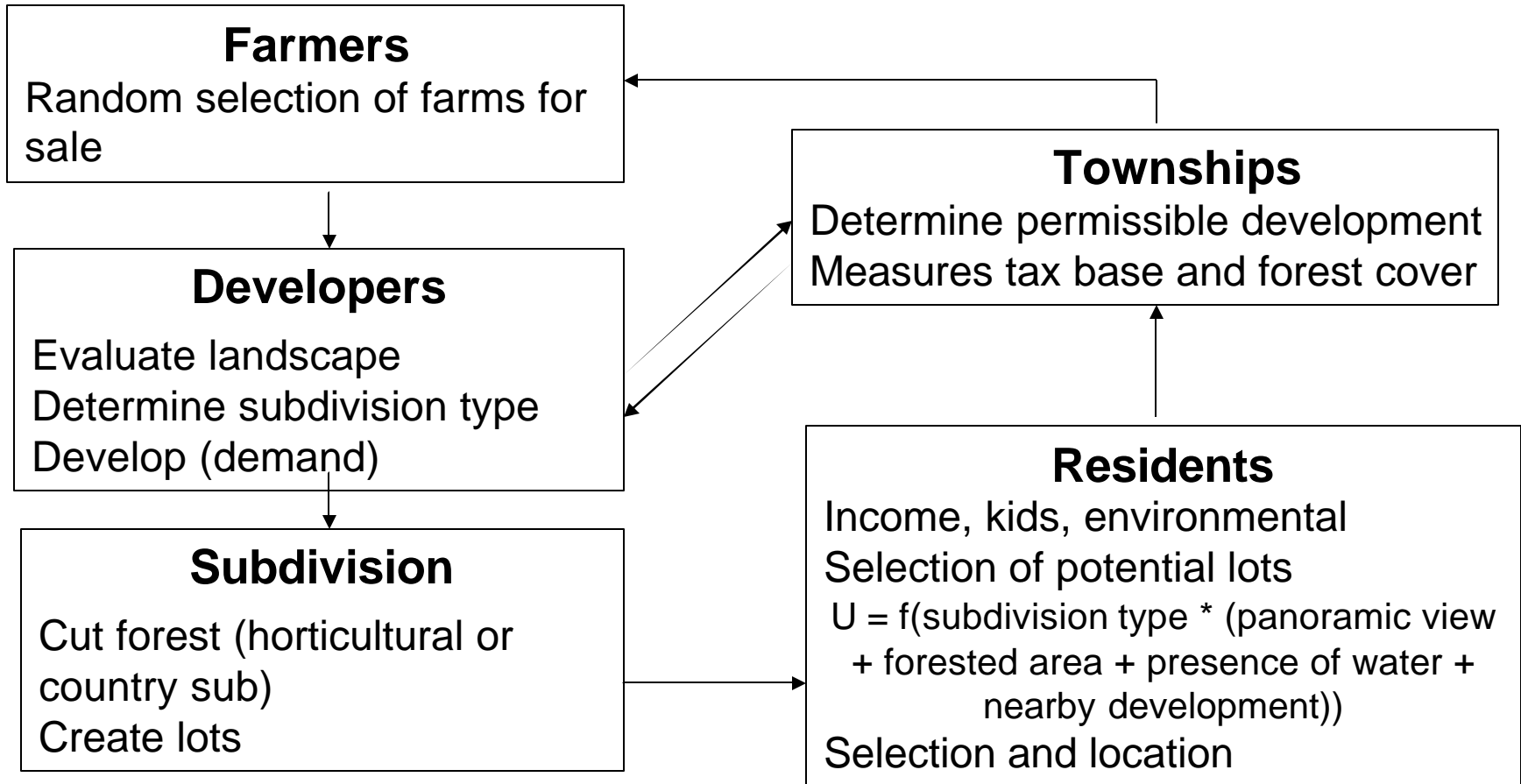
Research Questions

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

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



Experiments

Zoning policies

minimum lot size

high density → low density

Demographics

proportion of residents with

high income

low → high

Landscape

water, forest, elevation

homogeneous → heterogeneous

no water/forest



Township level

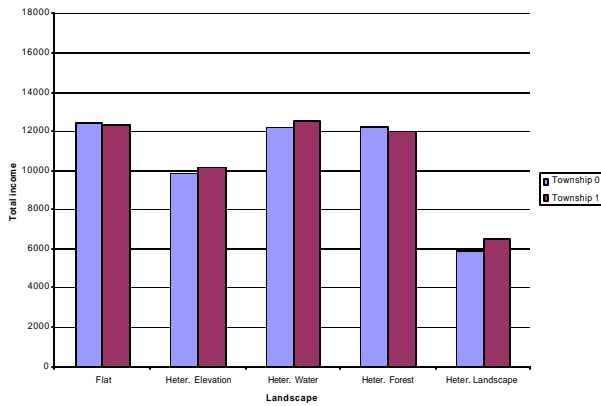
Residential tax base = total income level

Total area of forest

Results: Variable Landscape and Demographics with Fixed Policy

Residential tax base

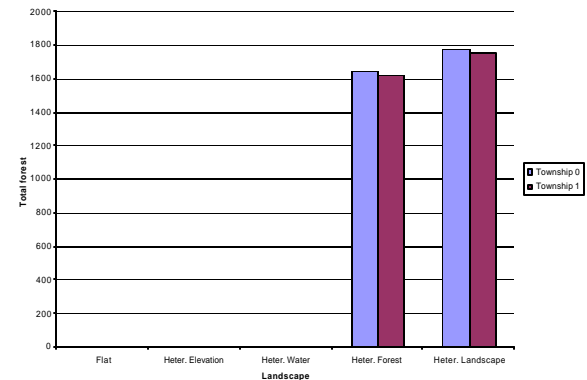
Residential tax base for fixed equal zoning
(20% high income)



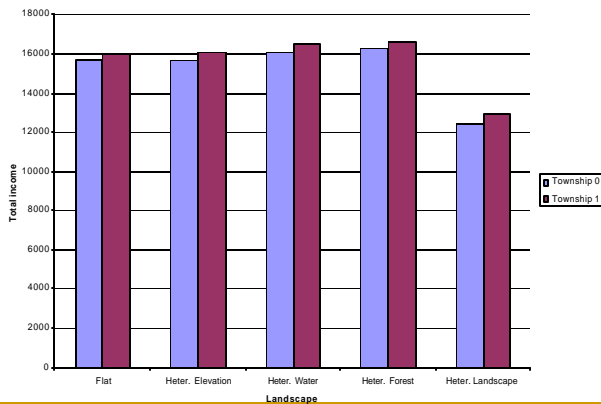
20%
high
income

Total forest

Total forest for fixed equal zoning
(20% high income)

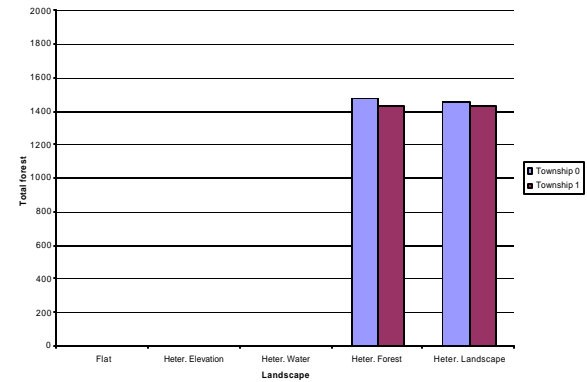


Residential tax base for fixed equal zoning
(50% high income)



50%
high
income

Total forest for fixed equal zoning
(50% high income)



Results: Variable Policy and Demographics with Fixed Forest

20% high income						
Township 1						
		1	2	3		
Township 0	1	12,248.97 , 11,975.47	15,254.73 , 4,683.93	16,440.87	3,023.80	
	2		4,301.07 , 4,604.33	5,864.20	3,113.13	
	3			4,265.67	4,275.73	
50% high income						
Township 1						
		1	2	3		
Township 0	1	16,241.97 , 16,627.17	20,127.97 , 11,273.03	22,448.80	7,485.37	
	2		10,917.07 , 11,247.27	14,721.93	7,427.87	
	3			7,666.00	7,798.00	

Residential tax base

20% high income						
Township 1						
		1	2	3		
Township 0	1	1,640.38 , 1,617.28	1,524.86 , 1,848.32	1,409.34	2,033.15	
	2		1,871.42 , 1,825.22	1,779.01	2,056.26	
	3			2,056.26	2,056.26	
50% high income						
Township 1						
		1	2	3		
Township 0	1	1,478.66 , 1,432.45	1,363.14 , 1,571.07	924.16	2,033.15	
	2		1,663.49 , 1,663.49	1,316.93	2,033.15	
	3			2,056.26	2,056.26	

Total forest

Results: Variable Policy and Demographics with Fixed Amenities

20% high income		Township 1					
		1		2		3	
Township 0	1	5,940.93	6,519.80	5,963.80	4,556.43	7,926.17	2,567.40
	2			4,379.00	4,573.53	6,251.87	2,694.27
	3					4,216.87	4,112.73
50% high income		Township 1					
		1		2		3	
Township 0	1	12,429.13	12,961.33	12,348.00	11,275.83	17,033.27	6,509.80
	2			11,076.87	11,058.67	15,504.67	6,617.87
	3					8,493.00	8,387.53

Residential tax base

20% high income		Township 1					
		1		2		3	
Township 0	1	1,779.01	1,755.90	1,779.01	1,848.32	1,594.18	2,056.26
	2			1,894.53	1,848.32	1,686.59	2,056.26
	3					2,056.26	2,056.26
50% high income		Township 1					
		1		2		3	
Township 0	1	1,455.55	1,432.45	1,478.66	1,524.86	877.95	2,033.15
	2			1,524.86	1,501.76	1,039.68	2,033.15
	3					2,056.26	2,056.26

Total forest

Conclusions

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

- Test different landscapes and assumptions
 - Add rural lots
 - Use real data
 - Change probabilities of farm sale with time
 - Include adjacency factor (NIMBYism)
 - Test other utility functions
 - Other models
 - scales of decision-making
 - aspatial model
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