Economic Incentives for Sustainable Development in Sensitive Tidal Environments

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Rationale:

- High population growth rates
  - 2000-2010 population of 6 GA coastal counties grew by 14 percent.
- Wisdom of laissez-faire development questioned
  - Urban sprawl
  - Large lots, more roadway, low permeability
  - Vulnerability of marsh ecosystems

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Rationale

- NOAA's website "Alternatives for Coastal Development: One Site, Three Scenarios"
  - Shows developers revenues from eco-friendly designs
  - Improvements in economic section needed
- This project attempts to provide better info, funded by Sea Grant
- Results have been incorporated into Ch. 5 of Green Growth Guidelines.

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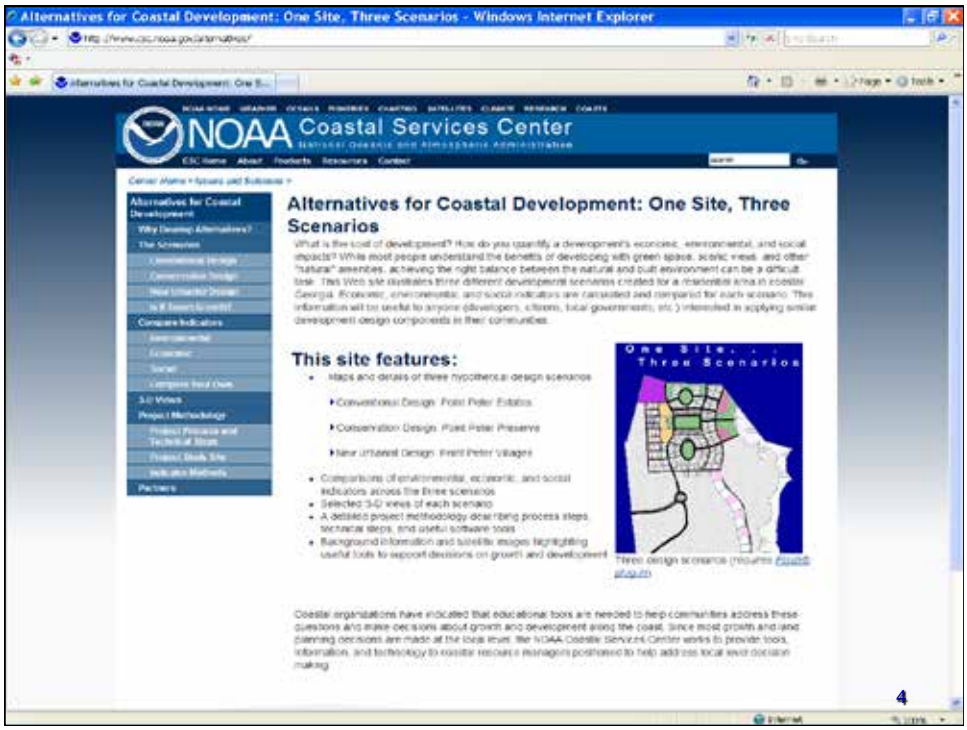

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Objectives

- Analyze coastal real estate market
  - Employ GIS tools
  - Conduct econometric analyses
  - Concentrate on tidal environments
- Improve the information base
  - Demonstrate whether developers have market incentives to reduce environmental footprint.
  - Show localities that design ordinances may not stifle growth

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Methods

- Hedonic price analysis of property prices
  - A standard tool of environmental economics
  - Property prices are explained in a regression:
    1. Home sq. footage, age, lot size, boat dock, etc.
    2. Neighborhood characteristics
    3. Amenity factors like marsh proximity and communal space

  - Beta coefficients are implied prices of characteristics

Method's logic is similar to the comparable sales technique of appraisal:

Subject price= comparable's price ± adjustments

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Methods (2)

- Explore developer incentives
  - Simulate gross revenues from property prices under alternative development scenarios
  - Estimated property prices are Y hats generated from the regression.

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Related Previous Studies

- Wetlands (size/distance)
  - **size of and proximity to wetlands has positive effect on house prices (Lupi, Graham-Tomasi, and Taff (1991); Doss and Taff (1996); and Mahan, Polasky, and Adams (2000)). Effect less certain in rural areas (Polasky, 2006)**
- Conservation subdivisions
  - **higher appreciation rate (Lacy (1990)**
  - **Price premium for conservation subdivisions (Mohamed (2006))**

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Related Previous Studies (2)

- Open space

- **permanently preserved open space/parks has positive effect on house prices (Bolitzer and Netisil (2000); Lutzenhiser and Netusil (2001); Geoghegan (2002); and Thorsnes (2002)**

- **commons area within subdivisions increase prices, developer faces trade-off between commons and lot size (Kopits, McConnell and Walls, 2007)**

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Data Collection

- Three coastal Georgia counties
  - Chatham (Savannah) pop= 251,000
  - Glynn (Brunswick) pop= 75,900
  - Camden (Kings Bay) pop= 47,600

- Sources of Data
  - County Tax Assessor's Office
  - Odum School of Ecology, University of Georgia
  - U.S. Census Bureau

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Problem: while there are many eco-friendly design characteristics for a subdivision, only a few have been quantified and are available:

- Lot size, from tax assessor
- Percent of the subdivision's area that is commons, derived from special parcel code in tax assessor's GIS overlay
- Percent of the subdivision's area that is impervious surface, GIS overlay from Odum School and Liz Kramer

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Property selection criteria

- Purchased between 2004-2006
- Within 1000 meters of marshland or water
- No beach properties
- Only arm's length, residential transactions

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Table 1: Variable Definitions and Summary Statistics, Variables Used in Hedonic Price Model of Marshland Area Properties in Three Counties, Georgia.

Variable	Definition	Chatham	Glynn	Camden
Price	Most recent property sale price, constant 1994 dollars	110656	123005	77536
Housesize	Size of the house, square meters	160.241	190.825	153.935
Parcelsize	Size of the parcel, square meters	1436.88	1738.11	1369.47
Fireplace	1 if house has fireplace, 0 otherwise	0.7743	0.2274	0.2426
Brick	1 if masonry exterior, 0 otherwise	0.3625	0.1981	0.0903
Garage	1 if garage on property, 0 otherwise	0.7564	0.6099	0.9339
Bedrooms	Number of bedrooms	3.1805	3.231	3.1464
Deck	1 if wooden deck, 0 otherwise	0.2271	0.1872	0.99
Pool	1 if swimming pool, 0 otherwise	0.0406	0.085	0.0506
Year	Year house was constructed	1986	1990	1994
Impervious	Neighborhood's % impervious surface	19.3184	11.2284	25.8241

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Table 1 (cont.): Variable Definitions and Summary Statistics, Variables Used in Hedonic Price Model of Marshland Area Properties in Three Counties, Georgia.

Variable	Definition	Chatham	Glynn	Camden
Commons	Commons space in neighborhood, %	8.5453	8.204	21.214
Floodzone	1 if inside a flood zone, 0 otherwise	0.5039	0.4993	0.1751
Distmarsh	Meters to marsh or river	221.8561	187.5788	177.531
Boatdock	1 if boat dock, 0 otherwise	0.0386	0.0146	0.0124
Marshfront	1 if marsh or water frontage , 0 otherwise	0.0188	0.0389	0.1141
Waterview	1 if view of marsh or river, 0 otherwise	0.0391	0.0284	0.2163
Postfirm	1 if constructed after community in NFIP, 0 otherwise	0.3576	0.6925	0.9369
Race	Percent of black residents in blockgroup	20.0657	14.3101	22.1993
Income	Median household income in blockgroup	51818.86	49359.4	44103.39

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Table 2: Regression estimates of the Hedonic Price Model (dependent variable, log of property's most recent sale price, constant 1994 dollars).

Variable	Camden	Chatham	Glynn
Intercept	-111.524*	-43.394*	39.041*
Housesize	0.936*	0.709*	1.075*
Parcelsize	0.078*	0.106*	0.023
Fireplace	0.034*	0.027	0.046*
Brick	0.004	-0.051*	-0.085*
Garage	0.107*	0.040*	0.020
Bedrooms	-0.008	0.007	-0.016
Deck	0.019	-0.011	0.025
Pool	0.125*	0.078*	0.085*
Year	15.055*	6.379*	-5.000*
Impervious	-0.011	-0.016	-0.014

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Table 2 (cont.): Regression Estimates

Commons	0.022*	0.078*	0.007*
Floodzone	0.086*	0.041*	0.057*
Distmarsh	-0.018*	-0.041*	-0.001
Boatdock	0.508*	0.413*	0.485*
Marshfront	0.032	0.258*	0.205*
Marshview	-0.045	0.012	0.134*
Postfirm	0.003	-0.002	0.157*
Race	-0.163*	-0.075*	-0.091*
Income	0.328*	0.216*	0.449*
N/R^2	2,405/73%	2,016/77%	2,365/76%

The double-log functional form was used, i.e. all continuous variables were transformed by their natural logarithms. The t-ratios are computed from White's consistent variance estimates. * indicates rejection of the one-tailed hypothesis test at the five percent level. For the dummy variables, the marginal effect given is the percent change in $300,000 house due to the presence of the attribute.

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Marshland-related variables

- Proximity is important, and in Chatham:
- Marsh or Water View adds $12,000
- Water access adds another $80,000
- Dock presence adds another $24,000

- Dock's effect less than expected
  - Swimming pool adds $12,000
  - Both are high-maintenance, low demand???

Is there spatial autocorrelation?

Geographic principle: everything is related, but items in closer proximity are more related.

In a regression, proximity of observations might be another causal factor.

If ignored, OLS estimates will be unbiased but inefficient.

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For Chatham county: Moran's I = 0.109, sd(I) =0.013, Z=8.51, p value = 0.0001

For Glynn county: Moran's I = 0.183, sd(I)=0.001, Z=91.8, p value = 0.0001

For Camden county: Moran's I = 0.634, sd(I) =0.069, Z=9.20, p value = 0.0001

Models have spatially correlated residuals. Surprising since we have neighborhood-level X variables

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Problem: Numerous alternative specifications of the spatial weights matrix.

- Donovan, Champ and Butry (2007) suggest using plotted semivariance of the OLS residuals to formulate the s.w.m.
- Plot will show how pairs of properties located within specified bands of each other become less similar as the distance increases (ie. they lose their grouping into neighborhoods)

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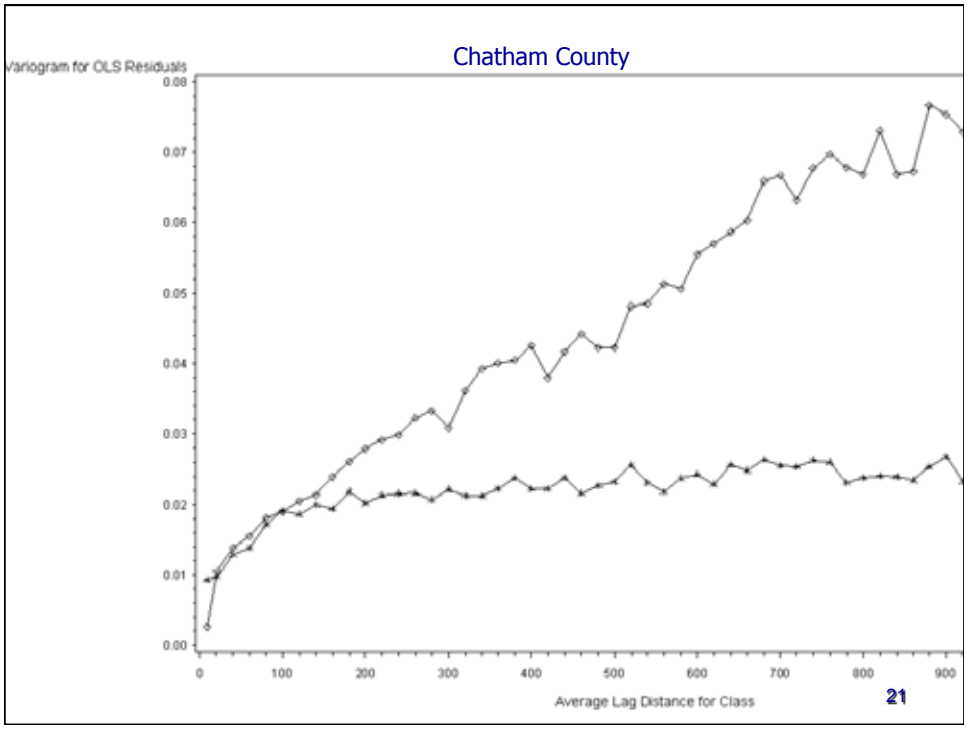
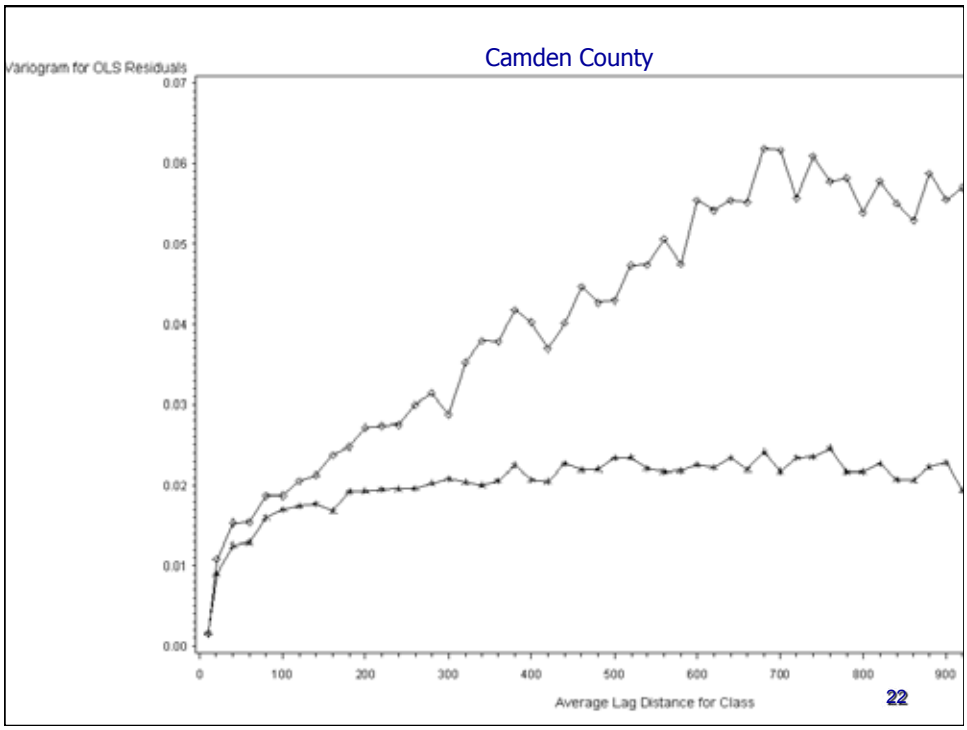
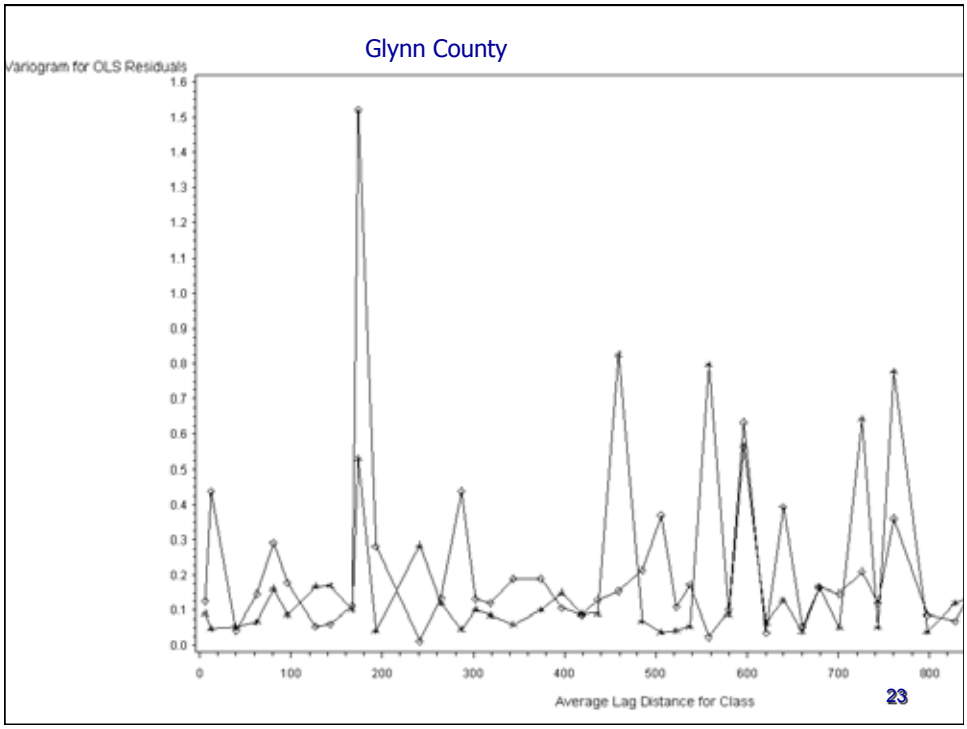
Chatham County



Camden County





Simulation scenarios

- **Status quo:** 20 ha, 100 homes, 5% Commons, 15% impervious surface, $300,000/home, $30mil revenue
- **Conventional design:** fewer lots, more set-aside, less impervious surface
- **Conservation design:** smaller lots, more set-aside, less impervious surface

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Chatham Subdivision Design Simulations

Conventional design: 20 ha, 100 homes, 5% Commons, 15% impervious surface, $300,000/home, $30mil revenue

	10 % Commons 10% Impervious	15% Commons 5% Impervious
Constant lot size	Lot size=1,600 m^2 95 houses Price= $312,457 Revenue= $29,683,000 Change = - $317,000	Lot size=1,600 m^2 90 houses Price= $321,822 Revenue= $28,963,000 Change= - $1,036,000
Variable lot size	Lot size=1,500 m^2 100 houses Price= $310,753 Revenue= $31,075,300 Change= +$1,075,000	Lot size=1,400 m^2 100 houses Price= $318,200 Revenue= $31,820,024 Change= +$1,820,024

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Glynn Subdivision Design Simulations

Conventional design: 20 ha, 100 homes, 5% Commons, 15% impervious surface, $345,000/home, $34.5mil revenue

	10 % Commons 10% Impervious	15% Commons 5% Impervious
Constant lot size	Lot size=1,600 m^2 95 houses Price= $353,179 Revenue= $33,601,880 Change = - $898,120	Lot size=1,600 m^2 90 houses Price= $358,168 Revenue= $32,235,120 Change= - $2,264,880
Variable lot size	Lot size=1,500 m^2 100 houses Price= $353,179 Revenue= $35,317,900 Change= +$817,900	Lot size=1,400 m^2 100 houses Price= $357,070 Revenue= $35,707,000 Change= +$1,207,000

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Camden Subdivision Design Simulations

Conventional design: 20 ha, 100 homes, 5% Commons, 15% impervious surface, $172,000/home, $17.2mil revenue

	10 % Commons 10% Impervious	15% Commons 5% Impervious
Constant lot size	Lot size=1,600 m^2 95 houses Price= $176,057 Revenue= $16,725,415 Change = - $474,585	Lot size=1,600 m^2 90 houses Price= $172,610 Revenue= $15,535,890 Change= - $1,664,110
Variable lot size	Lot size=1,500 m^2 100 houses Price= $175,173 Revenue= $17,517,300 Change= +$317,300	Lot size=1,400 m^2 100 houses Price= $170,833 Revenue= $17,083,300 Change= -$116,700

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Summary Subdivision Design Simulations

Chatham= urban, Glynn=suburban, Camden= rural

	10 % Commons 10% Impervious	15% Commons 5% Impervious
Constant lot size	Chatham -$317,000 Glynn -$898,000 Camden -$474,585	Chatham -$1,036,000 Glynn -$2,265,000 Camden -$1,664,000
Variable lot size	Chatham $1,075,000 Glynn $818,000 Camden $317,000	Chatham $1,820,024 Glynn $1,207,000 Camden -$117,000

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Main Conclusions

- In the urban county, housing developers have a market incentive for planning:
  - Higher density developments
  - Developments with more open/communal space
  - Developments with less impermeable surface

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Conclusions (cont.)

- Market incentives for green growth much less certain in the rural county
- With its projected growth rate will become urban in 10-20 years.
- Planning needed today for tomorrow's urban design features.
- Same applies to 3 other GA coastal rural counties.

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- Chapter Five of Green Growth Guidelines can be downloaded at

  www.georgiastats.uga.edu/marshp.htm

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