

# Spillover effect of habitat conservation programs on supply of private acreage for hunting in Georgia

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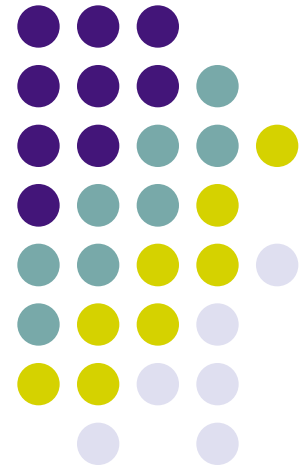
**J. M. Bowker**

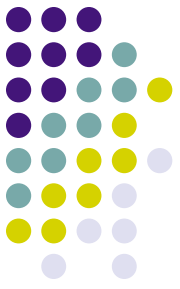
USDA Forest Service  
Southern Research Station

**Gary T. Green**

**Mike A. Tarrant**

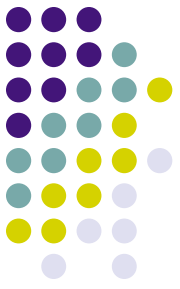
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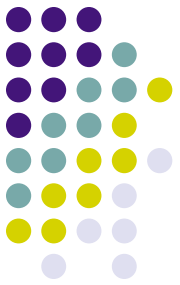
# Significance of hunting

- Social
  - Popular outdoor activity
  - >14 million hunt annually
- Ecological
  - Maintain game population
- Economic
  - Bigger than peanut's impact in GA



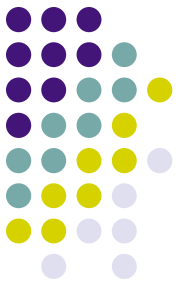
# Hunting in decline?

- Causes
  - Structural change in population (Poudyal et al. 2008)
  - Reduction in suitable hunting land (Mozumder et al. 2003)
- Public hunting land
  - Relatively constant supply
  - Other recreational needs



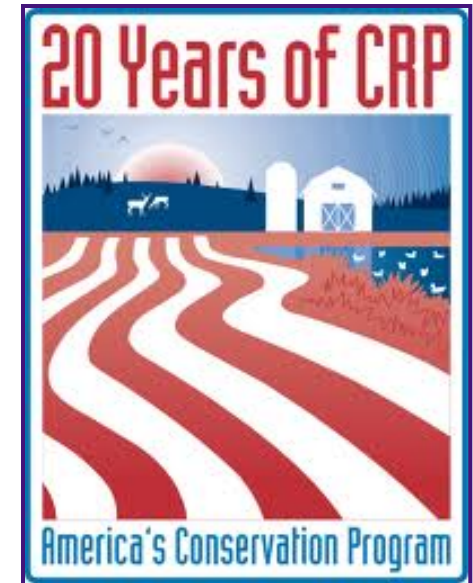
# Private hunting land

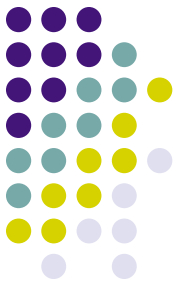
- Primary sites
  - Three quarters of hunting days (USDWS, 2007)
  - Higher preference & WTP of hunters (Anderson & Hill, 2005, Hussain et al. 2004)
- Issues
  - Slow growth in supply in recent days (Bihrlle, 2003)
  - Posted no hunting (Cordell & Betz 2000, Duda et al. 2004, Jagnow et al. 2006)



# Private hunting land

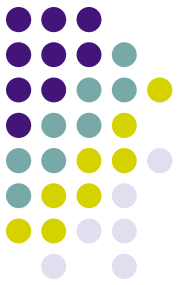
- Increase public access to private land
  - Majority of habitat in private ownership
- Government programs/incentives?
  - Habitat conservation payment
  - Publicly funded wildlife conservation units
- Ribaudo & Hellerstein (2008)
  - Public expenditure on conservation program help improve game habitat





# Previous Studies

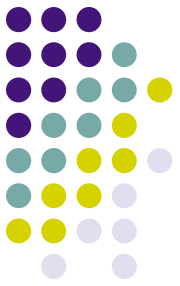
- Mostly survey-based
  - Liu et al. (2010): Appalachia
  - Zhang et al. (2005): Alabama
  - Hussain et al. (2007): Mississippi
- Hypothetical scenarios
  - Willingness to lease or
  - Binary responses (quantify not observed)



# Research Questions

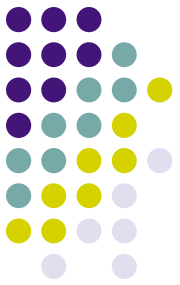
- Are communities receiving such public funding are actually opening their land to the public for outdoor recreation?
- Do publicly funded WMA areas have any spillover effects?

# Methods



- Estimate a supply model
  - Control for demographic, market forces and habitat characteristics
  - Evaluate how publicly funded habitat conservation programs affect the supply of private land for lease hunting

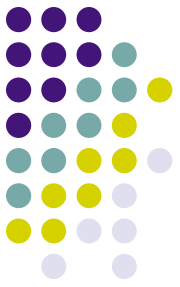




# A Supply Model

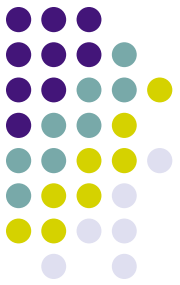
*Total private land leased = f( lease rate, substitute/complements, site/habitat characteristics, location and market forces, government policy & regulations, socio-demographic factors)*

# Measuring public investment in habitat conservation



- Habitat conservation payment (\$) paid to county landowners through
  - Conservation Reserve Program (CRP)
  - Wetland Reserve Program (WRP)
  - Farmable Wetland Program (FWP)
  - Conservation Reserve Enhancement Program (CREP)
- State managed Wildlife Management Areas
  - Whether or not the county has a WMA unit





# Econometric Model

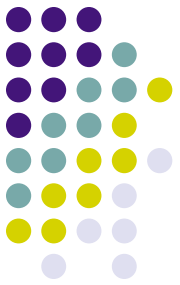
- Aggregated county level cross-sectional model (OLS)

$$Y = \beta_0 + \sum_k \beta_k X + \varepsilon$$

- Spatially correlated OLS residuals results into biased and inefficient estimates
- Spatial autoregressive model (SAM)

$$y = \rho W y + X \beta + \varepsilon$$

$$\varepsilon \sim N(0, \sigma^2 I_n)$$



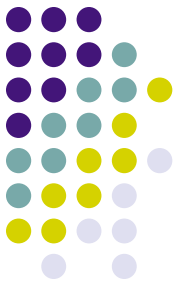
# Variation across counties

- Global model

$$\hat{\beta} = (X'X)^{-1} X'Y$$

- Varying parameter model (Fotheringham et al. 2002)

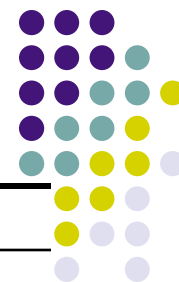
$$\hat{\beta}(u_i, v_i) = (X' w(u_i, v_i) X)^{-1} X' w(u_i, v_i) Y$$



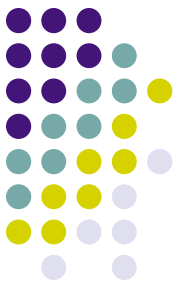
# Study Area and Data

- Georgia Counties
- Farm gate value Report 2009
  - Acreage leased
  - Average lease rate
- AG Census Report 2007
  - Conservation payment
- GA DNR-Wildlife Resource Division
  - WMA units in counties
- NRI
  - Broad Landuse
- FIA dataset
  - % of forest habitat types
- Georgia Statistics Database
  - Socioeconomic/demographic
- GA Dept of Transportation
  - Road mileage

# Regression Estimates



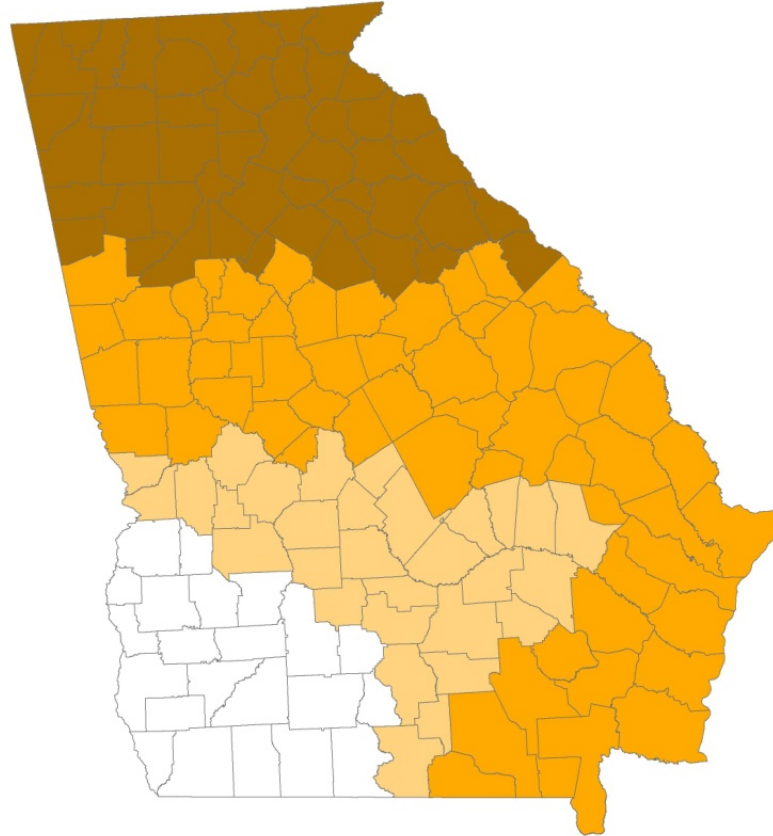
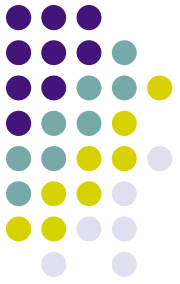
Variables		OLS	SAM
Price	Lease Rate (\$/acre)	1.244	1.232
Site /Habitat Characteristics Variables	Forest (% county area)	-0.245	-0.226
	Crops (% county area)	-0.934**	-0.908**
	Water (% county area)	-1.321	-1.407
	Oak-Gummy-Cypress habitat (% of forest)	1.914**	1.683**
	Loblolly Shortleaf habitat (% of forest)	1.360**	1.258**
	Longleaf Slash pine habitat (% of forest)	1.463**	1.357**
Location and market force variables	Road mileage (mile/sqmile)	68.697***	67.079***
	Distance to major cities (k mile)	-599.420**	-566.473**
	Population density (person/sqmile)	-0.076***	-0.072***
Other socio-economic variables	Per capita income (\$ K)	-0.091	-0.066
	African-American (%)	0.644*	0.580
	Age 35-64 (%)	-1.340	-1.303
	Age below18 (%)	-1.799	-1.778
Public investment in habitat conservation	Conservation payment (\$ K)	0.140***	0.142***
	Wildlife mgmt areas (# units)	10.502**	10.336**
R2		0.43	0.44







# Interpretation

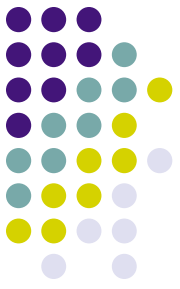
- Site and habitat characteristics (relative % of habitat), market forces, transportation etc. explain supply better than general land use
- Communities receiving higher payment for habitat conservation are seeing more private forest opened to the public for hunting
- Wildlife management areas bring (positive) spillover effect in nearby private lands

# Effect of Conservation Payment on Supply of Private Hunting Acreage



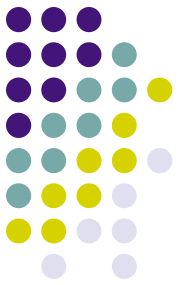
-  Insignificant Effect
-  Significant Low Effect
-  Significant Medium Effect
-  Significant High Effect





# Implications

- Landowners pay attention to habitat/site characteristics to increase supply (hardwood have bigger marginal effect)
- Justification for increasing conservation payment funding
  - Enhanced conservation
  - Increased recreation opportunities
  - Economic impact (landowner, local community)
- Support to keep WMAs open
  - Impact goes beyond boundaries
  - Develop outreach materials to enhance public understanding and acceptance of WMA areas



# Future research

- Cost effectiveness and value of these public investment schemes
  - Per acre cost and benefit of CRP, WMA programs

# Thank you

- Questions/comments

