

turning knowledge into practice

Private Forest Investment and Management

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*RTI International is a trade name of
Research Triangle Institute*

Overview

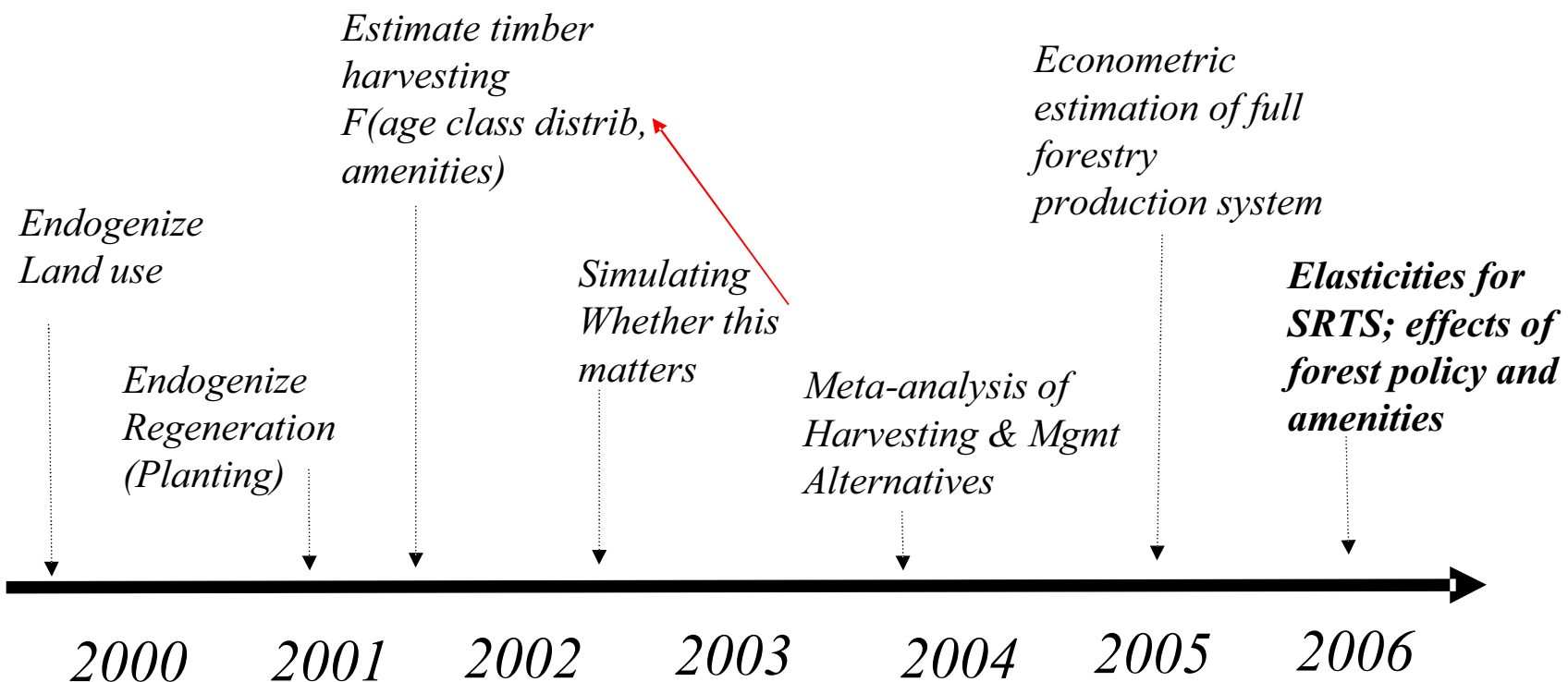
- Historical Context
- Modeling Objective
- Methods and Data
- Results
- Implications
- Next steps
- Related Work

How this component fits into the SOFAC Project Long-term Objectives

- **Overall SOFAC Project objective:** To improve the scope, features, theoretical, and empirical characteristics of SRTS
- **RTI role:** to update, using econometric methods, the empirical foundation of the key timber management decision variables
 - Harvesting
 - Regeneration
 - Silvicultural Treatments (TSI)

with emphasis on response to change in timber prices

Historical Context: Where Have We Been



Products To Date

■ Peer review validation

1. Beach, R.H., S.K. Pattanayak, J.C. Yang, B.C. Murray, and R.C. Abt. 2005. "Empirical Studies of Non-Industrial Private Forest Management: A Review and Synthesis." *Forest Policy and Economics* 7 (3) 261-281.
2. Pattanayak, S.K., R.C. Abt, A.J. Sommer, F. Cubbage, B.C. Murray, J.C. Yang, D. Wear, and S. Ahn 2004. "Forest Forecasts: Does Individual Heterogeneity Matter for Market and Landscape Outcomes?" *Forest Policy and Economics* 6: 243-260.
3. Pattanayak, S.K., B.C. Murray. and R. Abt. 2002. "How Joint in Joint Forest Production: An Econometric Analysis of Timber Supply Conditional on Endogenous Amenity Values." *Forest Science* 47(3):479-491.
4. Abt, R.C., and B.C. Murray. 2001. "Southeastern U.S. Timber Market Response to Climate Change Impacts on Forestry and Agriculture." *World Resource Review* 13(2):171-186.
5. Murray, B.C., R.C. Abt , D.N. Wear, P.J. Parks, and I.W. Hardie. 2001. "Land Allocation in the Southeastern U.S. in Response to Climate Change Impacts on Forestry and Agriculture." *World Resource Review* 13(2):239-251.

■ Papers in progress

- Beach, R.H., S.K. Pattanayak, K. Jones, J.-C. Yang, B.C. Murray, and R.C. Abt. "Determinants of Forest Management: An Econometric Analysis of Private Landowner Behavior in the Southern U.S."
- Beach, R.H., S.K. Pattanayak, J.-C. Yang, and R.C. Abt. "Implications of Forest Policy and Amenities for Forest Investment and Management."

■ Enhanced SRTS model

- Incorporation of parameters to endogenize land use, timber harvesting, and forest management

Southwide Analysis: Empirical Approach

- Secondary data (FIA)
- Discrete choice (probit)
 - Harvest (clearcut and partial harvest)
 - Timber Stand Improvement (TSI)
 - Regeneration
- Explanatory Factors
 - Market Drivers: prices, costs, interest rates
 - Owner Characteristics: NIPF, Industry, TIMO, public
 - Plot/Resource Conditions: site class index, slope, temperature, precipitation, amenities

Data

- FIA plot data
 - Southeast (5 states): FL, GA, NC, SC, VA
 - Southcentral (7 states): AL, AR, LA, MS, OK, TN, TX
- Timber Mart South
 - Timber prices
- Federal Reserve
 - Interest rates
- Bureau of Economic Analysis
 - County per capita income
- U.S. Southern Global Change Research Program
 - Temperature & precipitation

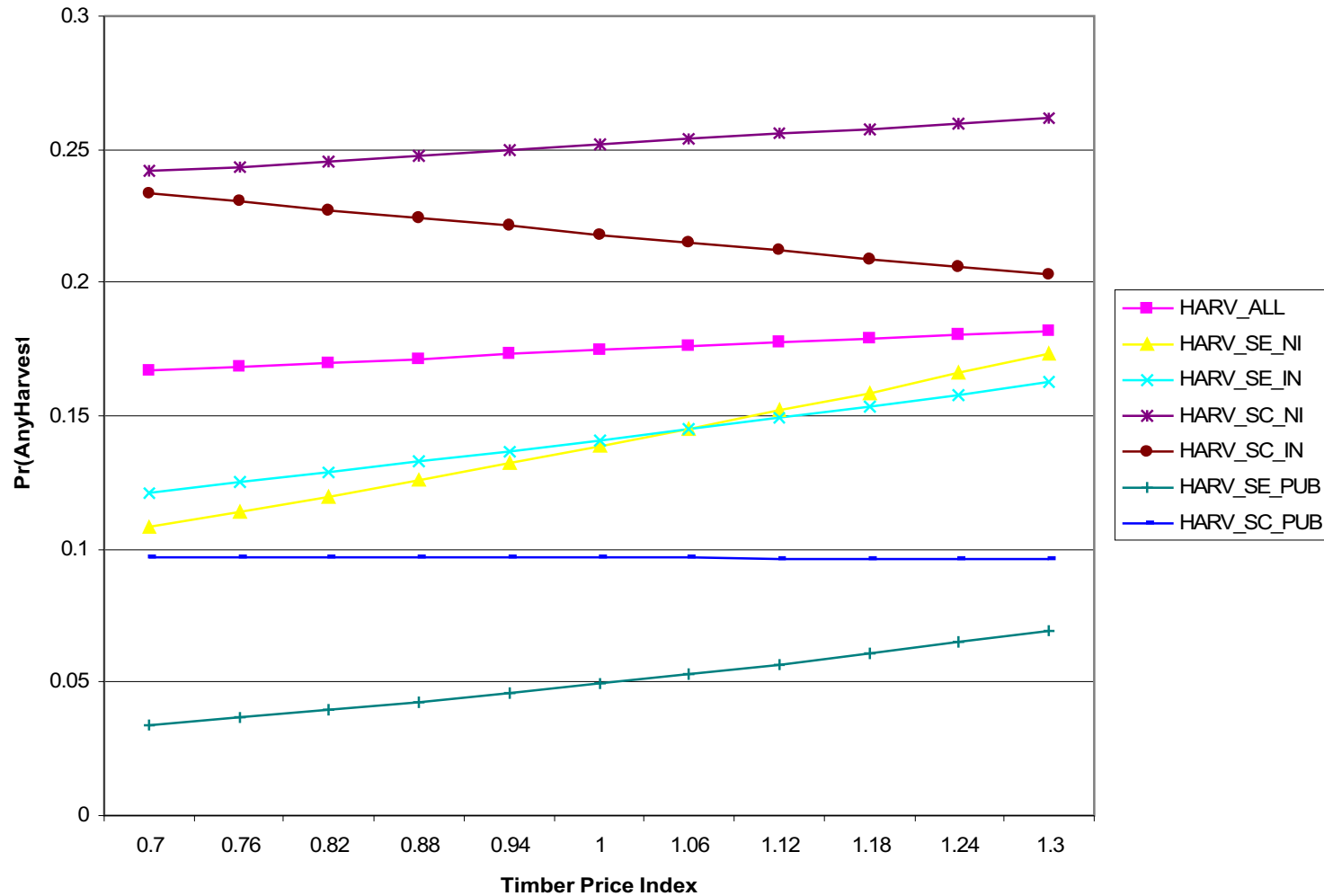
Harvest, TSI, & Regeneration

- 86,261 forestland observations included from FIA
- Harvest - 18.7% (16.6% SE vs. 21.8% SC)
 - Clearcut - 8.4% (14.1% SE vs. 4.4% SC)
 - Partial harvest - 10.3% (2.5% SE vs. 17.4% SC)
- TSI - 7.4% (2.8% SE vs. 14.5% SC)
 - Thinning if categorized as done to improve productivity
 - Timber stand improvement (cleaning, hardwood control, etc.)
- Regeneration – 10.4% (14.3% SE vs. 4.4% SC)
 - Site preparation
 - Artificial and natural regeneration

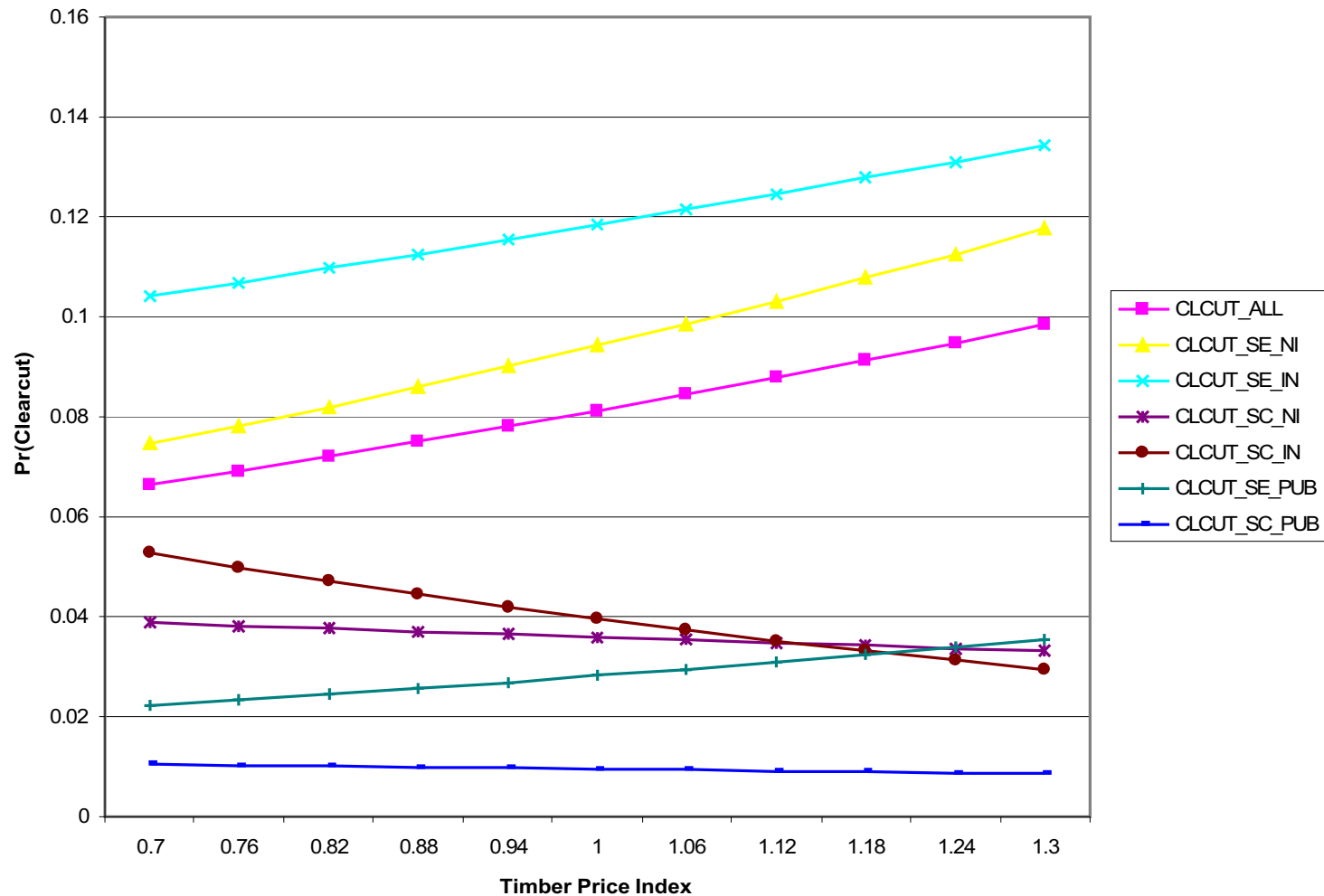
Previous Estimation Results

- Variables generally have expected signs for clearcut and regeneration, mixed in some cases for partial harvest and TSI
- Significant differences between
 - Regions (Southeast vs. Southcentral)
 - Owner type (NIPF vs. Industry vs. Public)
- Elasticities were in terms of changes in the probability of harvest, TSI, regeneration in response to price change

Responsiveness to Price: Pr(Harvest)



Responsiveness to Price: Pr(Clearcut)



Supply Elasticities

- Change in quantity supplied as a function of price calculated for a variety of ownership, region, age class, management type combinations
- NIPF less price-responsive than industry
- Planted pine and oak-pine less price-responsive than lowland; upland and natural pine not significantly different from lowland
- Price responsiveness varies considerably across survey units
- Less price-responsive in 11-20 year old age class, similar responsiveness across age classes for ages 21 and above
- Aggregate
 - Industry 0.97
 - NIPF 0.72

Regeneration Area Elasticities

- Calculated for a variety of ownership, region, management type combinations
- NIPF slightly more price-responsive than industry
- Planted pine less price-responsive than lowland, natural pine and oak-pine more price-responsive
- Price responsiveness varies considerably across survey units
- Aggregate
 - Industry 0.39
 - NIPF 0.48

NC Data

- FIA plot data
- Timber Mart South
 - Timber prices
- Federal Reserve
 - Interest rates
- Bureau of Economic Analysis
 - County per capita income
- U.S. Southern Global Change Research Program
 - Temperature & precipitation
- Nontimber amenity index (Pattanayak)
- County-level forest policy data
 - Forest Development Program acreage
 - Tax rate

Joint Estimation of NC Forest Management

- Estimated multivariate probit models that jointly represent harvest, TSI, and regeneration decisions
- Allows us to evaluate joint and conditional probabilities taking into account correlation across the 3 management decisions
- Significant cross-equation correlation was present in all systems of equations estimated

NC Model Results

	Harvest	TSI	Regeneration
Price	+	+	+
Tax rate	ns	ns	ns
FDP acres	ns	ns	ns
NIPF=1	+	-	ns
TIMO=1	-	ns	-
Site class	+	+	+
Slope	ns	-	-
Temperature	+	+	+
Precipitation	-	ns	ns
Distance to road	ns	-	ns
Ease of access	+	+	+
Per capita income	-	ns	-
Amenities index	-	-	-
Sample	-	-	-

Implications

- Important differences across regions and ownership to consider for projections
- Estimating system of equations jointly significantly improves predictions
- Amenities very significant factor influencing forest management on private lands
- Need to revisit forest policy variables

Next Steps

- Finalize south-wide analysis and paper and submit for review
- Test additional policy variables/specifications in the North Carolina model, where we have more data on amenities and government policies than in other states, then finalize and submit for review
- Additional work examining implications of elasticity parameters for SRTS price and inventory projections

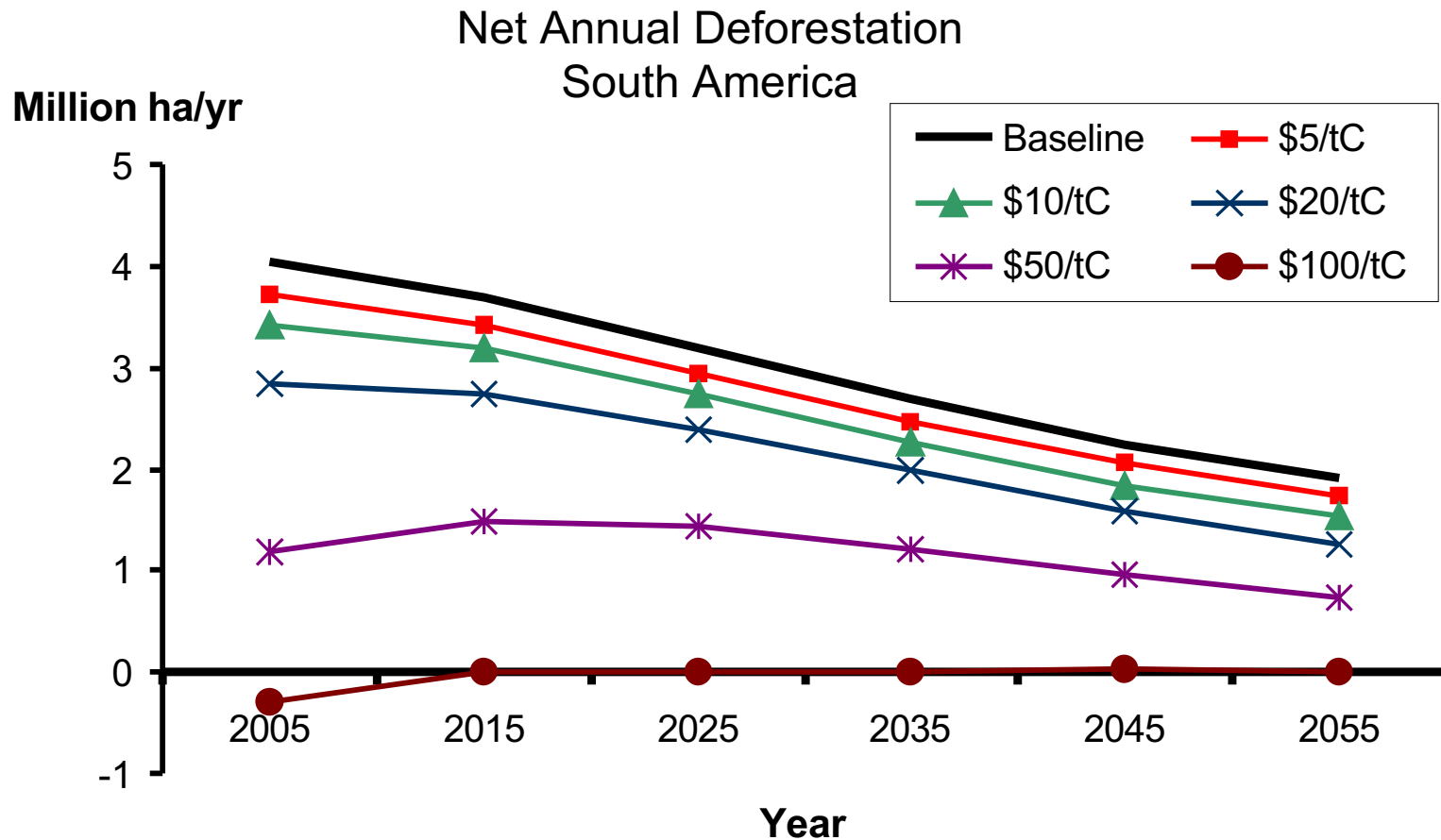
Related Work

- Forest management under endogenous weather risk
 - Literature review and theory
 - ◆ Beach, Sills, Liu, and Pattanayak. “The Influence of Forest Management on Vulnerability to Severe Weather.” Under review.
 - ◆ Site and species selection
 - ◆ Silvicultural practices
 - Empirical analysis using NC FIA data and wind speed data
- Fire management
 - Using USFS Forest Vegetation Simulator-Fire and Fuels Extension to examine implications of different thinning and prescribed burning regimes for fire severity and carbon sequestration

Related Work (2)

- Avoided deforestation
 - Sohngen and Beach. “Avoided Deforestation as a Greenhouse Gas Mitigation Tool: Economic Issues for Consideration.” Under review.
 - Examining implications of incentives for avoiding deforestation on currently forested lands in tropical regions for deforestation rates and carbon sequestration
- Climate change impacts
 - Potential impacts of climate change on forests
 - Climate change and extreme events

How Much May C Incentives Reduce Deforestation?



Note: All Carbon Prices, P_c , are assumed to be constant over time period

Average Annual Rental Payments at Different Carbon Prices (\$/hectare/year)

Region	Carbon Price (\$/t C)				
	\$5	\$10	\$20	\$50	\$100
South America	\$29.84 (3.17 , 34.13)	\$59.68 (6.35 , 68.27)	\$119.37 (12.72 , 136.54)	\$298.46 (31.92 , 341.35)	\$596.98 (64.2 , 682.7)
Central America	\$23.22 (3.19 , 33.46)	\$46.44 (6.39 , 66.93)	\$92.96 (12.81 , 133.87)	\$232.66 (32.2 , 334.69)	\$465.83 (64.91 , 669.38)
Southeast Asia	\$32.93 (3.06 , 61.21)	\$65.87 (6.13 , 122.43)	\$131.77 (12.3 , 244.86)	\$329.55 (30.88 , 612.15)	\$659.37 (62.83 , 1224.31)
Africa	\$24.97 (3.18 , 29.92)	\$49.94 (6.37 , 59.85)	\$99.9 (12.78 , 119.71)	\$249.83 (32.22 , 299.28)	\$499.79 (66.42 , 598.56)