



Discount Rates of Small Woodland Owners in North Carolina & Virginia

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Introduction

Objectives

- Estimate discount rates of small woodland owners
- Link discount rate with planning and management of woodlands:
 - Writing wills
 - Contacting professional foresters
 - Investing in stand improvements
- Woodland owners of interest
 - Limited resource
 - Traditionally underserved



Roadmap

- Target population, Study site, Respondent characteristics
- Discount rates
 - Methods
 - Results
- Forest management and planning
 - Methods
 - Results
- Summary and Discussion



Target population

- Limited resource
 - Small properties (>5ac woodland, <100ac total)
 - Low income
 - Limited education
- Traditionally underserved
 - Minorities

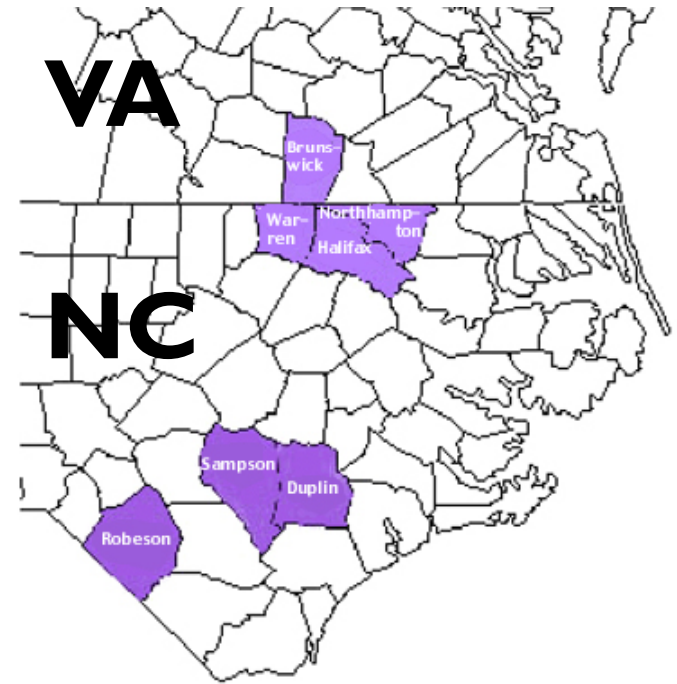
Sample frame

Seven study counties

- High % minority-owned & operated farms
- High % woodland on farms

Overlay

- US Census maps to identify
 - Tracts with high minority population, low median income, low educational attainment relative to county median
- County parcel maps & tax data to identify
 - Owners of 5 – 100 acre forest parcels





Survey

- Mail survey sent to 1,095 landowners
- 303 responded (27% response rate)
- 299 owned woodland parcels

Landowner Characteristics

Woodland Acreage



- 85% own less than 100 ac (vs 96% Birch 1996)

Landowner Characteristics

Income >\$45,000	62%
Education: Bachelors*	39%
Race : Af.American	22%
White	69%
Native American	7%
Gender: Female*	37%
Age (Median)	64 years
Sold timber	33%
Made written will	56%
Contacted forester	26%
Made stand improvements	41%
Inherit	58%
Absentee	35%

Literature Review

Discount rate estimates of US NIPF woodland owners

Study	Method	Acreage	State	Discount Rate
Kronrad & De Steiguer, 1983	Stated open ended	Ave 183ac	NC	15.1% Nominal, 25yr
Bullard et al., 2002	Stated open ended	Min 20ac	MS	13.1% Nominal, 25yr
Prestemon & Wear, 2000	Observed from harvest timing	Ave 1247ac	NC	18% Real
This study	Stated binary choice	Min 3ac Ave 74ac	NC& VA	

Discount Rate Estimation

- Choose between:

(LS) Larger Seldom timber income

*“You cut and sell **all** of the trees now and **replant** with pine seedlings. You earn **\$750** [P_{LS}] per acre. **Every 32 years**, you cut and replant all of your trees and earn **\$750** [P_{LS}] per acre. Your earnings already include all costs”*

(SF) Smaller Frequent timber income

*“You cut and sell **some** of the trees now and let them grow back on their own. You earn **\$250** [P_{SF}] per acre. **Every 8 years** you cut some more trees and earn **\$250** [P_{SF}] per acre. Your earnings already include all costs.”*

- Two questions per respondent

Discount Rate Estimation

Estimation methods & results

	Non-Parametric	Parametric
Binary Choice		
Bounded Ranges		

Key factors related to rates

- Harvest method & rotation length
- Timber price

Discount Rate Estimation: Binary

- Utility function

$$U = \alpha_{LS} - \alpha_{SF} - \beta_{LS} \cdot P_{LS} - \beta_{SF} \cdot P_{SF} + \varepsilon_{LS} - \varepsilon_{SF}$$

Harvest method

Timber Price

- Set Marginal Net Present Values equal

$$\frac{\partial U}{\partial P_{LS}} \cdot \frac{\partial NPV_{LS}}{\partial P_{LS}} = \frac{\partial U}{\partial P_{SF}} \cdot \frac{\partial NPV_{SF}}{\partial P_{SF}}$$

$$\Leftrightarrow \frac{\partial U}{\partial P_{LS}} \cdot \frac{1}{e^{-32r} - 1} = \frac{\partial U}{\partial P_{SF}} \cdot \frac{1}{e^{-8r} - 1}$$

$$\Leftrightarrow \frac{\partial U / \partial P_{LS}}{\partial U / \partial P_{SF}} = \frac{1 - e^{-8r}}{1 - e^{-32r}} = \frac{\beta_{LS}}{-\beta_{SF}}$$

Discount Rate Estimation: Binary

LHS: Pr (Choose LS)

Parameters	Coefficient
Intercept	-0.7419 ***
P_{LS} (32 yrs)	0.000361 *
P_{SF} (8 yrs)	-0.00071 ***

- General preference for Smaller Frequent (SF) payments
- Discount rate estimate: 7.8%
- Range: -3.9% to 18.5% (Bootstrap N=1000)

Discount Rate Estimation: Grouped

- Solve for implied discount rate (ρ) for each question

$$\frac{P_{LS}}{P_{SF}} = \frac{1 - e^{-32 \cdot \rho}}{1 - e^{-8 \cdot \rho}} \rightarrow \begin{array}{l} \text{Question 1} = \rho_{Low} \\ \text{Question 2} = \rho_{High} \end{array}$$

- Discount rate model

$$(\rho_{Low,j}, \rho_{High,j}) = \sum_{k=1}^K \beta_k \cdot Z_{k,j}^{\rho} + \varepsilon_j$$

- Maximum Likelihood Estimation

$$L = \prod_j \left[\phi \left(\frac{\rho_{High,j} - \beta Z_j}{\sigma} \right) - \phi \left(\frac{\rho_{Low,j} - \beta Z_j}{\sigma} \right) \right]$$

Discount Rate Estimation: Grouped

$$\text{LHS} = (\rho_{\text{Low}}, \rho_{\text{High}})$$

Parameter	Estimate
Intercept	-8.42292***
Children	0.73141*
Children ²	-0.13062**
Age	0.05529**
Age*Income>\$45,000	-0.08169***
Income>\$45,000	5.80498***

Significance level: ***(1%), **(5%), *(10%), †(15%)

- **Average discount rate: 2.9% (Range: 0-6.9%)**
Bootstrapped Estimates N=1,000



Landowner Behavior

Forest management and planning function of

- Discount rate
- Total woodland owned
- Tenureship: inherited land, co-own with spouse
- Distance to nearest woodland
- Sold timber
- Employment status: retired
- Gender & race

Landowner Behavior: Results

LHS=Pr(Wrote will) (Bootstrap N=1000)

Parameters	Estimate
Intercept	-0.25922
Discount rate estimate	6.59704
African American	-0.55505
Live within 5 miles from woodland	-0.80738***
Education: at least bachelor's	0.4881
Female	-0.06638
Inherited woodland	0.36392
Own with spouse	0.0819
Retiree	0.62286**
Sold timber in last 10 years	0.47091†
Total acres owned	0.00005

Significance level: ***(1%), **(5%), *(10%), †(15%)

Landowner Behavior: Results

LHS=Pr(Contacted foresters) Bootstrap N=1000

Parameter	Estimate
Intercept	-1.66708***
Discount rate estimate	-6.16166
African American	-0.12751
Live within 5 miles from woodland	0.5022
Education: at least bachelor's	0.10828
Female	-0.75553**
Inherited woodland	0.10476
Own with spouse	-0.61812†
Retiree	0.00834
Sold timber in last 10 years	1.37901***
Total acres owned	0.00246***

Significance level: ***(1%), **(5%), *(10%), †(15%)

Landowner Behavior: Results

LHS=Pr(Improved stand) Bootstrap N=1000

Parameter	Estimate
Intercept	-0.51612
Discount rate estimate	0.00027
African American	-0.61983†
Live within 5 miles from woodland	0.17248
Education: at least bachelor's	0.01675
Female	-0.3191
Inherited woodland	-0.84719**
Own with spouse	0.17857
Retiree	-0.60724*
Sold timber in last 10 years	1.73447***
Total acres owned	0.00196***

Significance level: ***(1%), **(5%), *(10%), †(15%)

Summary

Discount Rate

- Binary: Preference for Smaller Frequent payments
- Grouped: Average: 2.9%, Smaller range: 0-8%
- Weak effect on landowner behavior

Written will

- ↓ Proximity to woodlands; ↑ Retirement, sold timber

Contacting foresters

- ↓ Female, own with spouse; ↑ Landholdings, sold timber

Stand investments

- ↓ Inherit, retirement; ↑ Land holdings, sold timber



Discussion

- Prefer smaller payments in shorter intervals. What options do they have?
- Resource constraints (access to info, social networks) more important than time preferences
- Landowners living on their property need to be aware of the importance of wills.
- Less stand investments among heirs. Options for heir property owners?
- Female-oriented extension events?



Future work

- Get a job!
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Thank you!

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