

ECONOMICS RESEARCH IN FORESTRY, WILDLIFE AND FISHERIES



Don Hodges
The University Of Tennessee
Natural Resource Policy Center
Department of Forestry, Wildlife And Fisheries

UT NATURAL RESOURCE POLICY CENTER

Initiated in 2003 with request from President's Office

RESULT:

*Collaborative effort between Forestry, Wildlife & Fisheries;
Agricultural Economics; and Civil and Environmental Engineering*

*Funded Initially by Appropriations in FY 2005, 2006 via
EPA Science and Technology Program
Total Funding: \$1.5 million*

Additional Support Provided by External Grants and Contracts

<http://nrpc.ag.utk.edu/>

UT NATURAL RESOURCE POLICY CENTER PERSONNEL

CENTER STAFF

- Don Hodges, Director
- Karen Lannom, Adjunct Assistant Professor, GIS Specialist
- Angela Hartsfield, Research Associate
- Cora McCold, Research Associate
- Emily Saunders, Research Associate

FACULTY BOARD

- Seong-Hoon Cho, Chris Clark, Bill Park – Agricultural Economics
- Dave Ostermeier, Ted Henry, Mark Fly - FWF
- John Schwartz – Civil & Environmental Engineering

**UT NATURAL RESOURCE POLICY CENTER
PERSONNEL**

GRADUATE STUDENTS

- Edwin Deyton, M.S., C&EE
- Amy French, FWF
- Zhimei Guo, FWF
- Brandon Kaetzel, M.S., FWF
- Pracha Koonmathamdee, Ph.D., FWF
- Cindy Longmire, M.S., FWF
- Julie Mawhorter, Ph.D., FWF
- Keil Neff, M.S., C&EE
- Neelam Poudyal, Ph.D., FWF
- William Pridemore, Ph.D., FWF

**UT NATURAL RESOURCE POLICY CENTER
PRIMARY TASKS**

1. *SCIENTIFIC ANALYSIS & INFORMATION*
2. *POLICY AND IMPLEMENTATION PROCESS*
3. *LEADERSHIP DEVELOPMENT AND CAPACITY BUILDING*

**UT NATURAL RESOURCE POLICY CENTER
SCIENTIFIC ANALYSIS**

*“provide independent, timely analysis of natural resource issues.....
...including the economic, environmental, and social impacts of
environmental problems and current and proposed policies.”*

INITIAL RESEARCH PRIORITIES FOR EPA

1. Human Influences on Environmental and Natural Resources
2. Market Approaches to Sustainability

UT NATURAL RESOURCE POLICY CENTER
HUMAN INFLUENCES

Land Use Change and Environmental Impacts
Seong-Hoon Cho - Agricultural Economics

Effects of Acidic Deposition on Fish and Water Quality
John Schwartz - Civil and Environmental Engineering
Ted Henry - Forestry, Wildlife and Fisheries

UT NATURAL RESOURCE POLICY CENTER
MARKET APPROACHES

Market-Based Instruments to Cost-Effectively Improve Water Quality
Chris Clark - Agricultural Economics

Policy and Implementation Process Analysis
Dave Ostermeier - Forestry, Wildlife and Fisheries

Evaluating the Potential of Ecosystem Services for Enhancing Environmental Quality in Forested Ecosystems
Don Hodges - Forestry, Wildlife and Fisheries

UT NATURAL RESOURCE POLICY CENTER
ADDITIONAL FUNDING

HABITAT CONSERVATION PLANNING
PI - David Ostermeier
TWRA, USFWS, TNC - \$295,000

PRIVATE FOREST MANAGEMENT AND CONSERVATION ON THE NORTHERN CUMBERLAND PLATEAU
PI - Don Hodges
TDF - \$20,000

LANDOWNER DECISIONS AFFECTING CUMBERLAND PLATEAU FORESTS
PIs - Don Hodges, David Ostermeier
TNC - \$74,000

IMPACTS OF CLIMATE CHANGE ON FORESTS IN TENNESSEE
PIs - Don Hodges
National Commission on Energy Policy - \$50,000

WHAT IS ECONOMICS?



WHAT IS ECONOMICS?

An economist is a trained professional paid to guess wrong about the economy. An econometrician is a trained professional paid to use computers to guess wrong about the economy.



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Microsoft Corporation, 1978

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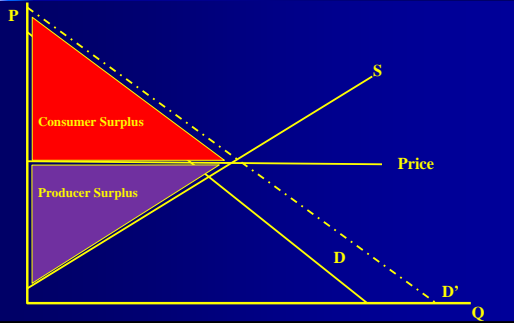
•ECONOMICS IS THE STUDY OF THE ALLOCATION OF SCARCE RESOURCES AMONG COMPETING USES



ROLE OF ECONOMICS IN NATURAL RESOURCES

ROLE OF ECONOMICS IN NATURAL RESOURCES

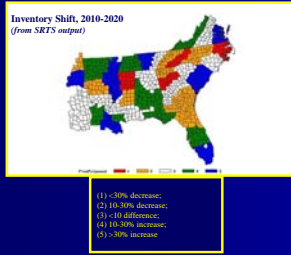
•ECONOMIC RETURNS AND WELFARE IMPACTS OF PUBLIC AND PRIVATE DECISIONS



ROLE OF ECONOMICS IN NATURAL RESOURCES

•ECONOMIC RETURNS AND WELFARE IMPACTS OF PUBLIC AND PRIVATE DECISIONS

•FUTURE CONDITIONS *"Economists have forecasted 9 out of the last 5 recessions"*



ROLE OF ECONOMICS IN NATURAL RESOURCES

•ECONOMIC RETURNS AND WELFARE IMPACTS OF PUBLIC AND PRIVATE DECISIONS

•FUTURE CONDITIONS *"Economists have forecasted 9 out of the last 5 recessions"*

•ECONOMIC ACTIVITY, SOCIAL EFFECTS, AND ENVIRONMENTAL IMPACTS

RECENT AND ONGOING RESEARCH

•LAND USE

•NONMARKET VALUATION

•BIOENERGY

LAND USE

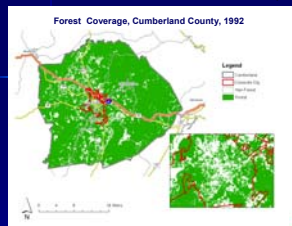
TOPICS

- LAND MARKETS AND VALUES
- LAND USE CHANGE PROJECTIONS
- EFFECTS OF LAND USE

PERSONNEL

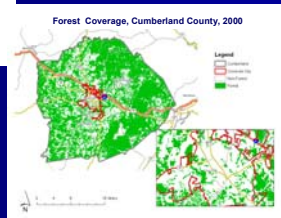
- BRANDON KAETZEL, NEELAM POU DYAL, WES SELECMAN, JEFF STRICKLAND
- KAREN LANNOM, ANGELA HARTSFIELD
- DAVE OSTERMEIER, SEONG-HOON CHO

LAND USE



ASSESSING CHANGES IN LAND COVER ON THE PLATEAU

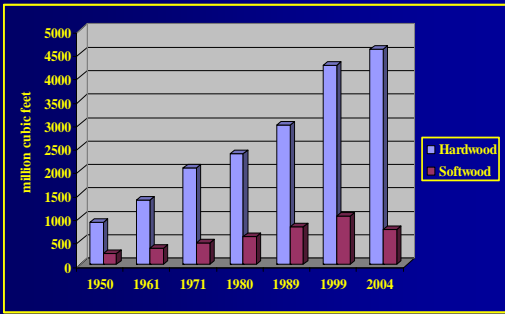
Neelam Poudyal



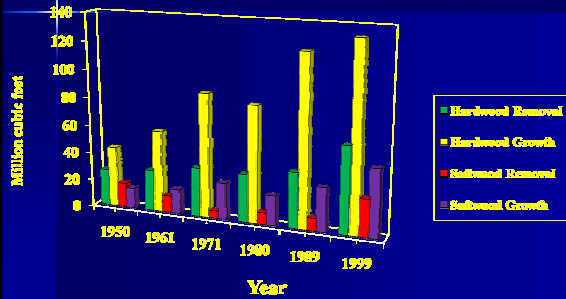
Landscape Statistics of Forest Fragmentation 1992 and 2001

| Period | Number of Patches | Forest Edge (m) | Avg. Patch Size (ha) | Patch Density (#/100 ha) | Edge Density (m/ha) |
|----------|-------------------|-----------------|----------------------|--------------------------|---------------------|
| 1992 | 2,617 | 6,334,000 | 58.01 | 1.72 | 41.71 |
| 2001 | 4,488 | 7,975,000 | 26.15 | 3.82 | 67.93 |
| % Change | 71.49 | 25.91 | -54.92 | 122.09 | 62.86 |

Growing Stock Volume Trends, TN Plateau Counties



Trends in Timberland Volume Plateau Tennessee, 1950-1999



FOREST PROCESSING INDUSTRY ON THE PLATEAU

| | TENNESSEE | KENTUCKY |
|------------------------|-----------|----------|
| ROUGH LUMBER | 93 | 11 |
| GRADE LUMBER | 8 | 27 |
| PALLETS | 12 | 32 |
| LOG HOMES | 4 | 1 |
| FURNITURE/ CABINETS | 9 | 0 |
| TOTAL | 173 | 97 |

Impacts of Land Use on Timber Availability and Sustainability

- Determine forested acres available for harvesting in each county
- Estimate impact of urbanization (city limits), topography (>40%), potential SMZs, protected lands on the total area available for timber production
- Estimate sustainability of current production levels

Study Area



- 16 Counties: Bledsoe, Campbell, Cumberland, Fentress, Franklin, Grundy, Marion, Morgan, Overton, Pickett, Putnam, Scott, Sequatchie, Van Buren, Warren, White.

Stream Buffers

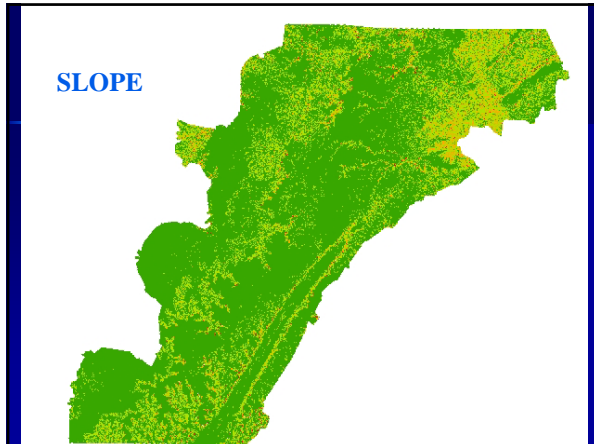
- 1st Order: 32 m.
- 2nd Order: 28 m.
- 3rd Order: 24 m.
- 4th Order: 20 m.
- 5th Order: 16 m.
- 6th Order: 12 m.
- 7th Order: 8 m.

Acres Lost To City Limits

| County | Area in Acres | | | Total Forested Acres |
|--------------|------------------|------------------|------------------|----------------------|
| | Deciduous | Evergreen | Mixed | |
| Bledsoe | 208.16 | 28.69 | 133.44 | 370.29 |
| Campbell | 3,113.97 | 717.67 | 1,651.73 | 5,483.37 |
| Cumberland | 7,957.73 | 1,536.53 | 3,226.28 | 12,720.54 |
| Fentress | 1,026.80 | 487.93 | 969.86 | 2,484.60 |
| Franklin | 3,812.96 | 570.44 | 1,771.60 | 6,155.00 |
| Grundy | 17,336.79 | 1,764.70 | 5,208.93 | 24,310.43 |
| Marion | 7,365.49 | 2,355.16 | 5,541.66 | 15,252.51 |
| Morgan | 457.24 | 167.02 | 318.25 | 942.51 |
| Overton | 873.34 | 173.47 | 519.29 | 1,566.10 |
| Pickett | 242.41 | 36.03 | 157.90 | 436.34 |
| Putnam | 3,065.71 | 637.16 | 2,083.84 | 5,786.71 |
| Scott | 2,513.06 | 1,005.00 | 1,897.03 | 5,415.09 |
| Sequatchie | 1,644.39 | 744.58 | 1,117.98 | 3,506.94 |
| Van Buren | 686.53 | 106.30 | 478.59 | 1,271.43 |
| Warren | 1,689.98 | 71.83 | 549.76 | 2,311.57 |
| White | 889.58 | 143.89 | 564.68 | 1,598.35 |
| Total | 52,874.15 | 10,546.41 | 26,191.22 | 89,611.78 |

Acres Lost To SMZs

| County | Area in Acres | | | Total Forested Acres |
|--------------|-------------------|------------------|------------------|----------------------|
| | Deciduous | Evergreen | Mixed | |
| Bledsoe | 8,299.33 | 1,287.22 | 2,310.46 | 11,897.01 |
| Campbell | 6,930.05 | 861.56 | 2,113.86 | 9,905.47 |
| Cumberland | 12,384.28 | 2,728.56 | 3,990.88 | 19,103.72 |
| Fentress | 8,163.67 | 3,056.59 | 4,165.90 | 15,386.16 |
| Franklin | 5,535.19 | 509.06 | 2,060.49 | 8,104.74 |
| Grundy | 6,980.97 | 792.39 | 1,672.63 | 9,446.00 |
| Marion | 7,660.84 | 1,110.20 | 2,753.47 | 11,524.50 |
| Morgan | 8,088.06 | 3,561.65 | 4,253.30 | 15,903.01 |
| Overton | 9,182.68 | 728.57 | 1,949.07 | 11,860.32 |
| Pickett | 3,200.04 | 104.08 | 364.73 | 3,668.85 |
| Putnam | 8,386.95 | 901.81 | 2,063.38 | 11,352.14 |
| Scott | 7,998.65 | 1,769.82 | 2,834.64 | 12,603.12 |
| Sequatchie | 5,496.27 | 1,086.40 | 1,513.62 | 8,096.28 |
| Van Buren | 4,755.02 | 835.09 | 1,396.42 | 6,986.53 |
| Warren | 7,537.41 | 386.08 | 1,630.38 | 9,553.86 |
| White | 5,531.40 | 733.90 | 1,542.75 | 7,808.06 |
| Total | 116,130.81 | 20,452.99 | 36,615.98 | 173,199.77 |



Acres Lost To Slopes >40%

| County | Area in Acres | | | Total Forested Acres |
|--------------|-------------------|-----------------|------------------|----------------------|
| | Deciduous | Evergreen | Mixed | |
| Bledsoe | 10,003.32 | 239.74 | 619.37 | 10,862.43 |
| Campbell | 39,609.41 | 1,294.34 | 3,571.88 | 44,475.63 |
| Cumberland | 6,493.48 | 581.12 | 906.48 | 7,981.08 |
| Fentress | 16,940.48 | 1,256.09 | 2,441.90 | 20,638.46 |
| Franklin | 7,583.22 | 56.60 | 413.43 | 8,052.25 |
| Grundy | 7,770.03 | 86.51 | 329.37 | 8,185.91 |
| Marion | 25,910.56 | 760.61 | 2,773.93 | 29,465.09 |
| Morgan | 24,377.37 | 2,277.77 | 4,156.76 | 30,811.92 |
| Overton | 15,821.61 | 304.01 | 987.66 | 17,113.28 |
| Pickett | 9,274.53 | 172.80 | 588.01 | 10,035.34 |
| Putnam | 19,936.59 | 441.45 | 1,287.89 | 21,665.93 |
| Scott | 38,764.76 | 1,912.37 | 4,341.37 | 45,018.50 |
| Sequatchie | 8,151.44 | 296.01 | 652.28 | 9,099.73 |
| Van Buren | 3,278.99 | 94.52 | 206.38 | 3,579.89 |
| Warren | 4,305.79 | 11.34 | 91.40 | 4,408.53 |
| White | 5,667.51 | 104.08 | 278.88 | 6,050.47 |
| Total | 243,889.08 | 9,908.36 | 23,647.02 | 277,444.46 |

Cumulative Effect

| | |
|----------------------------|-----------------------|
| ■ Total Forest Acres: | 2,346,600 |
| ■ Protected Acres: | 455,769 |
| ■ City Limit Acres: | 89,612 |
| ■ SMZ Acres: | 173,200 |
| ■ Acres Lost due to Slope: | 277,445 |
| ■ Available Acres: | 1,760,774 |
| | (75% of total) |

NONMARKET VALUES

TOPICS

- RECREATION VALUES
- AMENITY VALUES
- ECOSYSTEM SERVICES
- OPEN SPACE

PERSONNEL

- AMY FRENCH, NEELAM POUDYAL, CHARLES SIMS, AARON WELLS
- CORA MCCOLD

OBED WILD AND SCENIC RIVER ROCK CLIMBING SURVEY RESULTS



STUDY OBJECTIVES



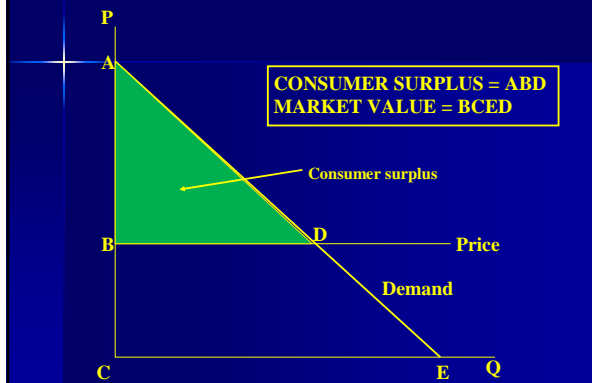
- Determine direct economic impact of rock climbing
- Model spending and trip taking behavior using Travel Cost Model
- Ascertain the value of access

TRIP EXPENDITURES



- Average trip expenditures were estimated at \$46.20
- Largest trip expenditure categories were food and beverage and transportation
- Only 38% of expenditures are captured by Morgan County
- Rock climbing at the Obed WSR is responsible for over \$146,000 in direct economic impacts annually

CONSUMER SURPLUS



CONSUMER SURPLUS

- Annual individual consumer surplus was estimated at \$6,903.58
- Individual per-trip and per-day estimates are \$170.62 and \$113.75
- Annual consumer surplus for rock climbing at the Obed WSR is \$360,121.17

**ASSESSING WILLINGNESS TO PAY FOR
FOREST AMENITIES USING DISCRETE
CHOICE MODELING**



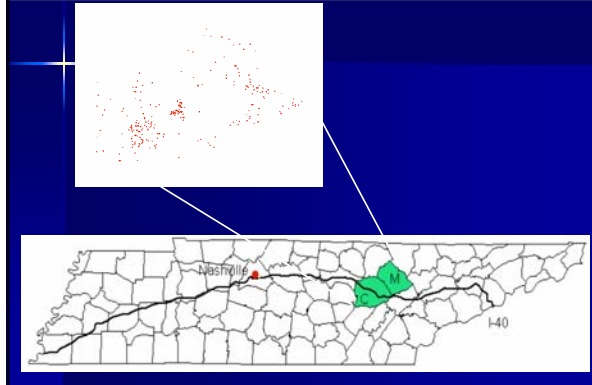
Objectives

1. Assess respondents' willingness to pay for amenities/services
 - a. recreation
 - b. scenic beauty
 - c. wildlife habitat
 - d. stream quality
1. Assess differences between landowners and residents
2. Test for information/framing effects

Methods

1. Stated preference method of choice modeling was selected to present the respondent with multiple forest amenity enhancement plans in one setting
2. 3000 surveys mailed to residents and owners in 2 counties
3. Low response rate (11 %) but no non-response bias

Study Area and Respondent Locations



Example Choice Set – CM Instrument

SCENARIO 1 of 5

Note: Please refer to the definitions page to clarify any unfamiliar terms.

Reminder: Choose one Option that has your favorite quality levels (in the middle) and the amount you are willing to pay.

Annual contribution represents your willingness to pay annually for 5 years in the form of a voluntary contribution to fund the Option you select.

| Non-Timber Forest Benefit | Option A (CURRENT) | Option B (ALTERNATIVE) | Option C (ALTERNATIVE) |
|----------------------------|--------------------|------------------------|------------------------|
| Recreational Opportunities | LOW | MEDIUM | LOW |
| Stream Quality | MEDIUM | MEDIUM | HIGH |
| Scenic Beauty | LOW | HIGH | HIGH |
| Wildlife Habitat | LOW | MEDIUM | MEDIUM |
| Vol. Annual Contribution | \$0 | \$35 | \$50 |

Please respond by checking (✓) the option that you most agree with and that you can afford with your present budget:

I prefer Option A I prefer Option B I prefer Option C

Development Threat

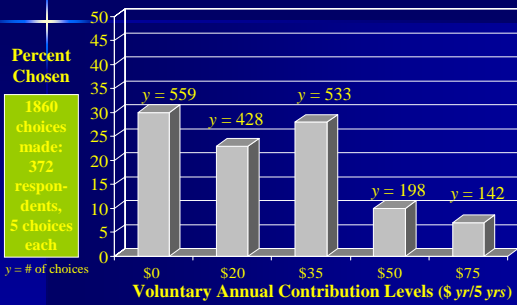
DEVELOPMENT information:

The landowner has been approached by a developer to sell the land for a future subdivision.

Also, the landowner would forgo development if compensated for providing these forest benefits.

Choice is conditional upon information provided in the survey, with the null hypothesis of no effect.

Histogram of Choice by Payment



Association Tests for Responses by Specification of Landowner Type and Development (H_0 : No Association)

| Specification | Choice | |
|---------------------------|------------|----------------------------|
| | Status Quo | Forest Amenity Improvement |
| <i>Landowner Type</i> | | |
| Less than 5 ac | 380 (28%) | 990 (72%) |
| More than 5 ac | 181 (37%) | 309 (63%) |
| CMH $\chi^2(df = 1)$ | 14.5071* | |
| <i>Development Threat</i> | | |
| No Development | 345 (33%) | 700 (67%) |
| Development | 216 (26%) | 599 (74%) |
| CMH $\chi^2(df = 1)$ | 9.2161* | |

Summary

Participants in the constructed market react to choice scenario information—they are more likely to choose (and have higher WTP) one of the forest amenity enhancement options when faced with the possibility of land conversion to residential development

Residents are more willing to pay for amenity enhancement than are landowners

BIOENERGY

TOPICS

- PLANT SITING DECISIONS
- RESOURCE AVAILABILITY
- POLICY IMPLICATIONS

PERSONNEL

- ZHIMEI GUO
- TIM YOUNG, BOB ABT, JIM PERDUE, TIM RIALS

Project Overview

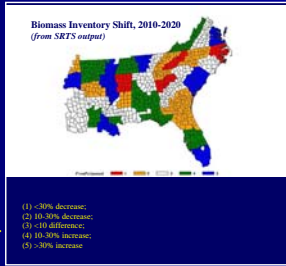
Develop Model to Identify and Project Comparative Advantage in the 3 Main Costs of Delivered Fiber:

- Resource Cost
- Logging
- Transportation

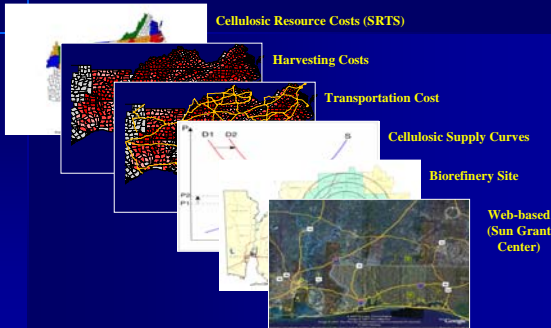
Additional Work

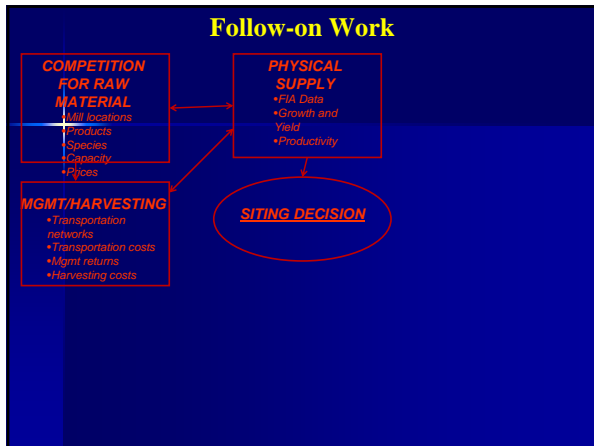
- assess sustainability of resource base
- incorporate effects of dedicated woody crops

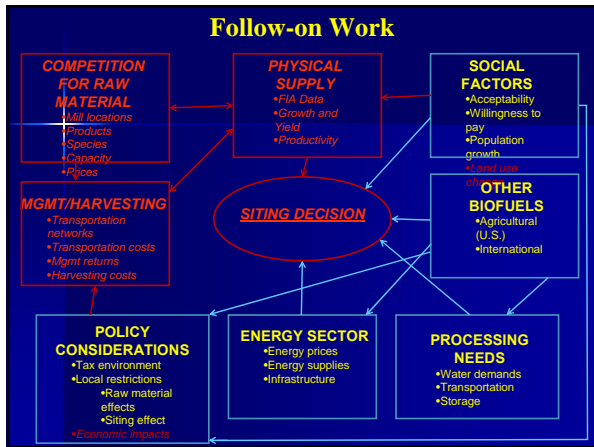
All models are wrong but some are useful.
-George Box



Project Overview







OTHER RESEARCH TOPICS

Trade and Sustainable Forest Management – Pracha Koonathamdee

Value of Open Space in Tennessee – Seong-Hoon Cho, Amy French, Cora McCold, Neelam Poudyal

Impacts of Climate Change on Tennessee Forests – Virginia Dale (ORNL), Jonah Fogel (VA TECH)

Bureaucratic, Professional, Economic, and Legal Influences on Management Decisions – Bob Durant (American University)

QUESTIONS?