

Spatial Data for Agent-Based Wood Supply Chain Modeling

The Agents

Pulp Mills Saw Mills
Pellet Mills Bioenergy Plants

Their Behavior

Bid on timber sales to meet their wood demand for each successive time iteration

The Factors

All of the data mentioned here provides information relating to dynamic levels of supply and demand of the resource and contributes to each agent's goal of minimizing the cost of timber procurement, while obtaining enough wood to continue to operate. Distance from the timber stand to the mill is an important cost factor.

The Modeling Software



Symphony Repast 2012

Spatial Data – Required and Optional

County and State Boundaries

Census Tract and Census Block Groups

Road Network
StreetMap™ Premium or 2010 US Census TIGER

Railroads - TIGER

National Land Cover Dataset

Future Land Cover Projections

Soils - SSURGO

Forest Inventory Plot Data

USGS National Elevation Dataset

USGS National Hydrography Dataset

Wood-Using Facilities (Mills) TPO or WDRP

Public and Protected Lands

Critical Data: Distance from timber sale to mills

ESRI ArcMap Network Analyst Extension Service Areas and OD Cost Matrices

ESRI ArcMap Thiessen Polygons

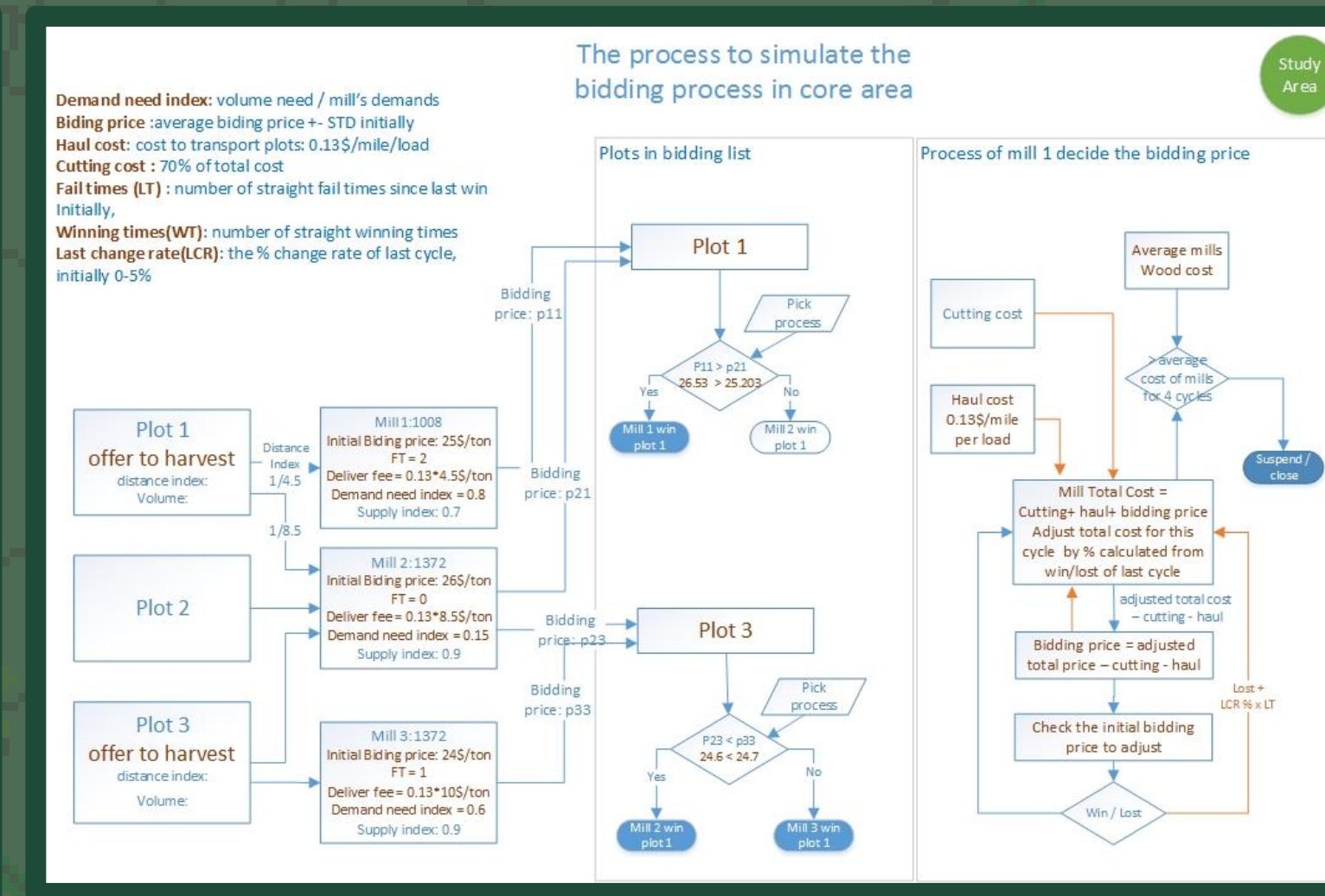
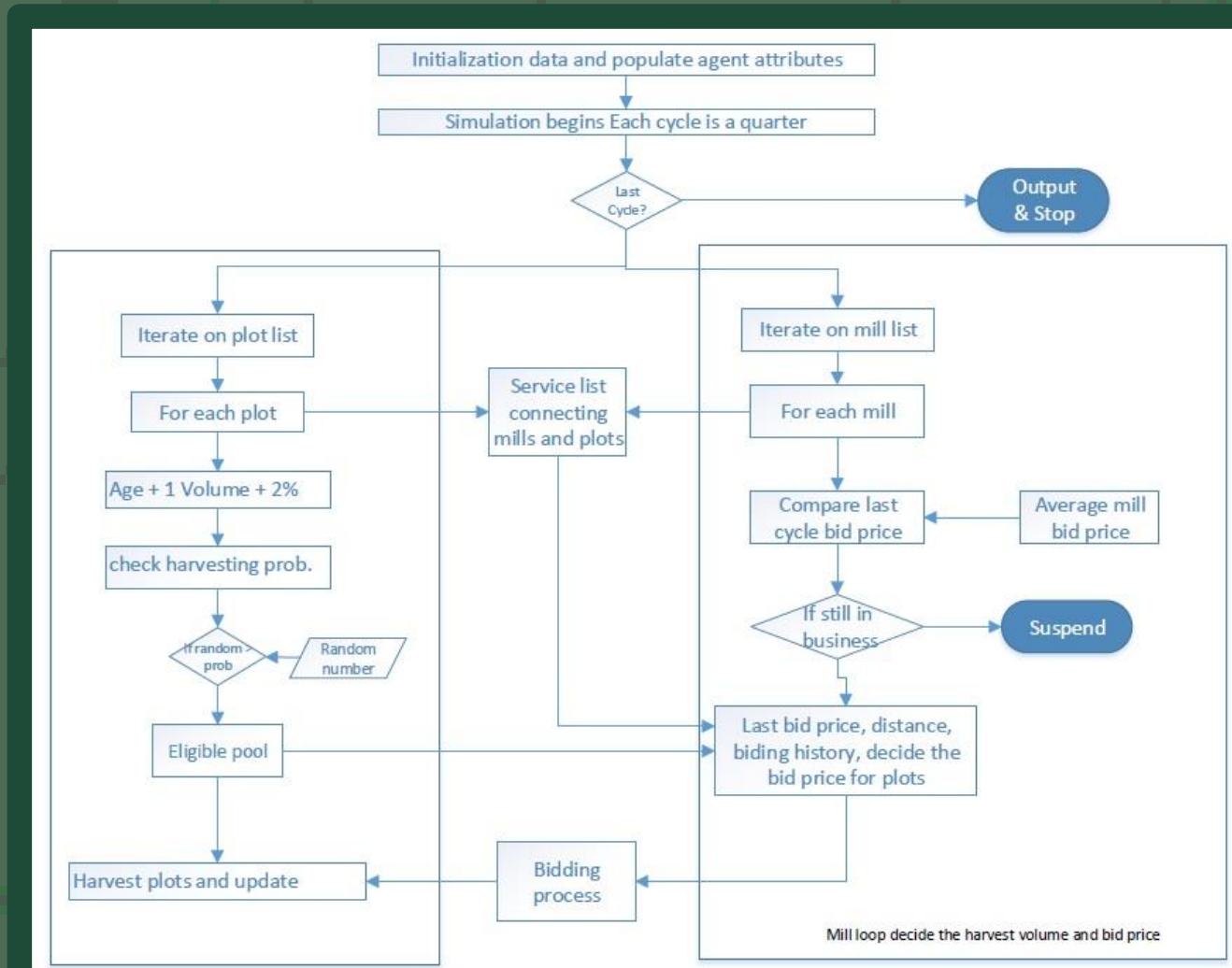
Region	Hick	Oak	Maple	Pine	Hard
1	42.04	54.56	40.68	24.71	23.38
2	46.48	52.26	48.99	23.17	29.77
Ave	45.26	53.42	44.84	24.54	26.58
1	38.98	57.08	44.54	28.28	22.55
2	42.58	56.43	46.63	28.19	27.23
Ave	40.77	56.78	45.28	28.74	27.38
1	44.32	54.45	48.04	27.64	28.17
2	44.28	53.28	44.13	27.07	28.16
Ave	38.41	54.61	48.12	27.81	28.12
1	41.41	61.28	48.28	30.58	26.77
2	41.58	57.98	46.54	31.11	28.1
Ave	42.21	59.58	47.41	30.58	28.29
Ave	41.58	56.08	46.7	28.51	28.2

Price Data from Timber-Mart South

Big Data
Big Decisions

ABMS

What is Agent-Based Modeling and Simulation?



"The world is increasingly complex, and the systems that need to be analyzed are becoming more complex."

"...Agent-based modeling emphasizes the development of models that reproduce critical features of complex systems using component-level rules."

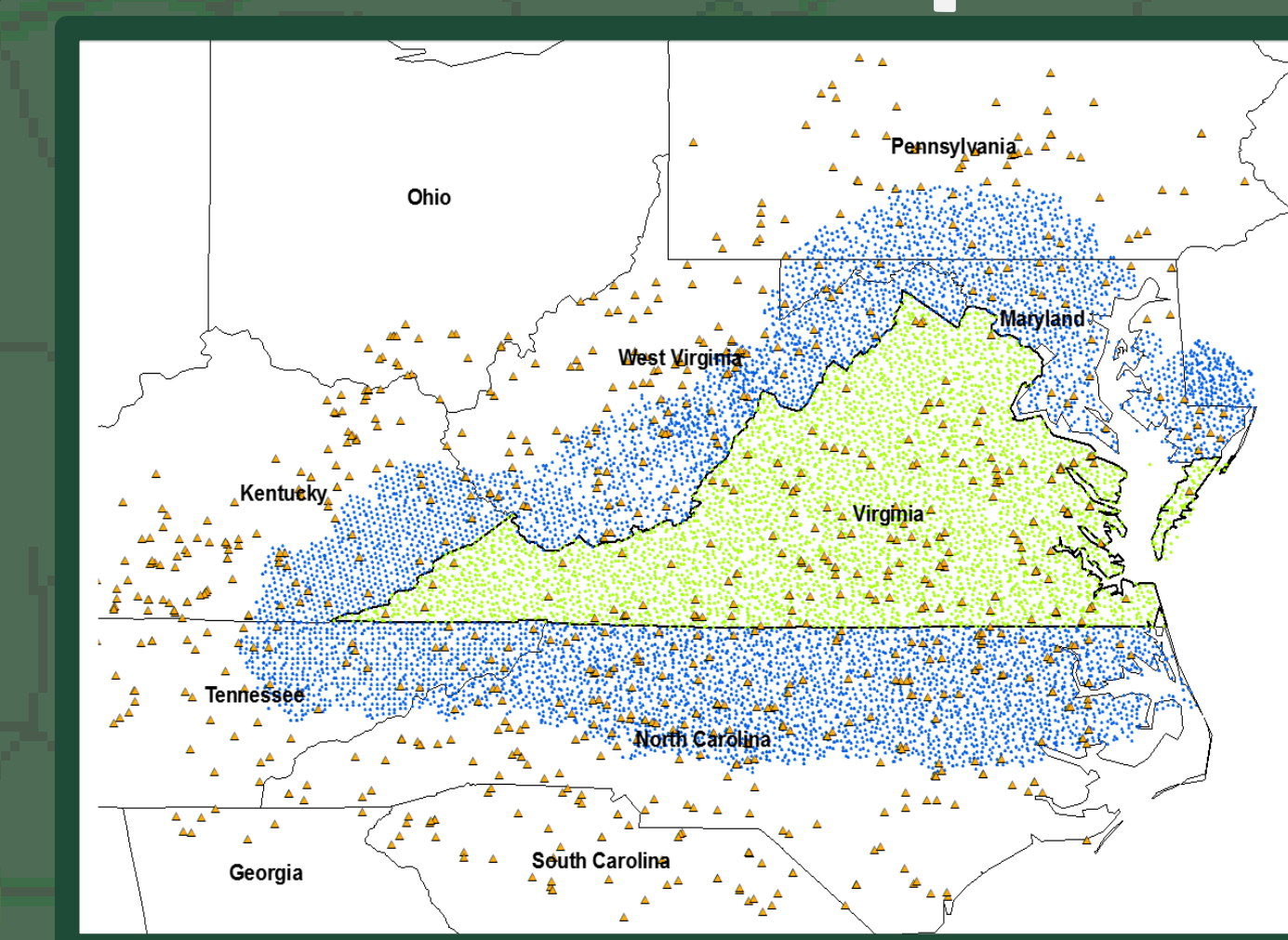
Michael J. North and Charles M. Macal. 2007. *Managing Business Complexity: Discovering Strategic Solutions with Agent-Based Modeling and Simulation*. Oxford University Press, Inc., New York, NY, USA.

CeNRADS Center for Natural Resources Assessment and Decision Support

Joby Kauffman, Steve Prisley,
Xiaozheng Yao, Neil Crescenti,
Pamela Braff

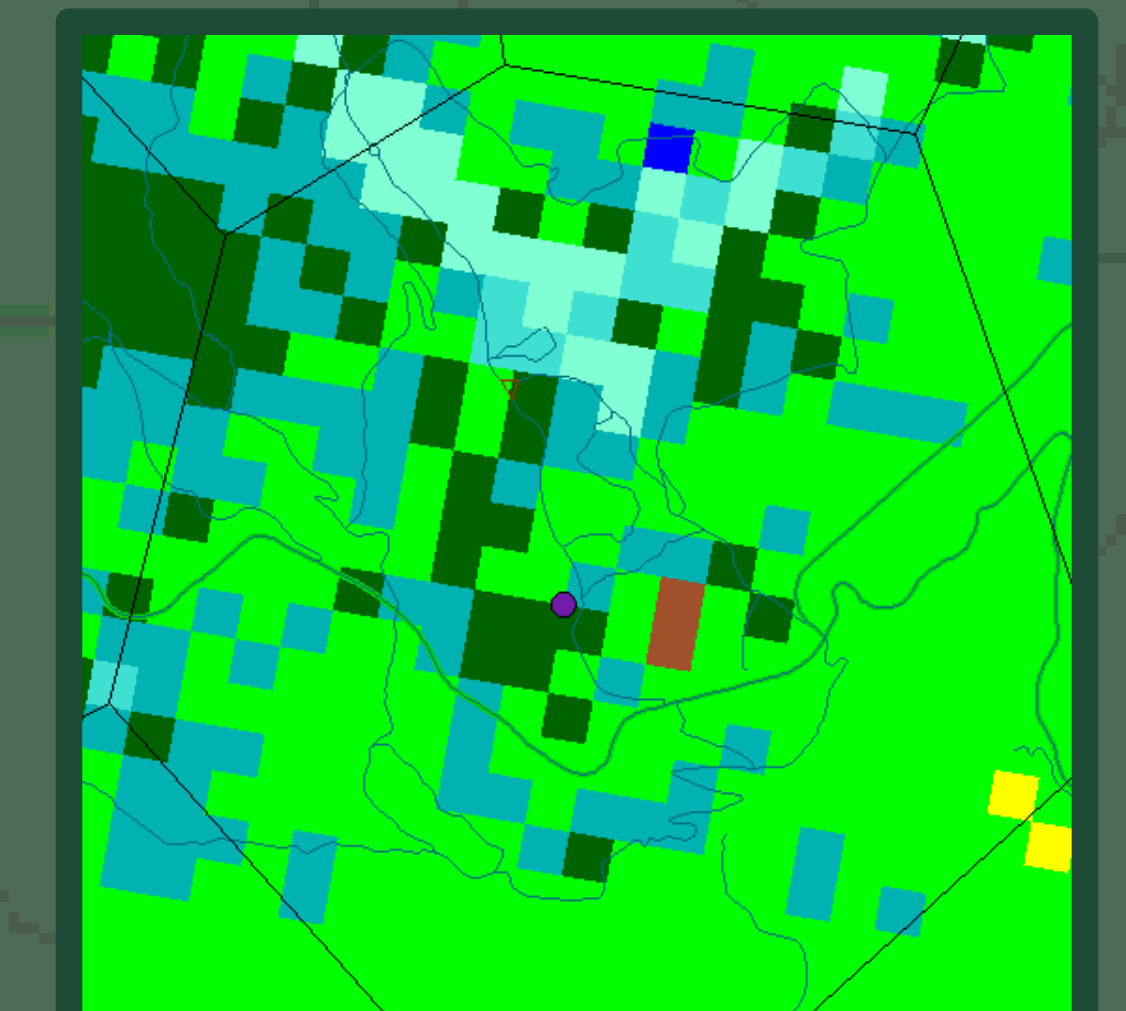
Virginia Tech
**College of Natural Resources
and Environment**

Decisions, Data Requirements, Simplicity, Realism



Ex. 1 - Boundary Issues
Where do you draw the line?

(1) Virginia mills buy timber outside of Virginia, and mills from other states buy timber inside Virginia. Where is it best to stop modeling individual mills and timber stands?



Ex. 2 - Plot vs. Pixel Data:
How Much Spatial Precision?

(2) The Forest Inventory and Analysis program measures timber resources on 1/26 of an acre plots that represent ~ 6000 acres of forest. The National Land Cover Dataset alone illustrates that there is a lot of heterogeneity in the forest surrounding a plot. Will data derived from satellite images improve the model? Will the improved spatial precision make the model sluggish? For example, distances from each pixel to each mill within 100 miles will need to be calculated.