



Forest2Market[®]

WSRI Price Volatility Study

Why Study Price Volatility?

- New entrants in the market
 - Pellet manufacturers (perhaps some torrefaction manufacturing)
 - Some biofuels (diesel mostly, for now)
 - Bioelectric facilities
- New entrants = opportunities
 - For timberland owners / dealers / loggers / sawmills:
 - New markets for under utilized forest material
 - Expanded markets for existing products
- New entrants = challenges
 - For mills:
 - Competition for wood
 - Competition for supply chain resources





Risk Indicators

Scale Ticket *		Mill 1		Mill2
* All loads are equal in weight				
1	\$	25.50	\$	26.50
2		25.50		26.50
3		26.00		26.50
4		27.00		27.60
5		27.25		27.60
6		28.50		27.60
7		28.50		28.20
8		29.00		28.20
9		29.40		28.20
10		29.10		28.90
Average Price	\$	27.58	\$	27.58
Spread	\$	3.60	\$	2.40



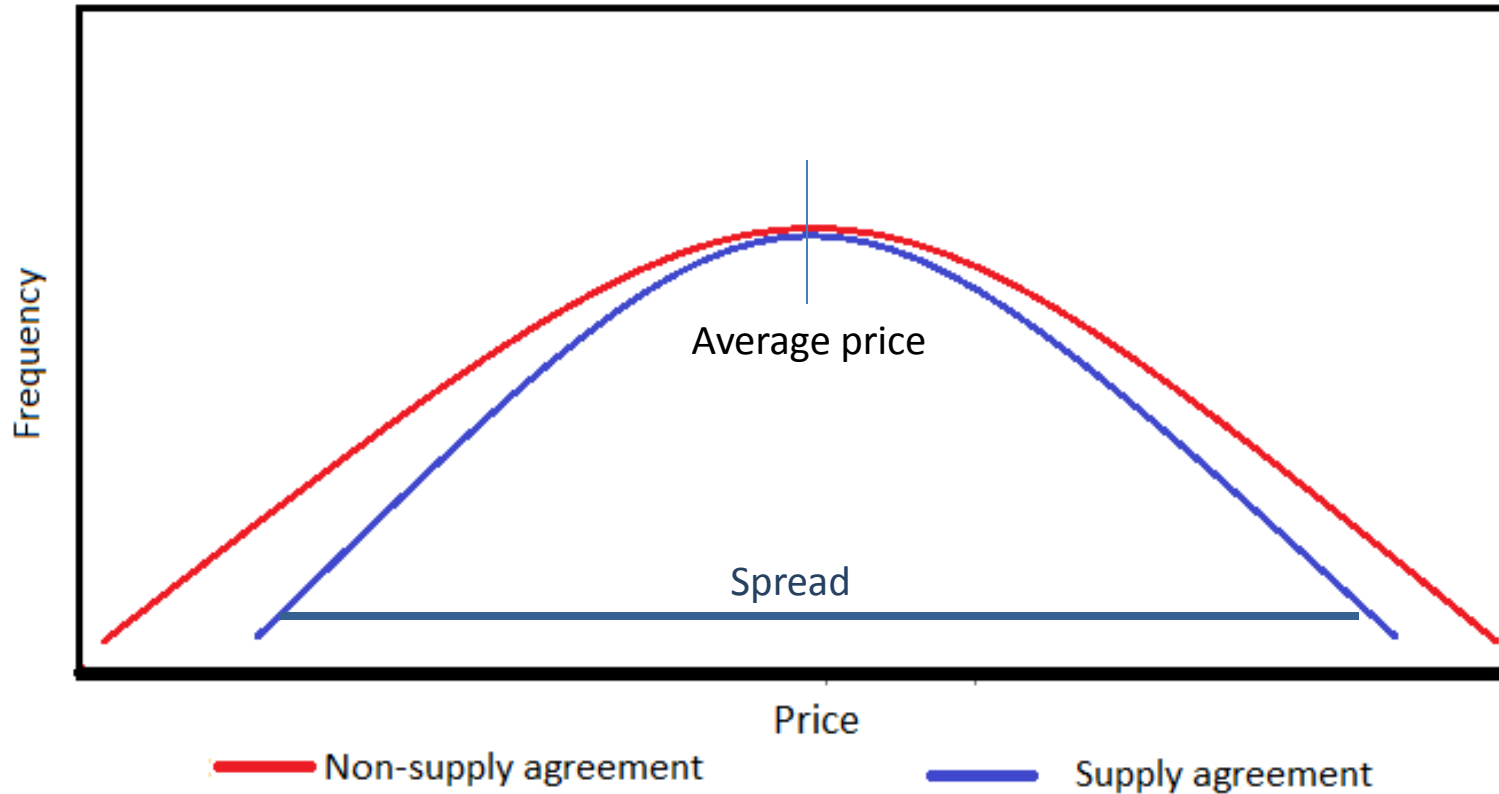
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Study Hypothesis



Data Source

- *Mill2Market* – Delivered Price Benchmark Service
 - Represents the only aggregation of load-by-load transaction data from the vast majority of wood consuming facilities in the US South.
 - 70 - 92% of the market depending on product and region.
 - All data is collected and managed to exacting standards of completeness, timeliness and accuracy.
- Data set used in this analysis contained 29.8 million rows of data (loads), approximately 747.1 million tons of wood raw material.



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Data Preparation

- Sixteen quarters of data were examined (Q1-2007 - Q4-2010).
- To eliminate price distortion resulting from variable haul distances, each load's dollar per ton-mile freight rate was adjusted to a haul cost of a standard fifty-mile haul distance.
- *All transactions sold* between entities with supply agreement were tagged; all others were considered open-market sales.



Methodology: for the Statisticians

$$CV = \frac{S}{\bar{X}} = \frac{1}{\bar{X}} \left[\frac{\sum_{i=1}^n (X_i - \bar{X})^2}{n - 1} \right]^{\frac{1}{2}} \longrightarrow W_{+(-)} = \sum_{i=1}^n \phi_i R_i$$

P-Value

Reject or Accept $H_0: CV_{NS} = CV_S$



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Methodology: for the Rest of Us

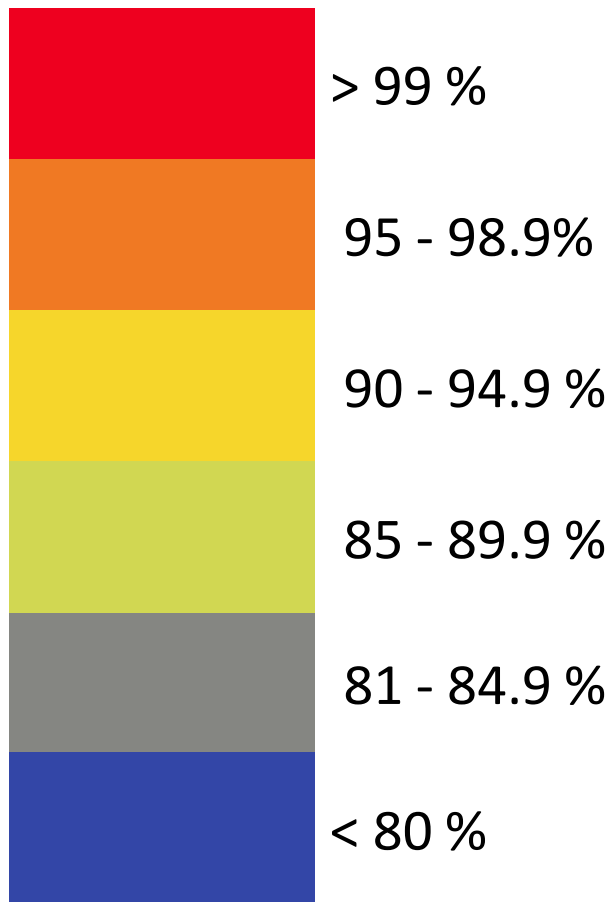
$$\text{Coefficient of Variation (CV)} = \frac{\text{Variability in Price (std. dev.)}}{\text{Mean Price}}$$

Wilcoxon Signed Rank Test:

PRODUCT_ID	Facility_Type	QUARTER_ID	CV_Non_Supply	CV_Supply	CV_Diff
Pine Pulpwood	Paper	20074	101.38	81.43	19.95
Pine Pulpwood	Paper	20081	98.32	77.75	20.57
Pine Pulpwood	Paper	20082	82.89	75.66	7.24



How the Results Are Shown



- No absolutes in statistics!
- Only degrees of confidence.
- Results are shown based on levels of confidence.

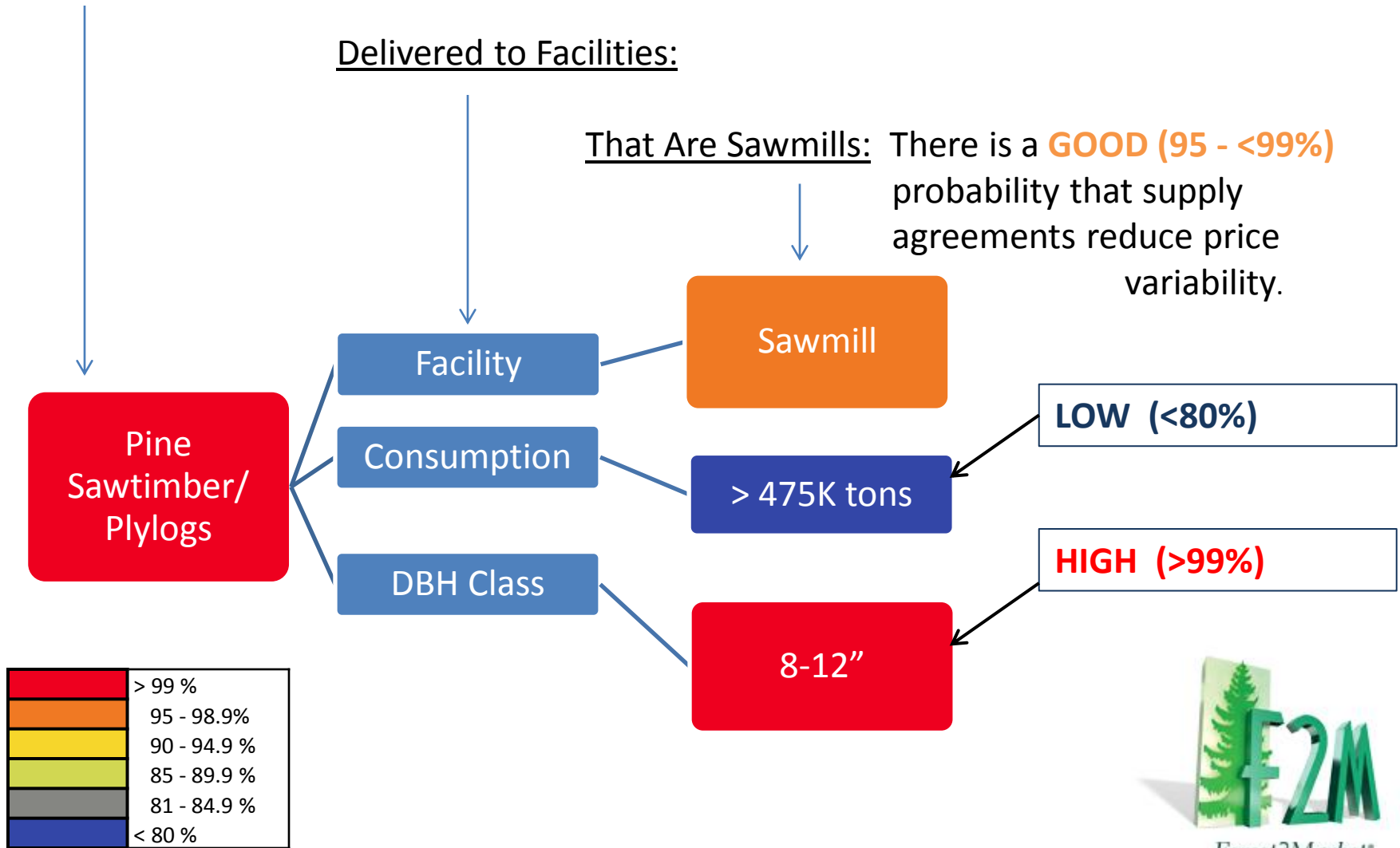


Reading the Diagrams

For Pine Sawtimber/Plylog Deliveries:

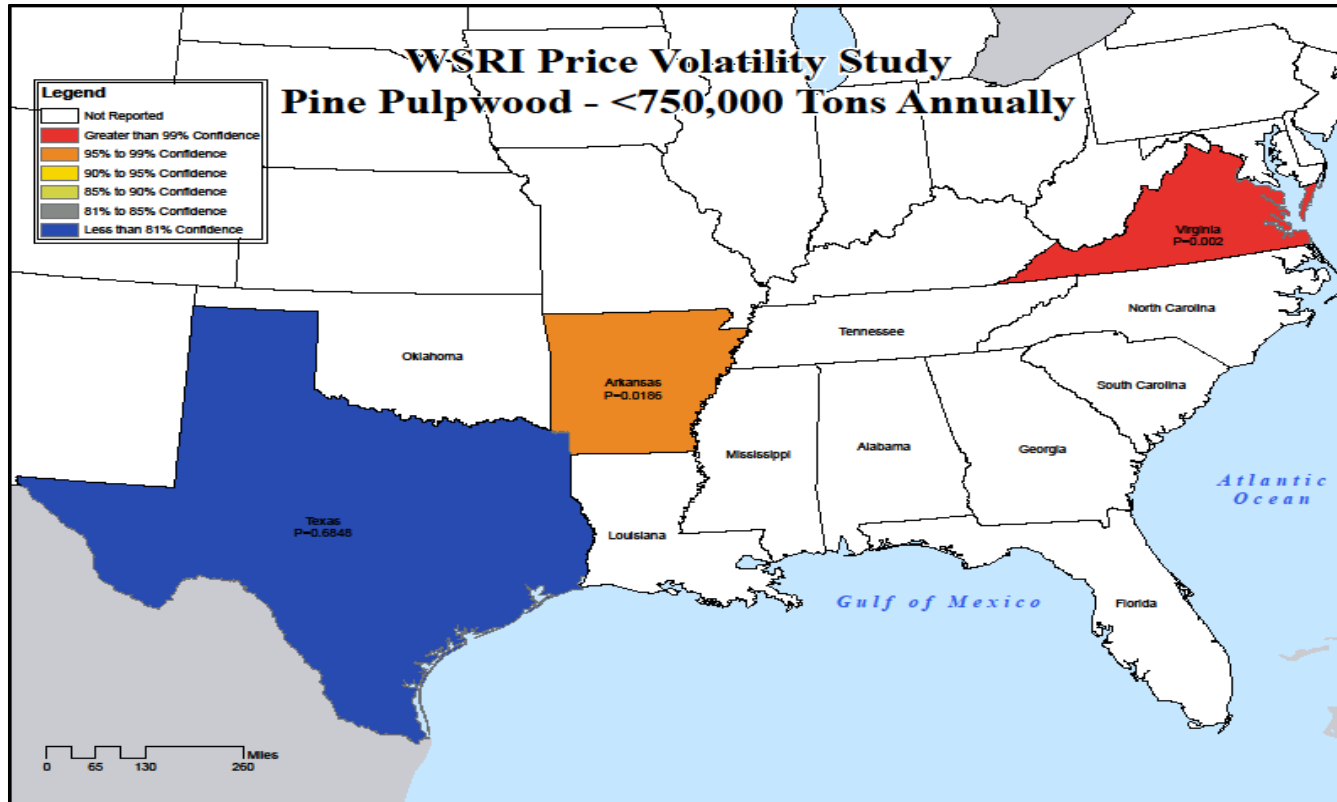
Delivered to Facilities:

That Are Sawmills: There is a **GOOD (95 - <99%)** probability that supply agreements reduce price variability.



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Reading the Maps



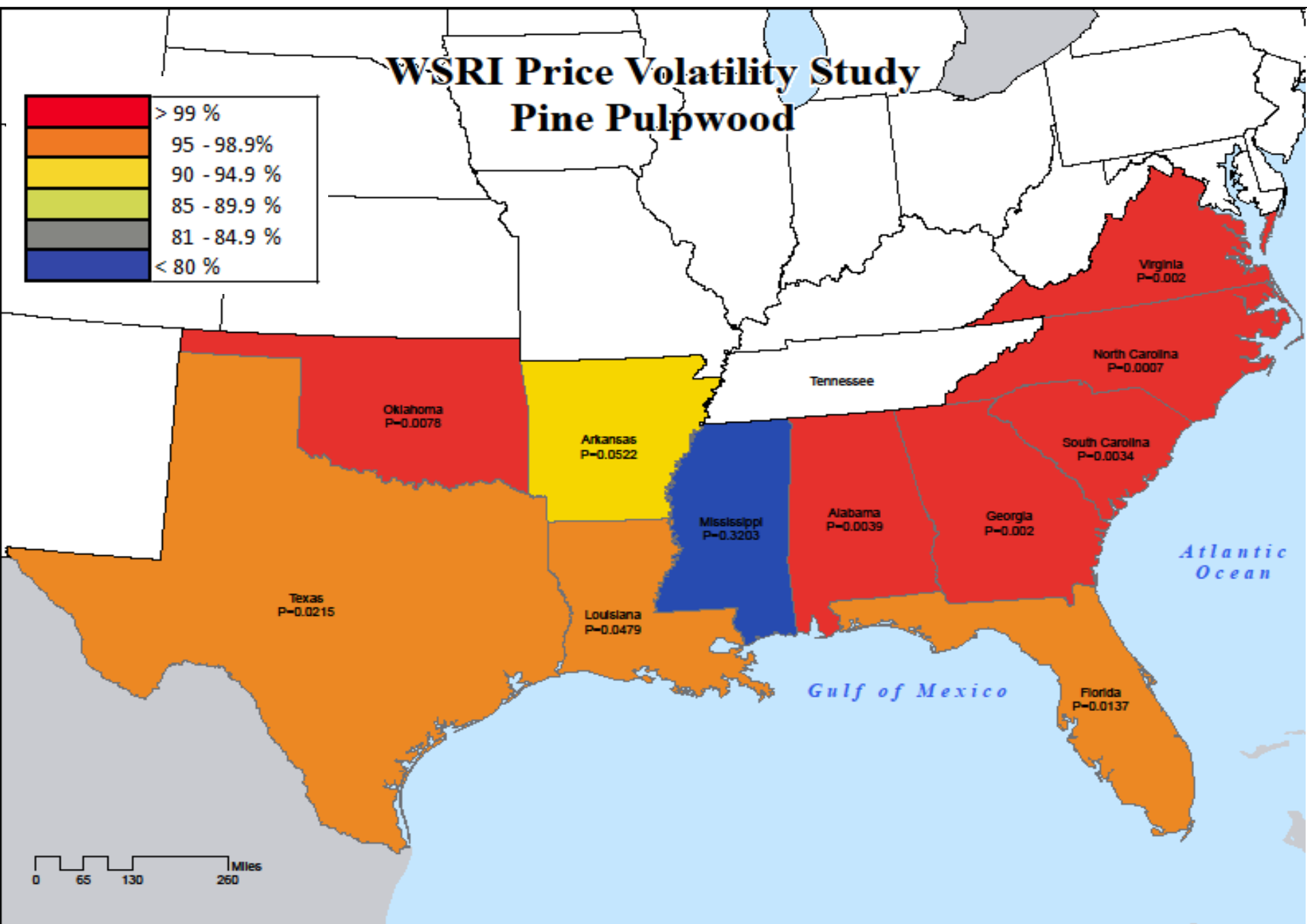
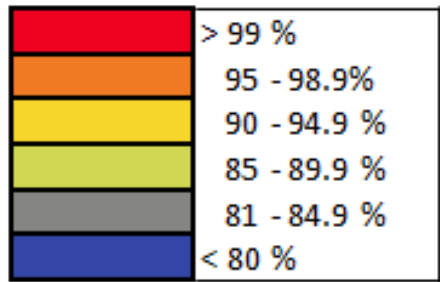
White states indicate either/or:

- There are *no known supply agreements* meeting the conditions described in the map title.
- Results (if shown) would violate a customer's confidentiality.



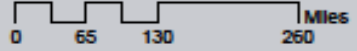
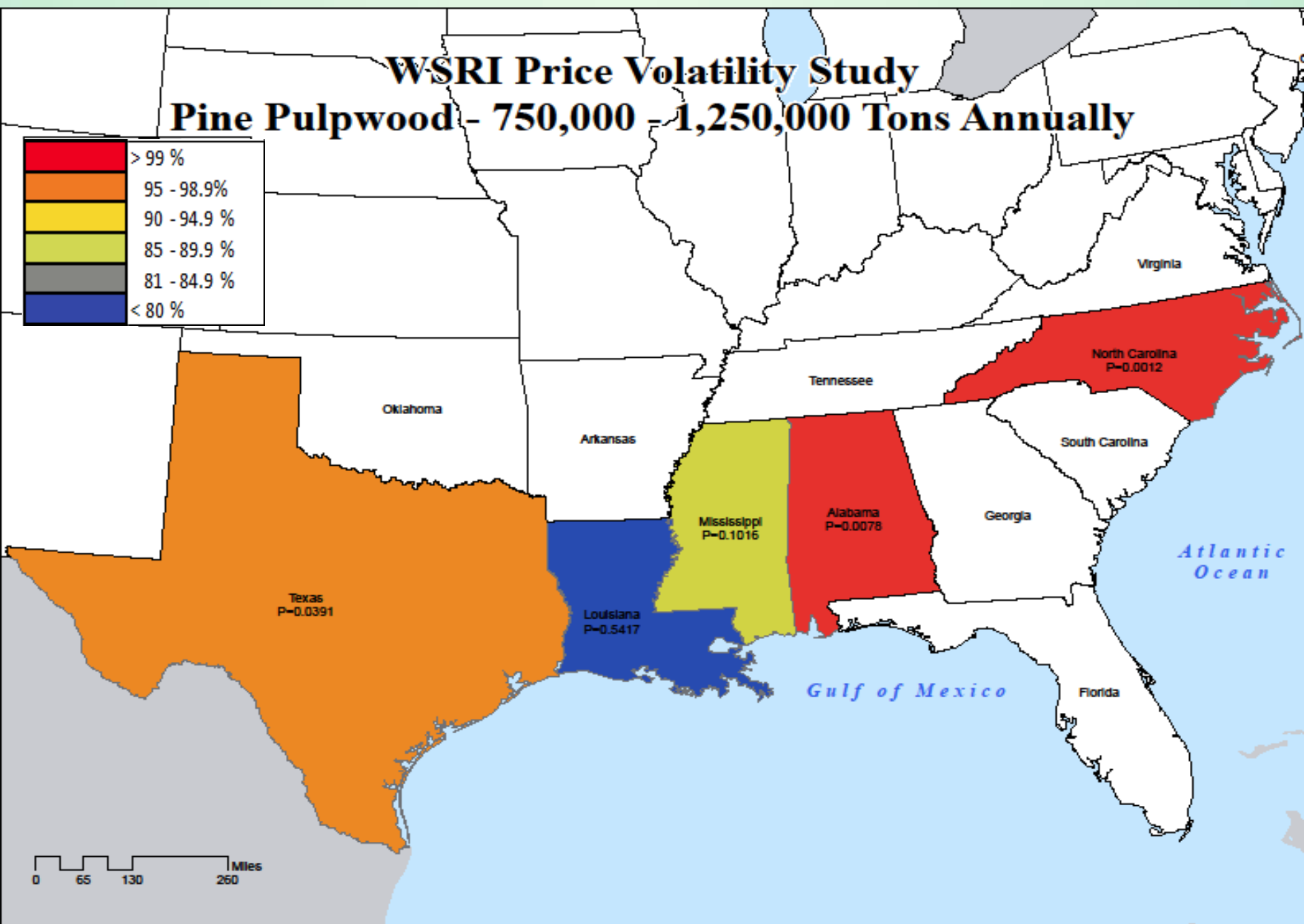
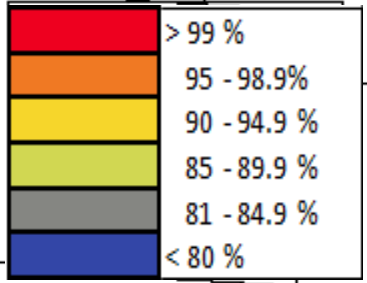
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WSRI Price Volatility Study Pine Pulpwood



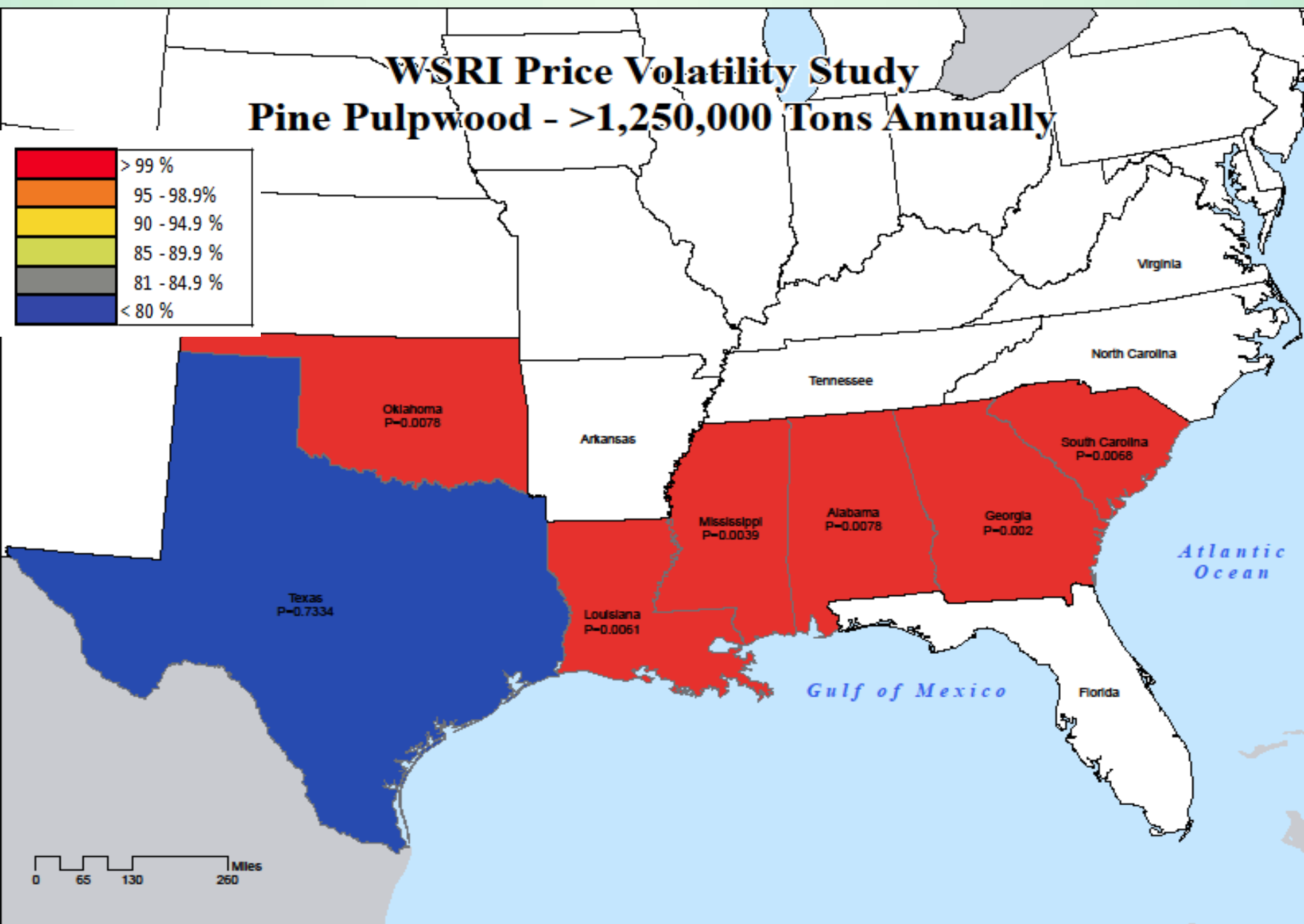
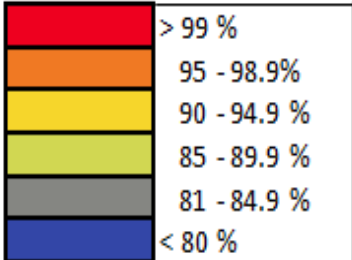
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Pine Pulpwood - 750,000 - 1,250,000 Tons Annually

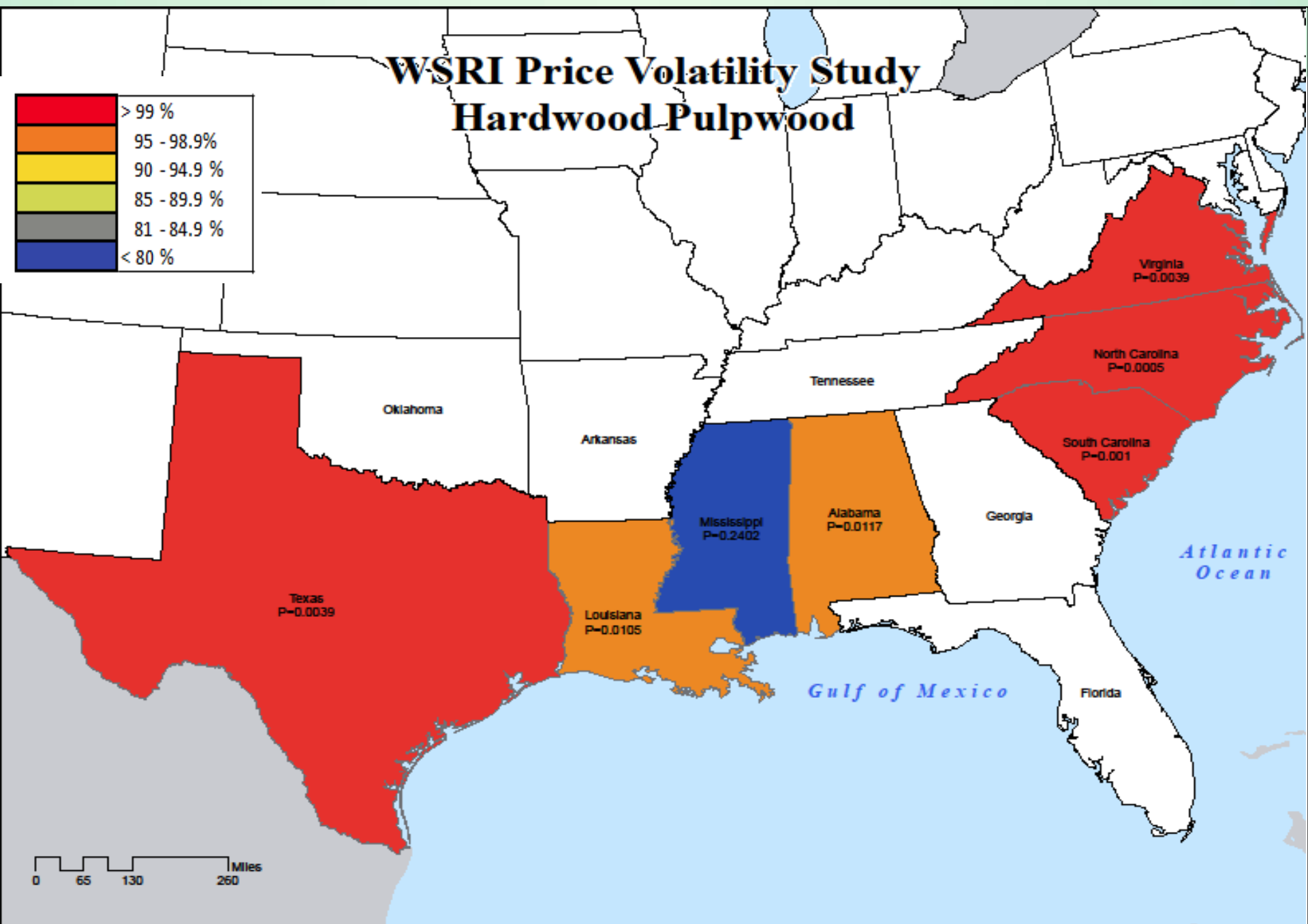
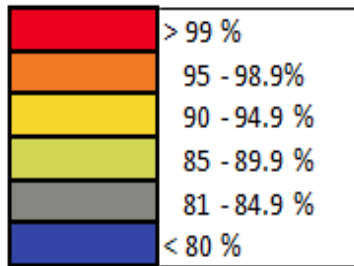


WSRI Price Volatility Study

Pine Pulpwood - >1,250,000 Tons Annually



WSRI Price Volatility Study Hardwood Pulpwood



Summary of Findings

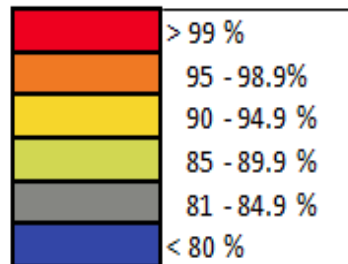
- Forest2Market's results prove the hypothesis – *price volatility is reduced for wood raw material products sold under supply agreement* – is true for all products evaluated.

Pine Pulpwood

Hardwood
Pulpwood

Pine
Sawtimber

Pine Residual
Chips



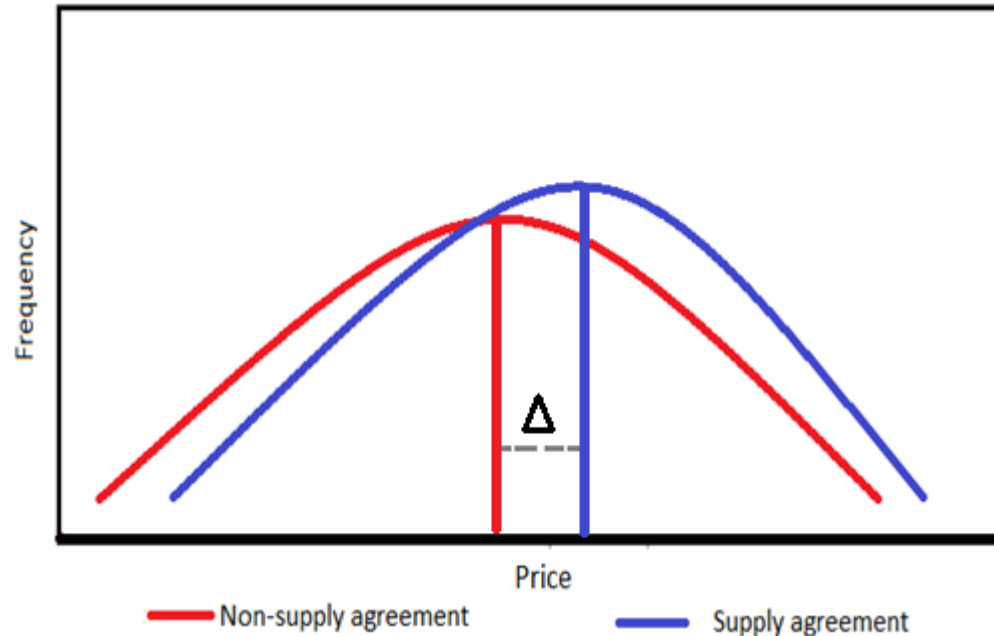
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Other Findings

Price

When a strong difference in price volatility existed, mean supply agreement price was often higher than the mean non-supply agreement price.

Depending on the product, the difference was modestly higher.



Conclusion

- Supply Agreements = Less Volatility
- Supply Agreements = Modest Premium in the Past
- Best Supply Agreements have indexes for:
 - Diesel
 - Operational/Labor
 - Stumpage/Woodfiber
- Supply Agreements = Efficient Supply Chain



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