THE FUTURE OF OUR RAW MATERIAL…
LOG MARKETS

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TODAY'S RESOURCE SUPPLY CHAIN

- **Information on harvests**
  - In OH and WV – 60 harvest operations visited in 2009-2011
  - Selection cut and clearcut percentages slightly higher than for the broader data just shown by Bill
  - Forester involved in 66% of sales
  - 85-90% contract or independent loggers
  - In OH, a combination of markets and terrain allows for more tree length logging/hauling … an opportunity to optimize
  - Log brokers???

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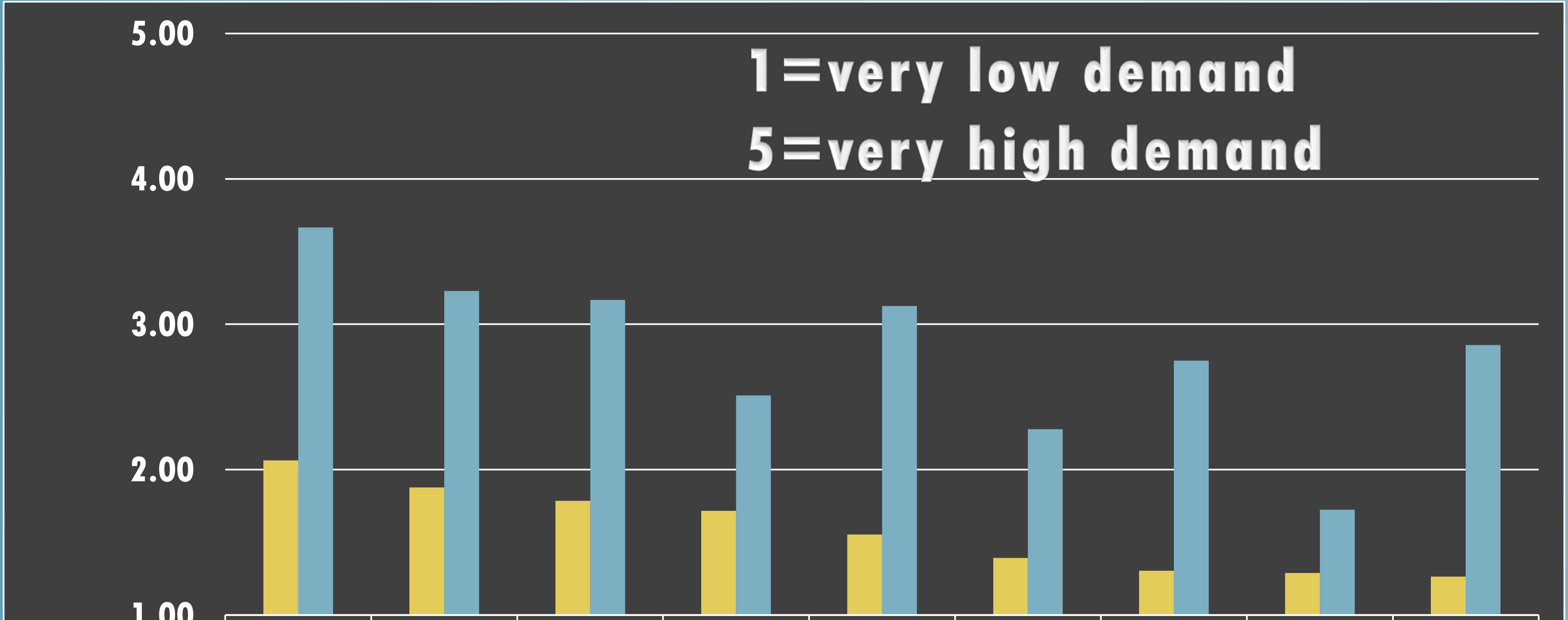
The Hardwood Log Supply Chain

A comparison of Log Brokers' and Sawmills' Log Procurement Activities in 2012

LOG BROKER SERVICES …

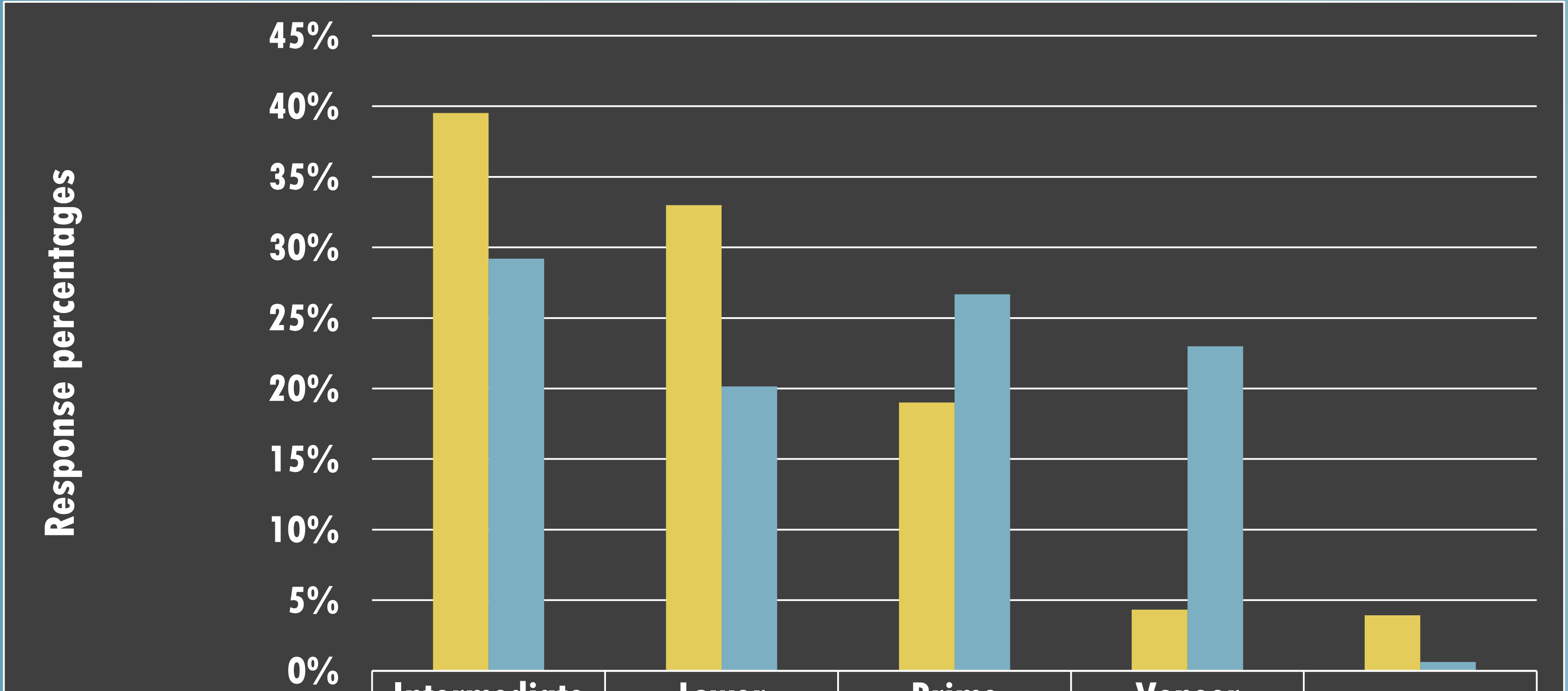
WHAT SAWMILLS DEMAND VS. WHAT BROKERS PERCEIVE DEMAND TO BE



	Log delivery	Log bucking to specific lengths	Short lead times	Log inventory to fill shortages	Procuring hard to obtain species	Metal detection	End waxing	Certified logs	S-ironing
Sawmill	2.06	1.88	1.79	1.72	1.55	1.39	1.30	1.29	1.26
Log broker	3.67	3.23	3.17	2.51	3.13	2.28	2.75	1.73	2.86

Brokers perceive higher demand for species procurement, end waxing, and S-ironing

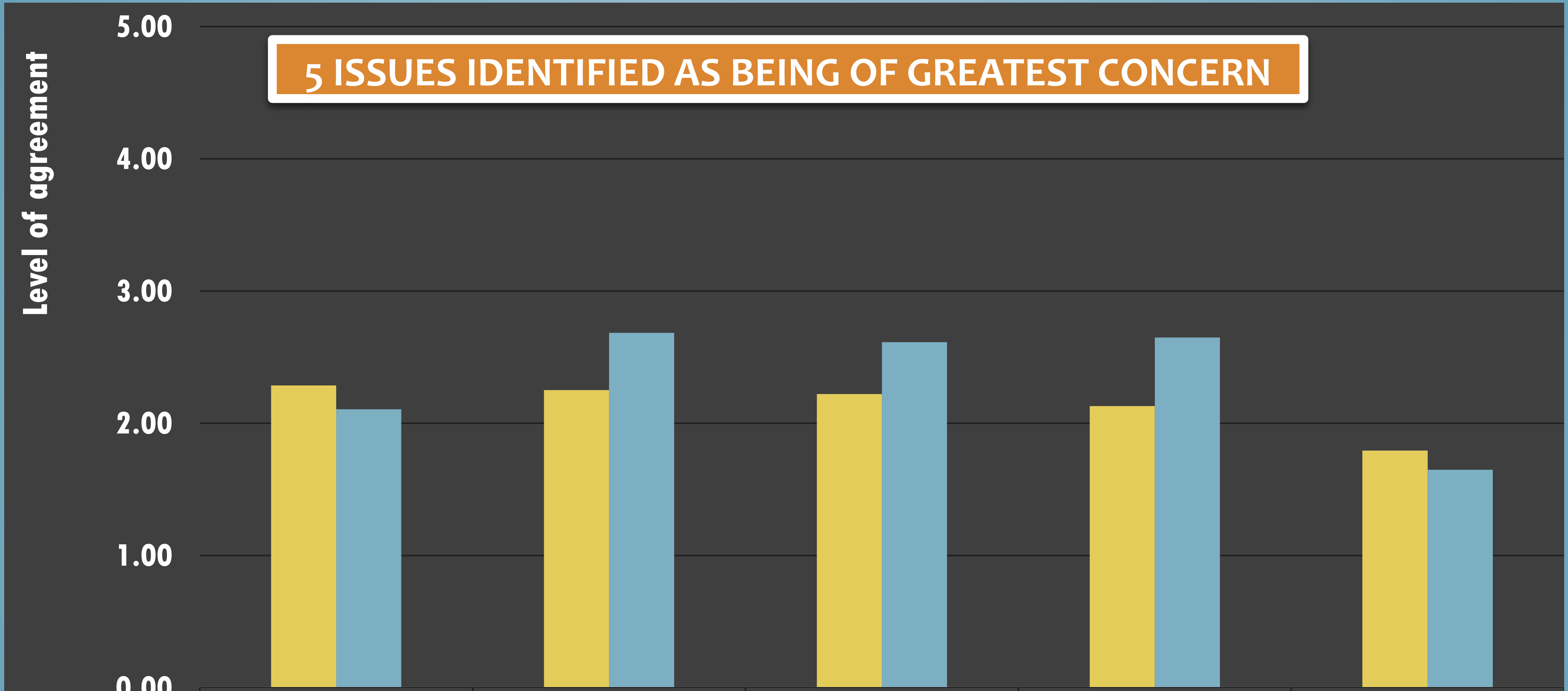
LOG GRADES COMPARED: SAWMILLS VS. BROKERS



	Intermediate grades	Lower grades	Prime grades	Veneer grades	Other grades
Sawmill (N=271)	40%	33%	19%	4%	4%
Log broker (N=57)	29%	20%	27%	23%	1%

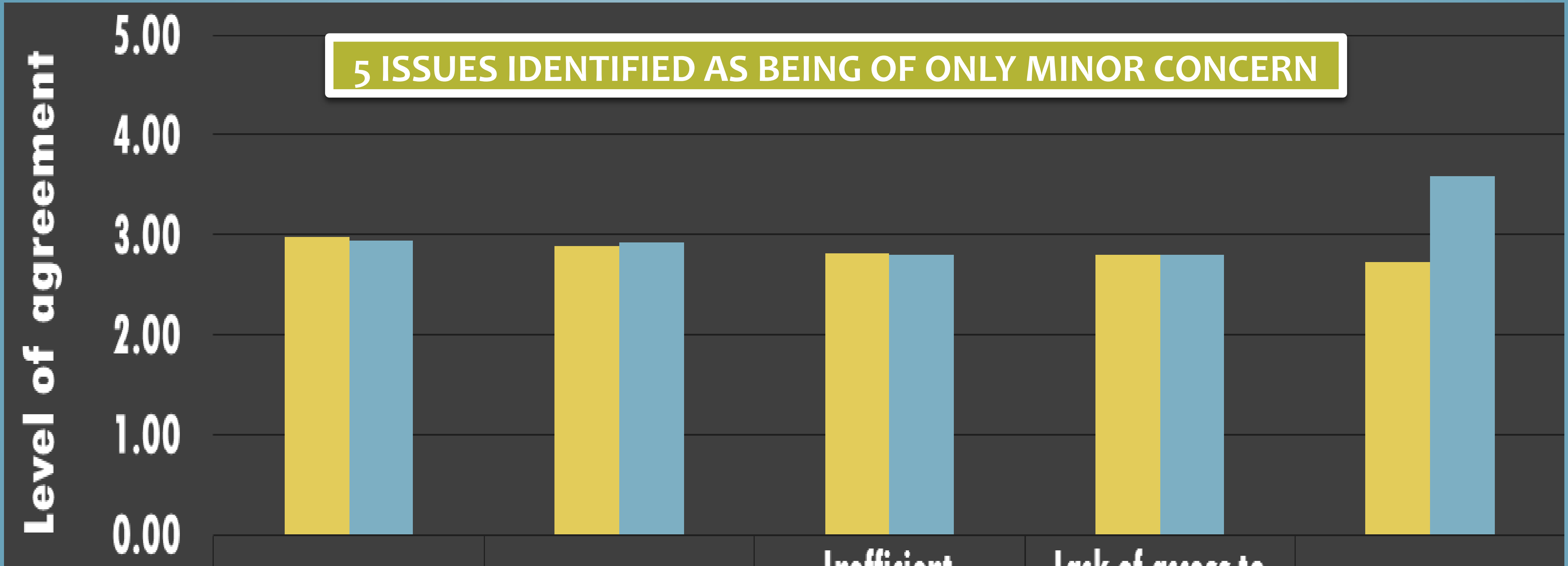
Brokers trade in higher grade logs

1= major negative effect, 3= no effect, 5= major positive effect



	Shortage of loggers	Log shortages	Unpredict log supply	High log cost	Increasing fuel and trucking costs
Sawmill	2.29	2.25	2.22	2.13	1.79
Log broker	2.11	2.68	2.61	2.65	1.65

1= major negative effect, 3= no effect, 5= major positive effect



	Local wood bioenergy markets	Availability of certified logs	Inefficient unloading of delivered logs	Lack of access to info. from foresters	Increasing log exports
Sawmill	2.98	2.88	2.81	2.79	2.72
Log broker	2.95	2.93	2.79	2.79	3.58

Figure 2-1a: The Structural Shift in US Timberland Ownership from 2002 to Present

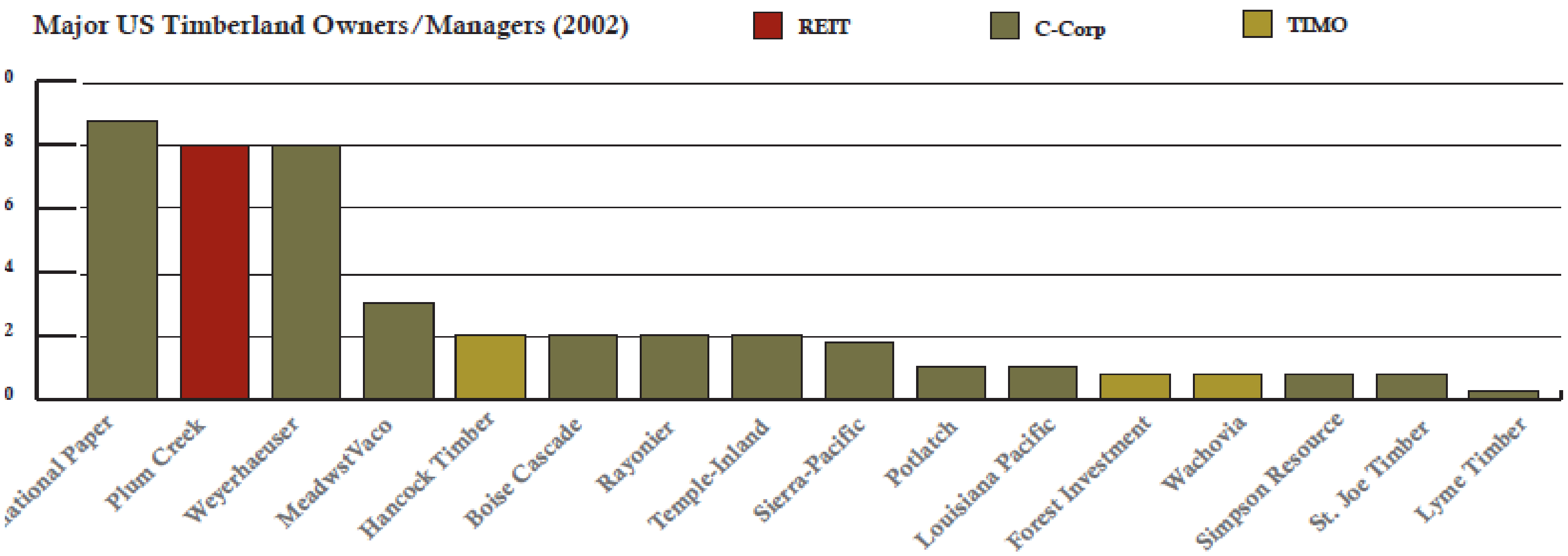
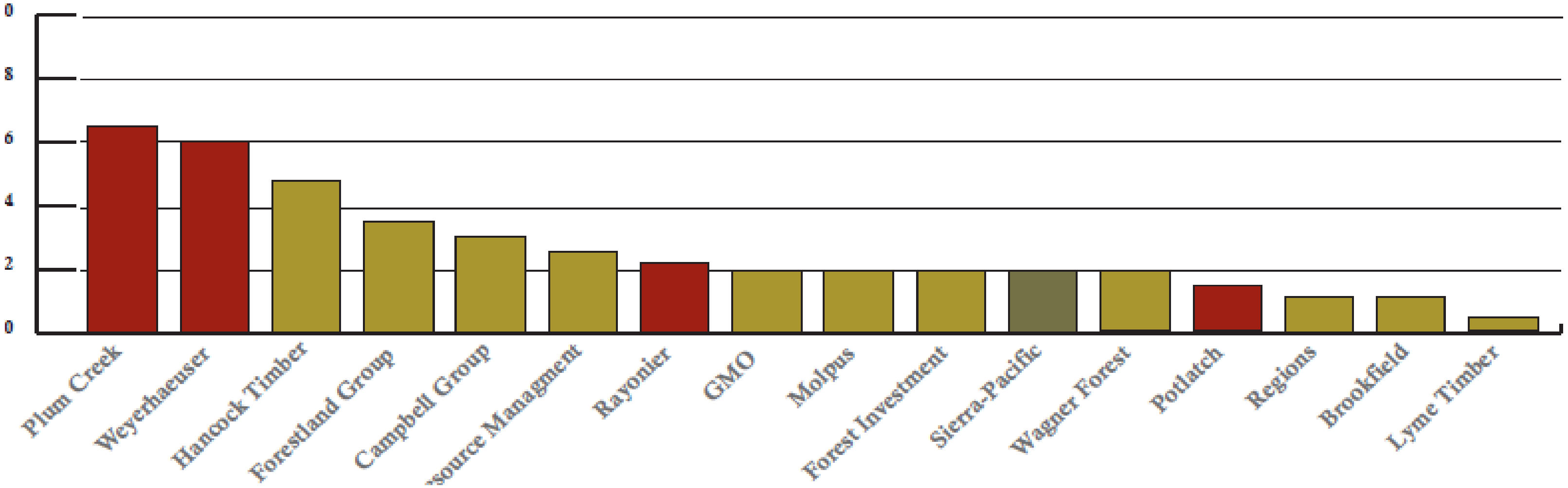


Figure 2-1b: Major US Timberland Owners/Managers (Current)



From Goergen et al., 2013 "The State and Future of U.S. Forestry and the Forest Industry."

THE LOGS FROM OUR FORESTS IN YEARS TO COME

Maple-beech-birch forest type will increase

- But under climate change scenarios oak will be more resilient
- In PA, black cherry decline on Allegheny Plateau with black birch coming in

Land-use change in the North expected to cause reduced acreage

- Overall, 13% of total "removals" due to land use change
- In some states this will exceed 50% in coming decades (NJ, MD, RI, MA)

THE LOGS FROM OUR FORESTS IN YEARS TO COME

Forest area dominated by older timber

- Larger trees will be widely available
- But will we have markets for the smaller timber?
  - Based on 60 harvest operations in WV/OH – only 2% of sawlogs have SEDs <10 in
  - About 23% of scragg logs have SEDs <10 in
  - In clearcut operations, 31% of butt logs have SEDs <10 in
  - In selection cuts, 26% <10 in
  - In diameter-limit cuts, 8% <10 in

Insect and disease caused tree mortality will continue to increase

USFS disease risk map for 2013-2027

WHAT WE MIGHT LOOK FOR IN THE FUTURE FOR LOGGING

- Connected equipment on the logging job site enhances machine utilization and safety
- Digital monitoring of equipment utilization rates, fuel consumption, tire pressures and wear, other maintenance needs…
- GIS tagging of highest value trees during pre-harvest survey ensures those trees are not damaged, overlooked, or misallocated
- Log truck tracking systems incorporated into smart road networks alert other drivers of on-coming trucks to improve safety on public roads
- Social media used by loggers to network with other loggers enabling cooperation on various activities (e.g., operator sharing, maintenance assistance, bulk purchasing of chain/fuel)