

# Acoustic Evaluation of Warp Potential in Small-Diameter Ponderosa Pine Trees and Logs

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# Objective

Can stress wave analysis of trees help us predict the warp potential of lumber?



Test trees with stress wave analysis



Test logs with stress wave analysis



Test lumber with stress wave analysis



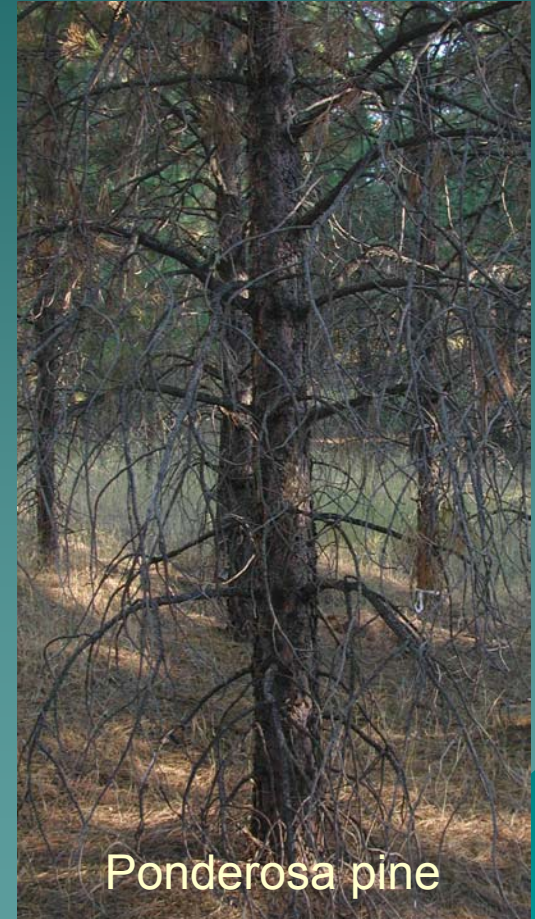
Kiln dry lumber



Evaluate defects and measure warp of dried lumber

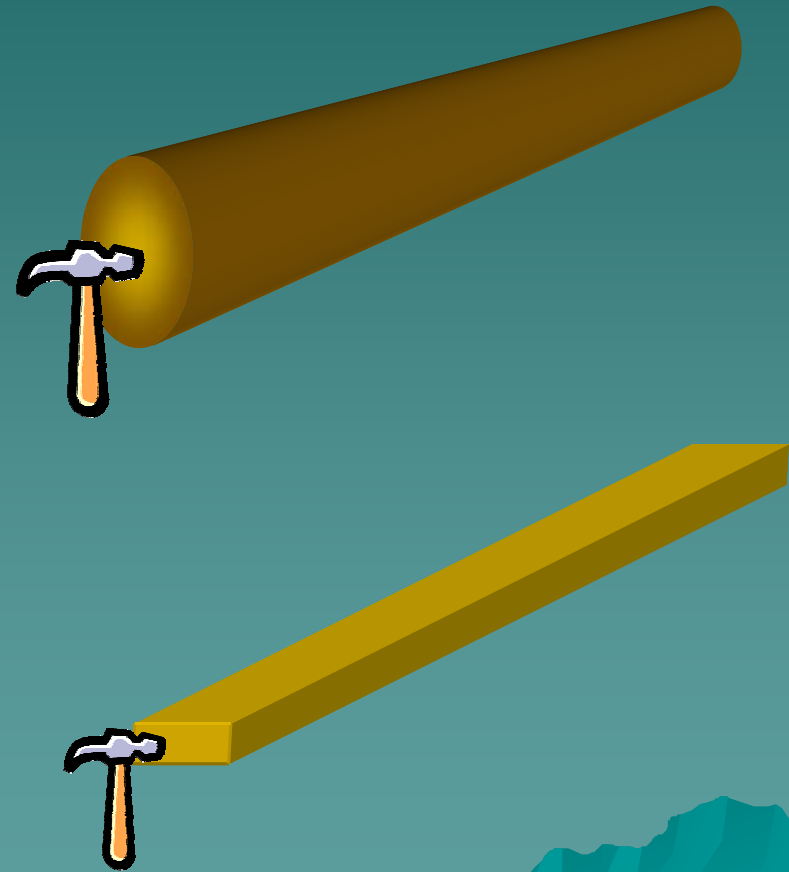
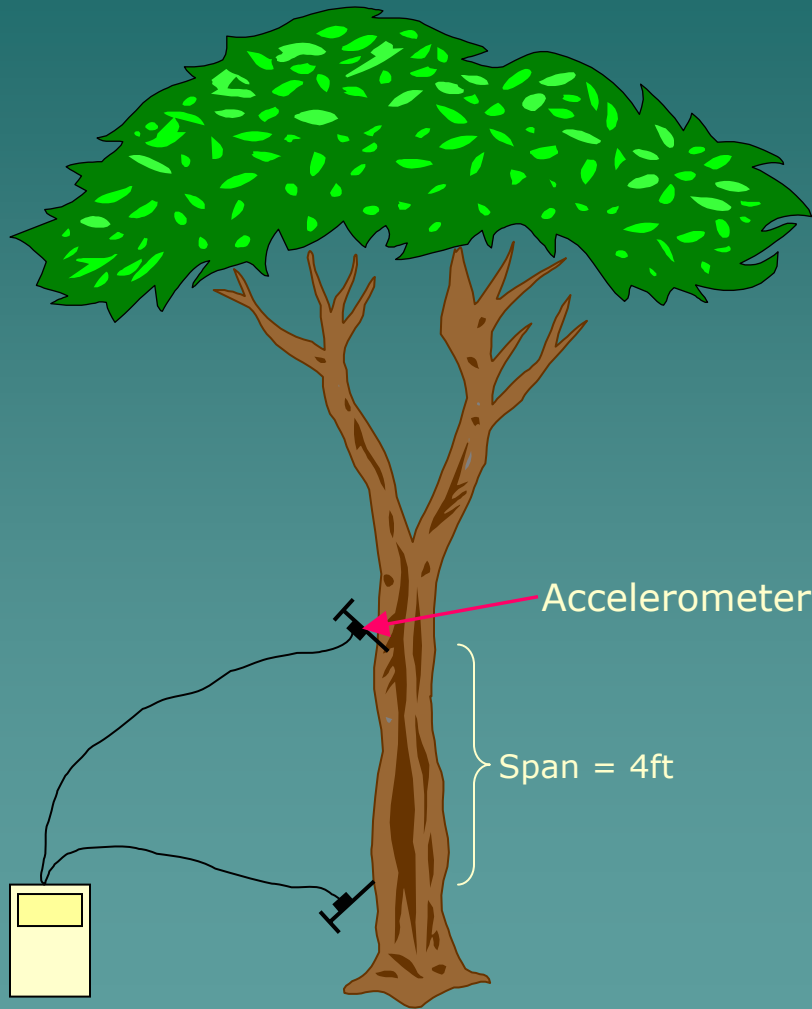
# Site Information

Boise National Forest, Idaho



Ponderosa pine

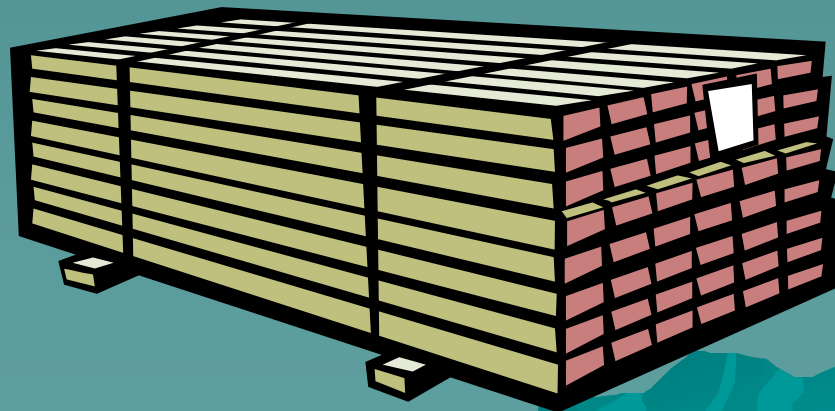
# Measurements



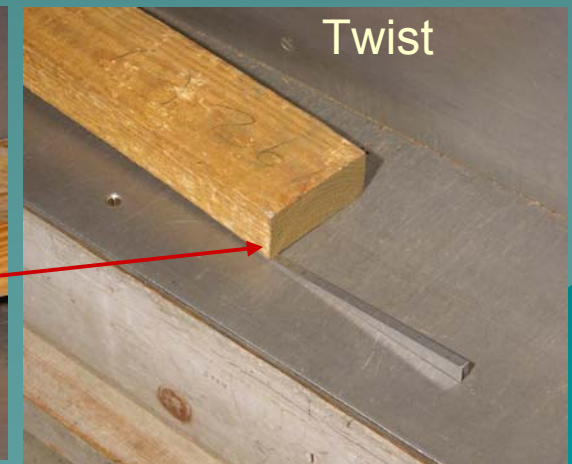
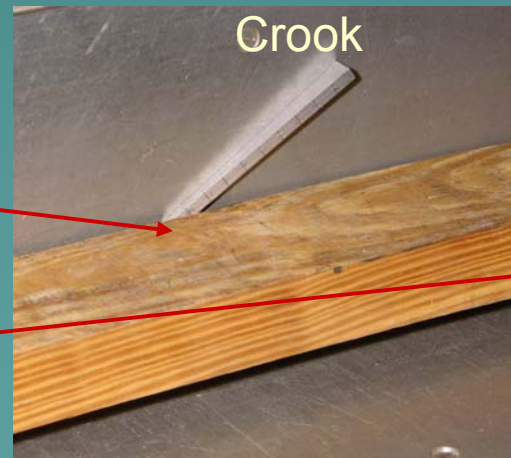
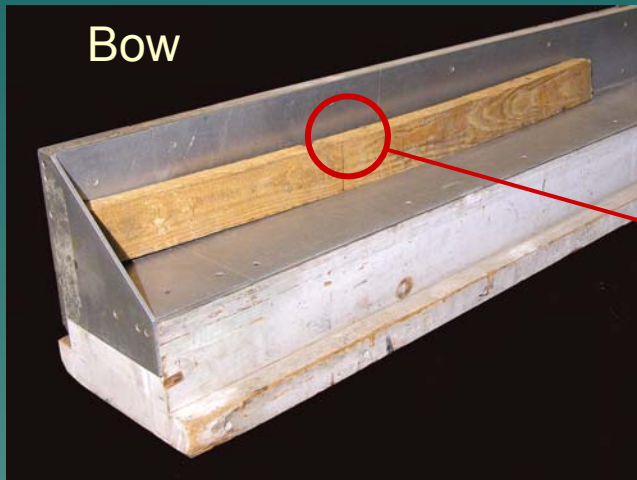
Oscilloscope

# Kiln Drying Schedule

Time (h)	Dry-bulb temperature (°F)	Wet-bulb temperature (°F)
0-24	160	140
24-36	165	140
36-60	170	140
Equalize to 12% EMC	170	160

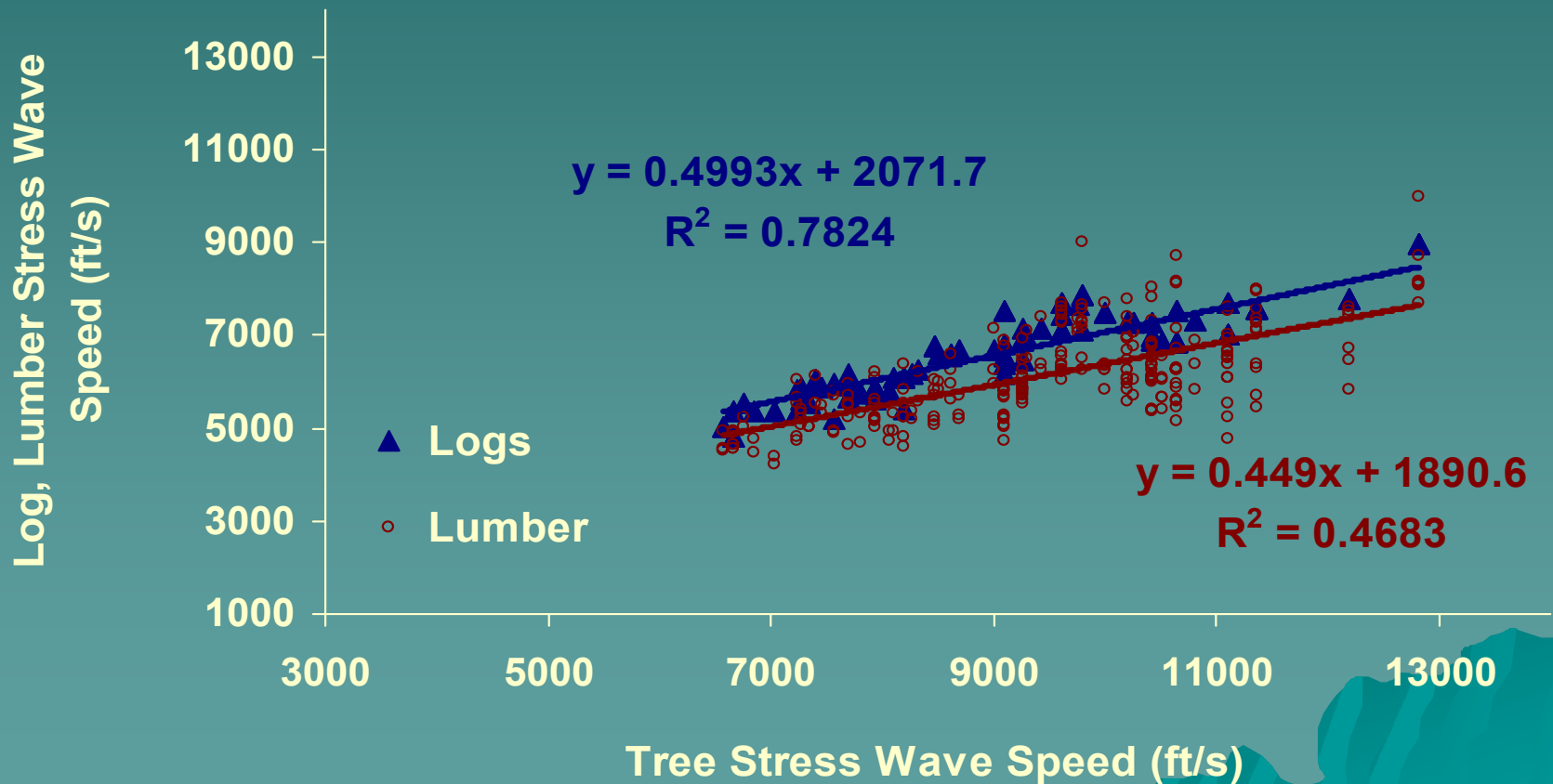


# Warp Measurement




# Results

Comparison of stress wave speeds of trees vs. lumber and trees vs. logs (ft/s)



# Results

- ★ Separate tree and log data into different classes based on acoustic velocities
  - ★ Compare acoustic velocities to average warp measurements for that particular class
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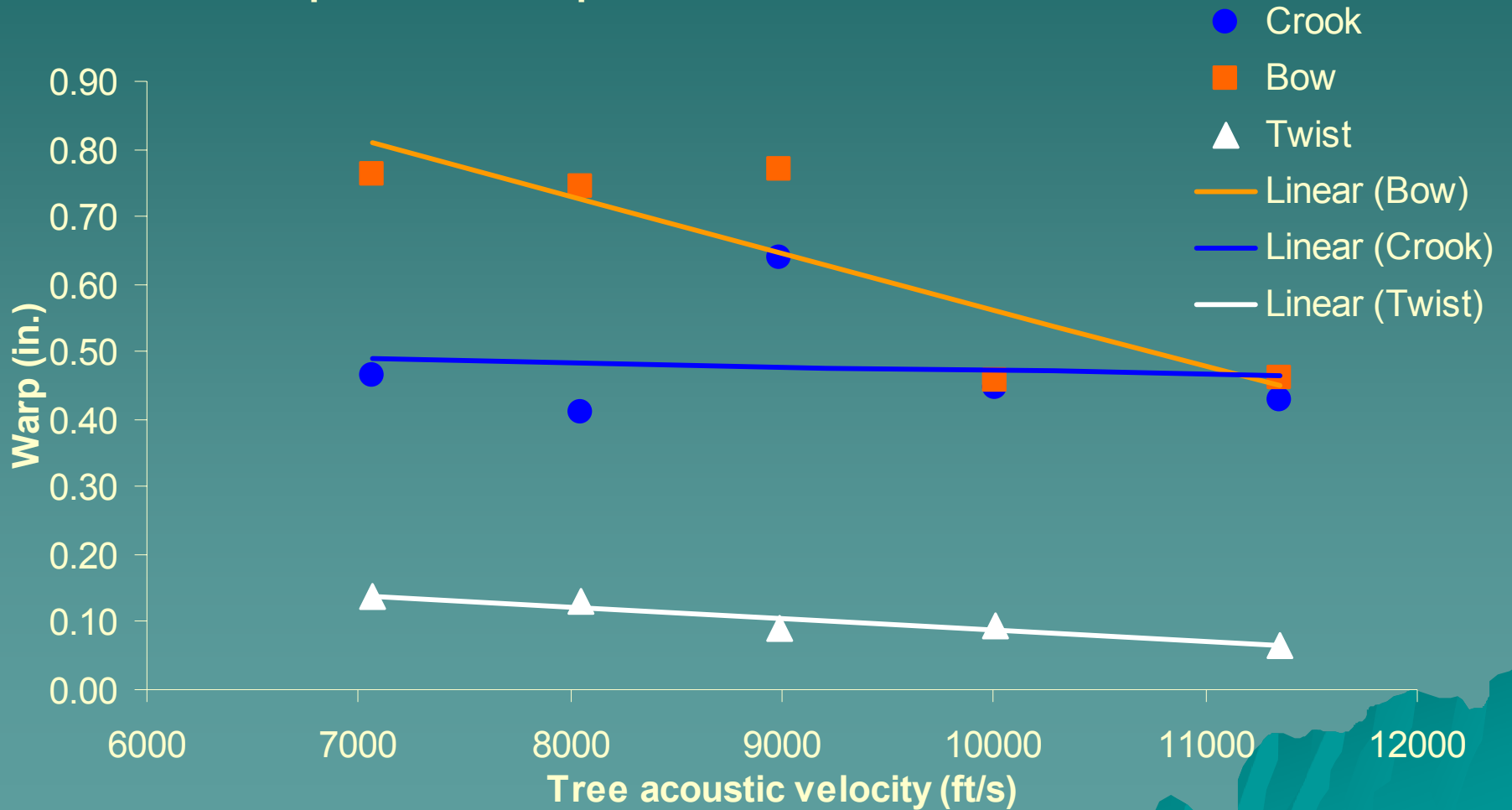


# Results

Tree acoustic group (ft/s)	Number of specimens in group
< 7500	10
7500-8500	10
8500-9500	8
9500-10500	7
> 10500	7
<b>Total</b>	<b>42</b>

# Results

Comparison of warp measurements to tree measurements

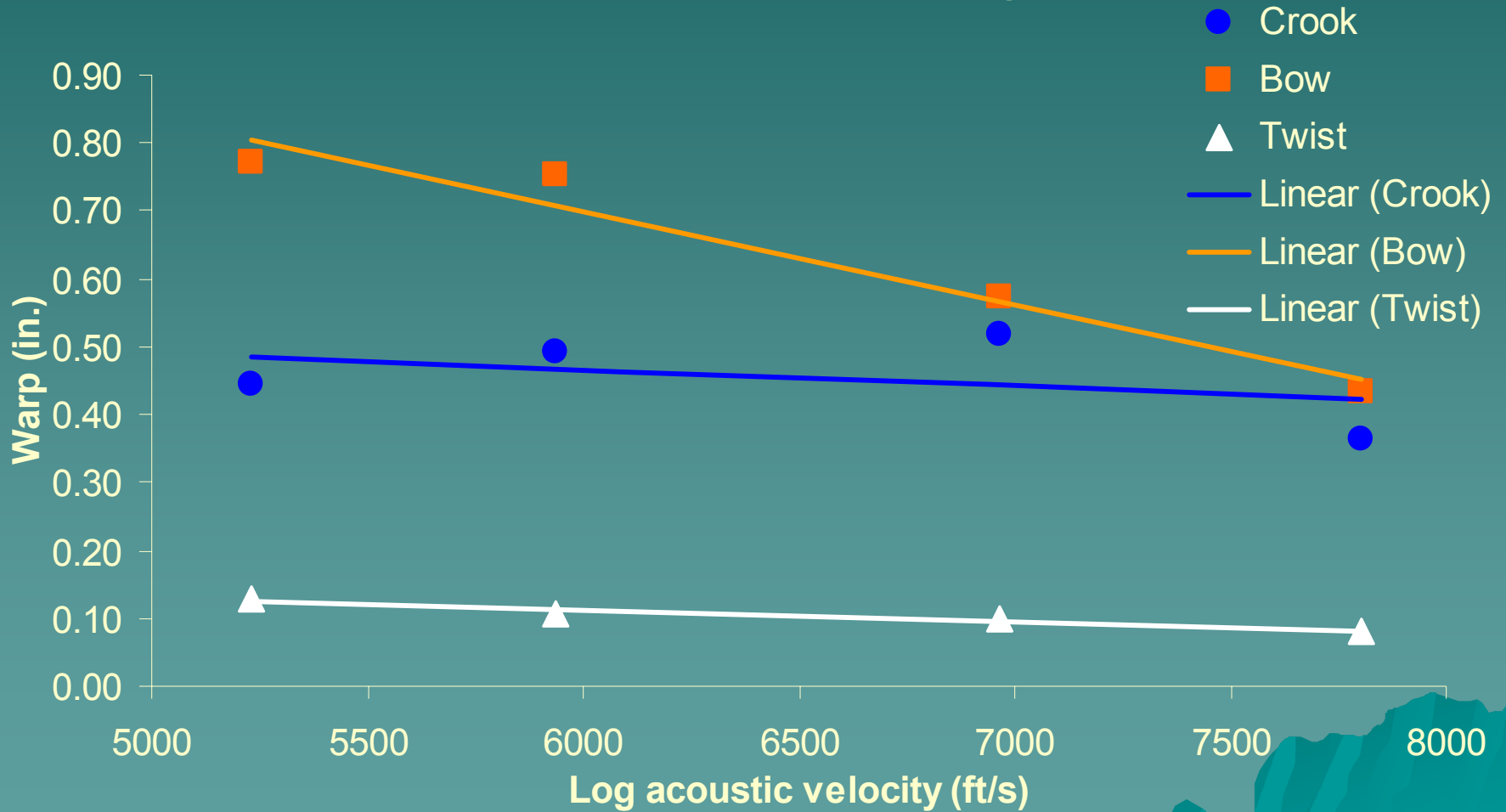


# Results

Log acoustic group (ft/s)	Number of specimens in group
< 5500	8
5500-6500	24
6500-7500	28
> 7500	9
<b>Total</b>	<b>69</b>

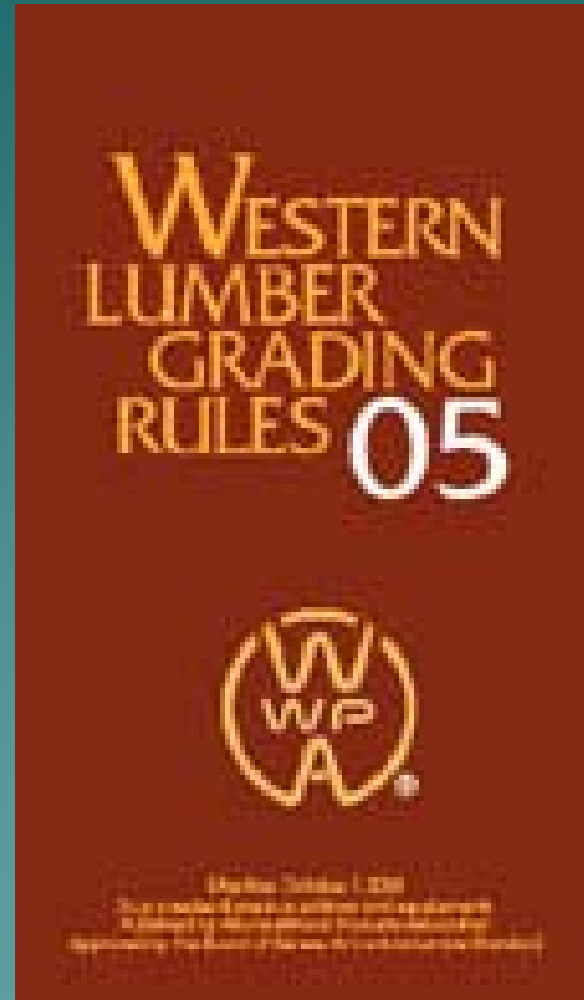
# Results

Comparison of warp measurements to log measurements



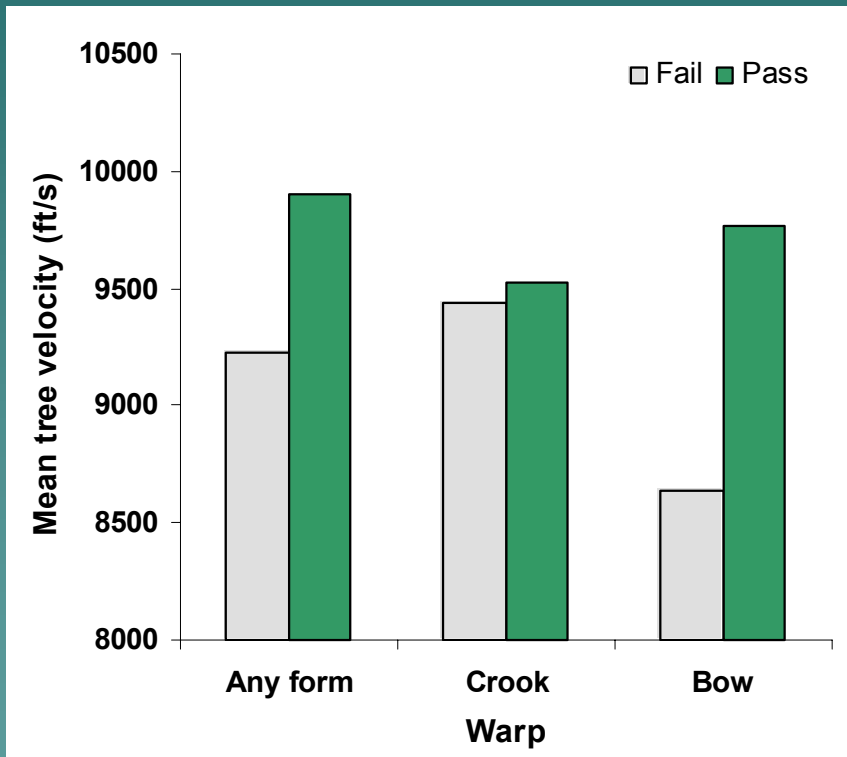
# Results

- ★ WWPA Structural Light Framing #2
  - ✦ Western Wood Products Association
  - ✦ Did any boards lose grade because they exceeded the warp limits?

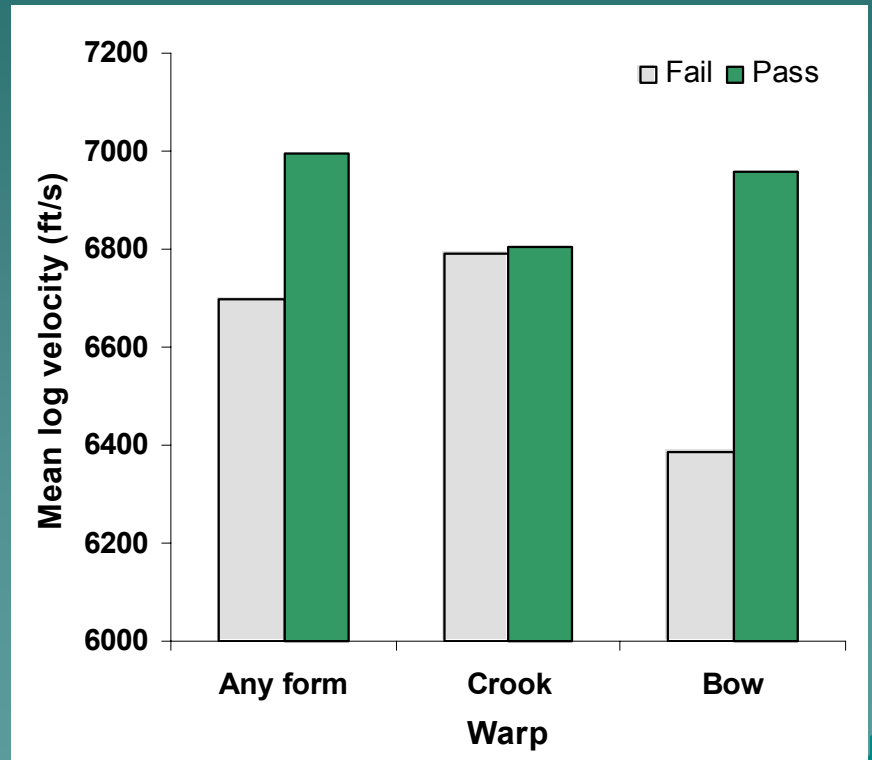


# Results

## Trees




## Logs



Twist not evaluated because very few boards exceeded the #2 grade warp limits

# Conclusions

- ★ Good correlation between tree measurements and log measurements
  - ★ Amount of warp in the form of bow and twist decreased as velocity of trees and logs increased (crook had no strong relationships with stress wave speed)
  - ★ Analysis of standing timber and logs can possibly be used to predict warp potential of lumber
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# Questions?

