

*Cracking the Small Diameter Nut*

*Emerging Technologies . . . New Markets*

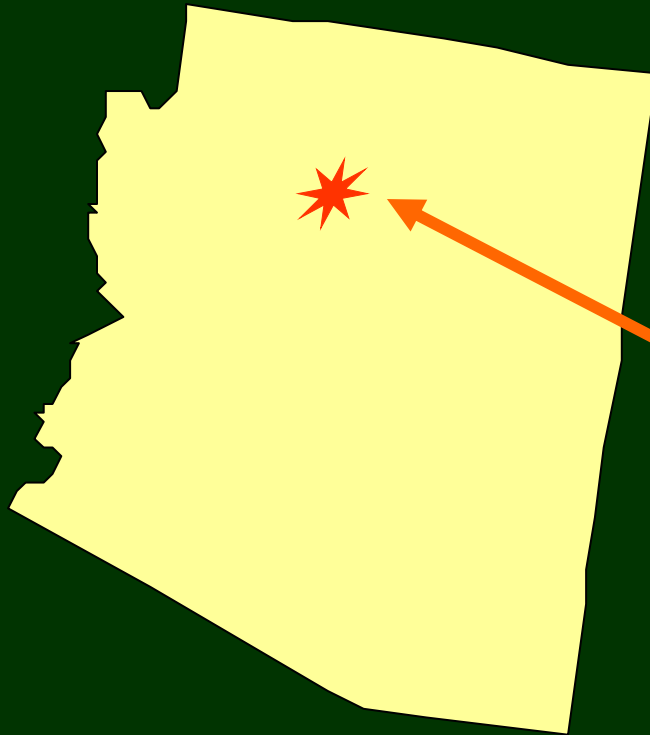
**Presented by**  
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Cracking the Small Diameter Nut: Consider

- ✓ *Biomass-to-energy not the economic silver bullet.*  
In the aggregate, better opportunity exists for solid wood and composite product development.
- ✓ Nothing good happens without *“levelized” supply.*
- ✓ *Emerging technologies* may present best value-add potential for biomass use.
- ✓ *New project financing options* melded to forest restoration (fuel load reduction) offer remarkable new access to capital.

Nothing good happens without “*levelized*” supply.

- ❑ *To explain levelized supply, you need to know about **CROP**, and . . .*
  
- ❑ *to explain **CROP**, you have to know . . .  
. . . where and why it all began*



*Arizona*

*Grand Canyon Trust*

*Greater Flagstaff Forests  
Partnership*

**But, constraints to fuel load reduction work were powerful:**

No infrastructure to process small logs (5''-12'' with central focus 5''-7'') and biomass (< 5'') material.

No means to invite new investment into the region to process and market restoration resource.

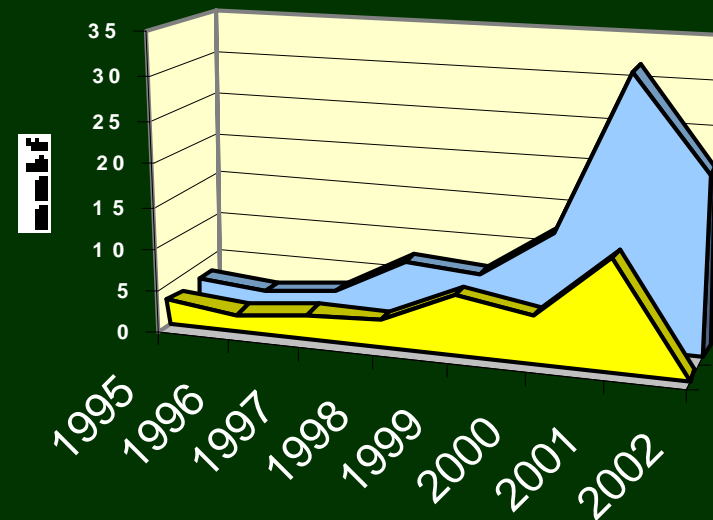
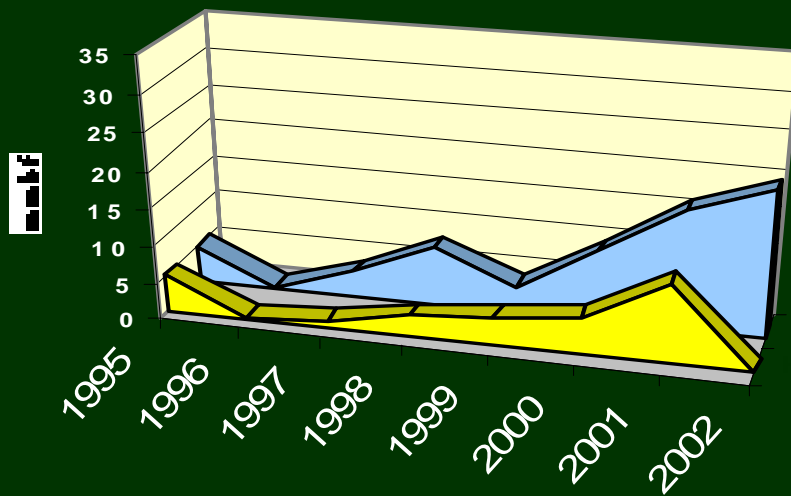
## Logs Offered versus Sold Coconino & Kaibab NF

■ Offered

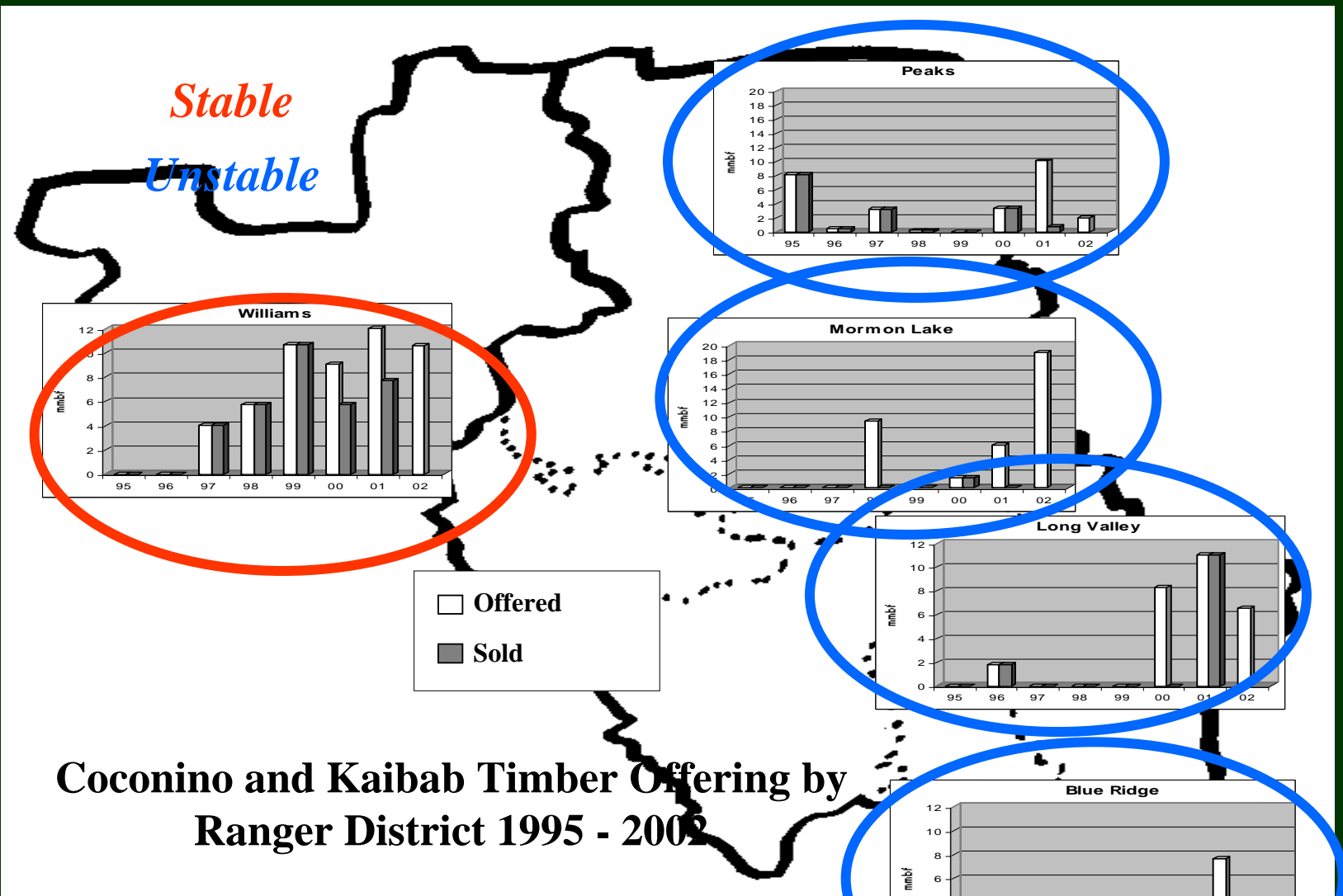
■ Sold

Small (5" – 8.9")

Large (9" +)



# Emerging Technologies – New Markets



**Coconino and Kaibab Timber Offering by Ranger District 1995 - 2002**

What we see:

- *No coordination* between NF systems in regions
- *No coordination* between USFS ranger districts
- *No coordination* with other agencies in region with harvest activity (BLM, state, DOT, etc)

... coupled with biomass-to-energy projects proving *not economically viable*

### What investors see:

- *erratic supply* at best; no level playing field
- *Uncertainty* where or when supply will come from in an investment landscape (~200 mile radius)
- *little information* on resource characteristics to be supplied
- *no investor risk mitigation* efforts within the investor landscape (agency coordination targeting risk factors)

What is clear:

- Change the dynamics of resource offering in an investor landscape . . .
- . . . where levelized supply and risk reduction are perhaps more important than increased volume.

*Latest projections prompting passage of the Healthy Forest Restoration Act*

- *190 mm acres* of forestland in US to be treated for fuel load reduction (~950 billion bf)
- *73 mm acres* will be on USFS land
- None of it currently is being coordinated for offering

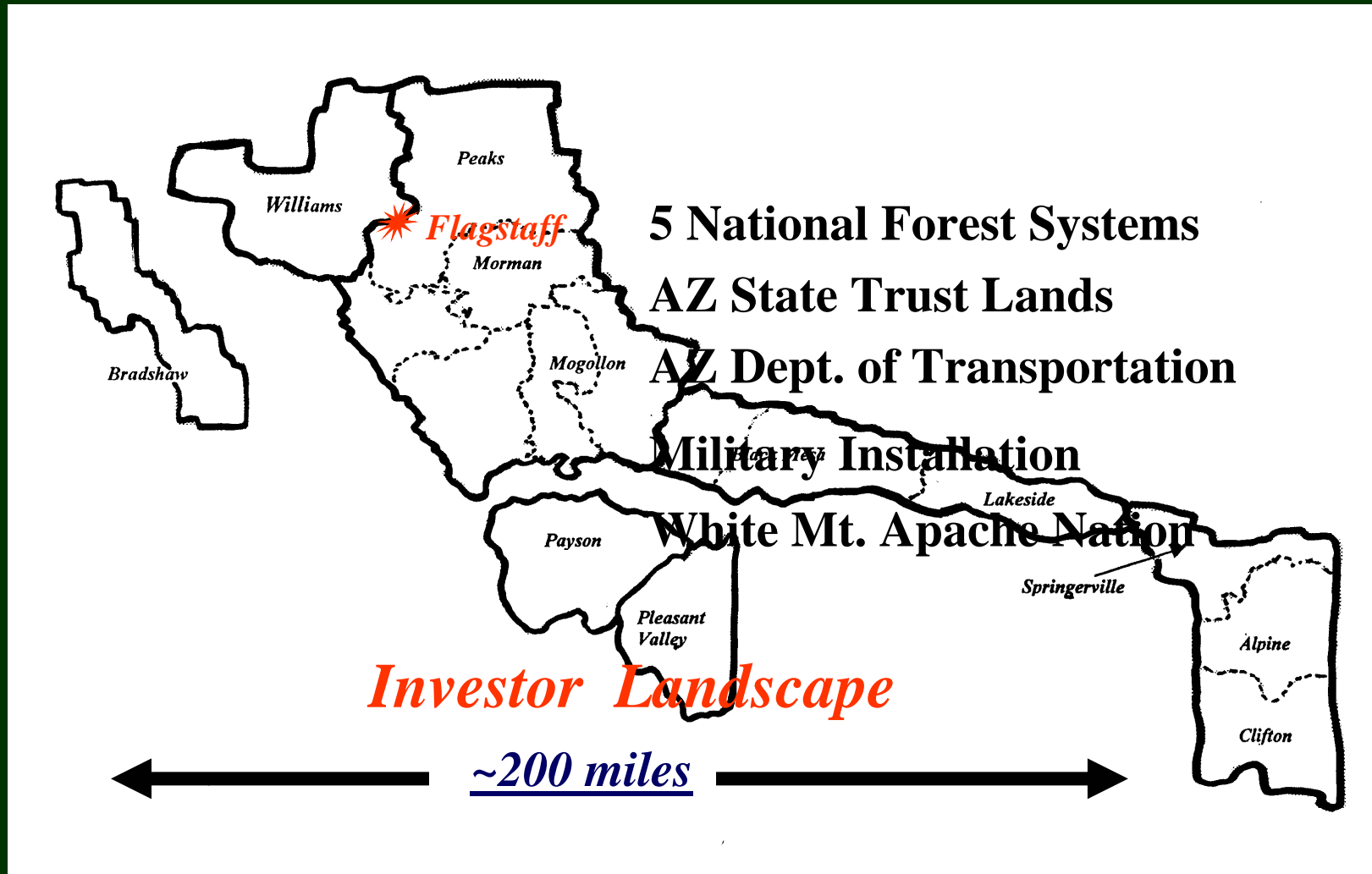
*Solution . . . Seed the **CROP***  
*Coordinated **R**esource **O**ffering **P**rotocol*

**CROP**

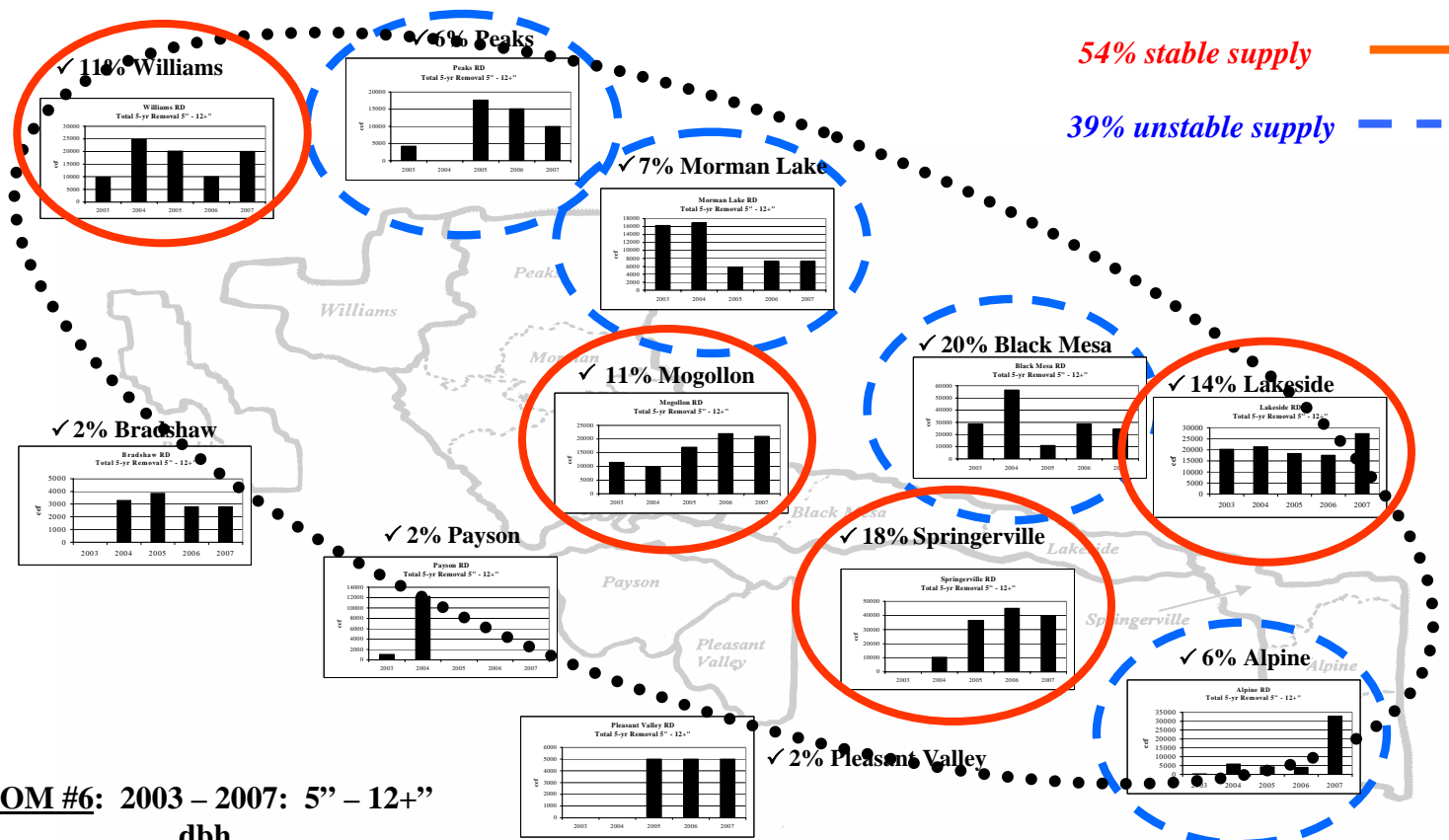
- ✓ Nation's first benchmark projects in investor landscape **coordination** of projected resource offering:
  - ***Within agencies*** (ie RD's within NF system)
  - ***Between agencies*** (USFS, BLM, state, Counties, Indian nations, etc.)

**CROP**

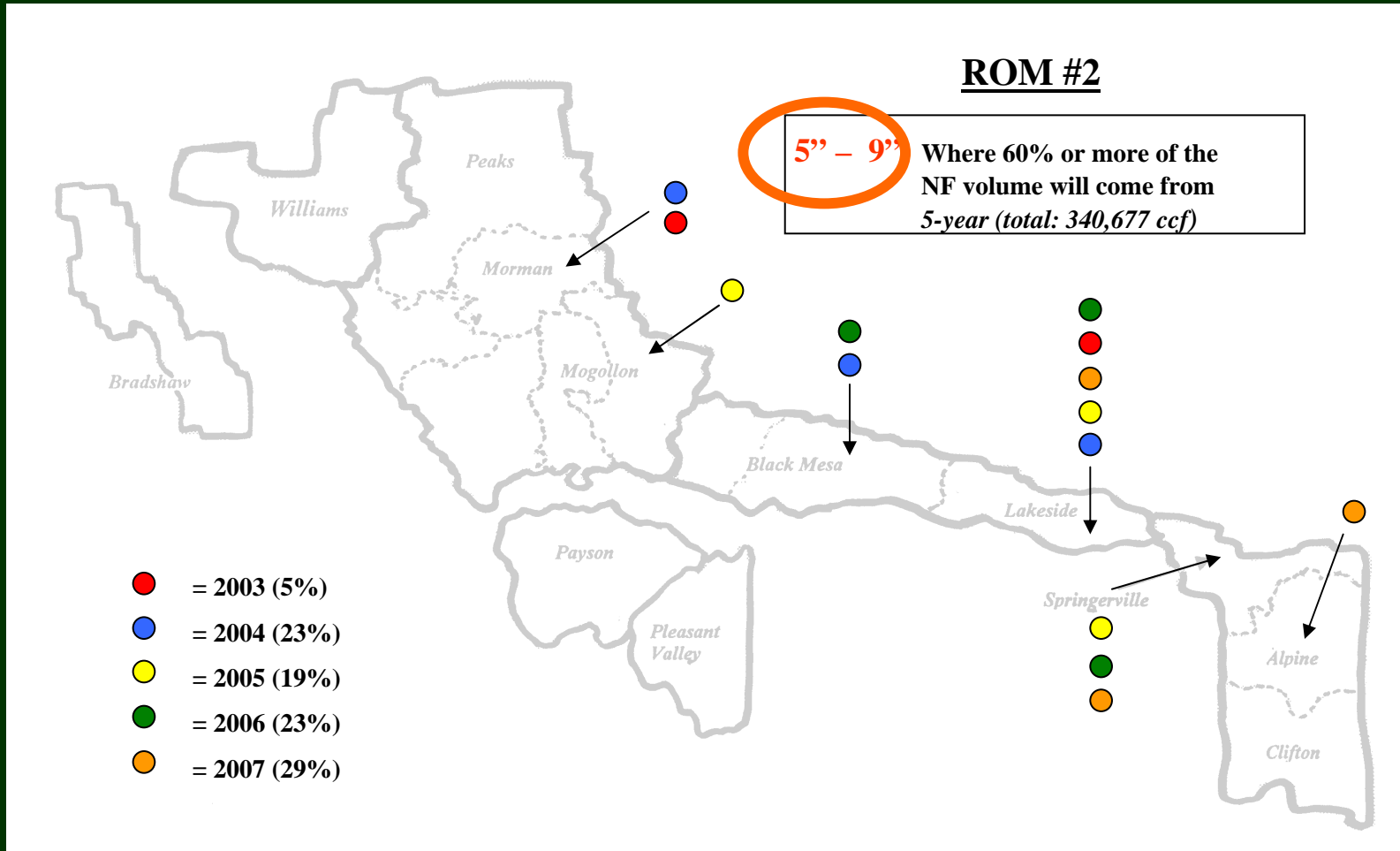
- ✓ **Premise:**
- Focus is on “*levelized*” supply between key players, not necessarily adding more supply.
  - “Levelized” effort must apply to *volume, diameter, and species* in locational context.

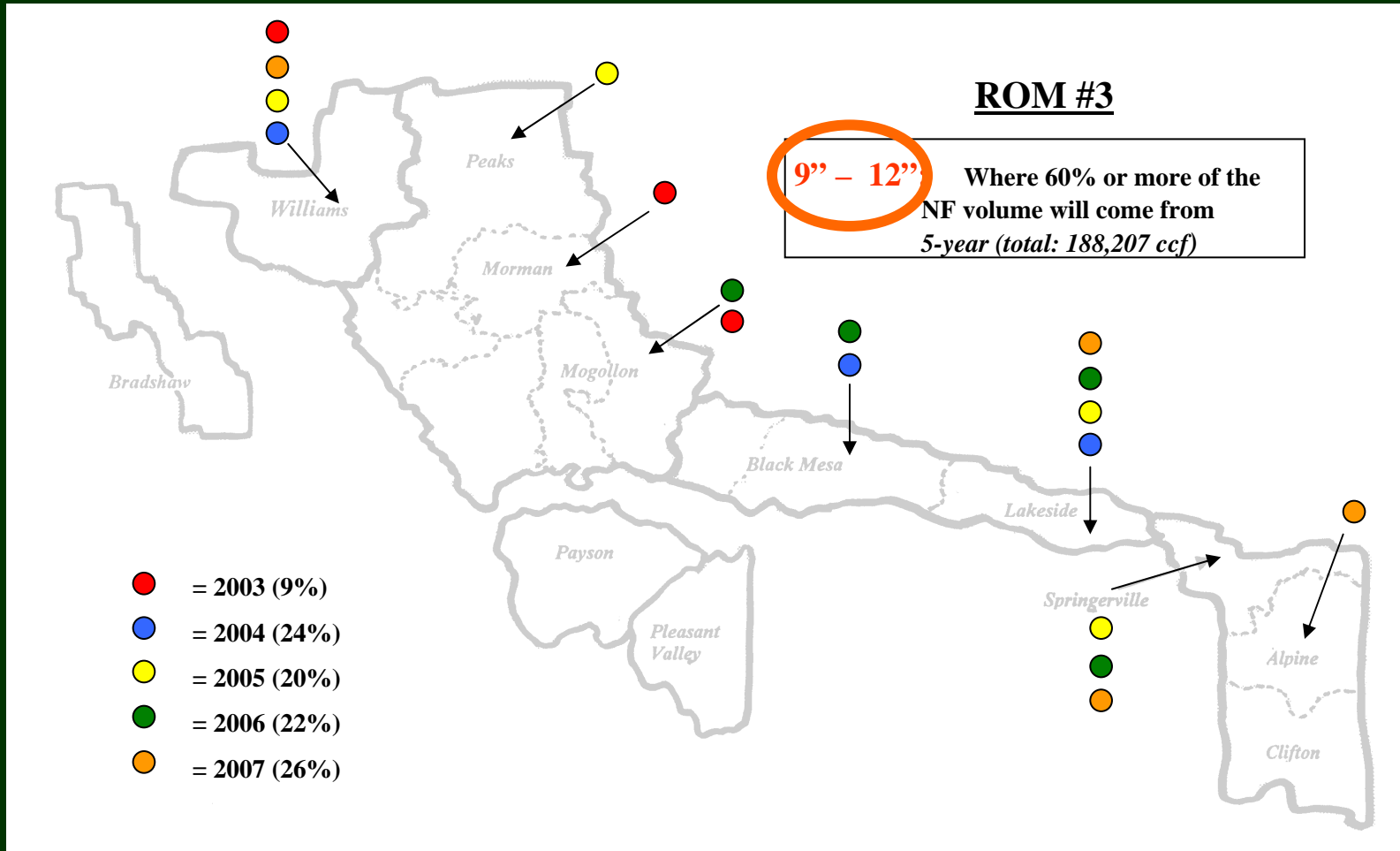


# Emerging Technologies – New Markets

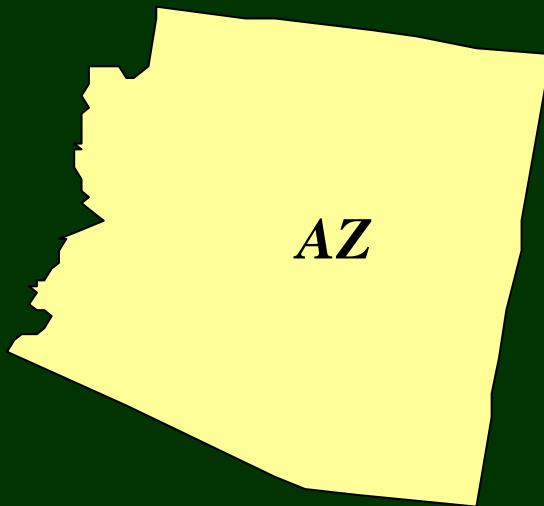


**ROM #6: 2003 – 2007: 5" – 12"**  
**dbh**  
**(741,904 ccf)**



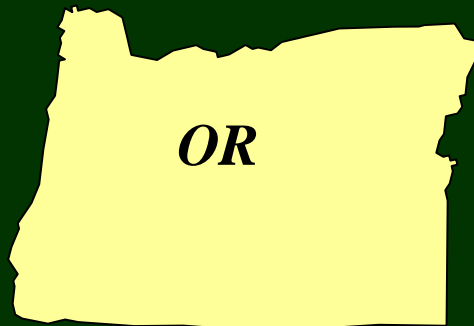


*Results thus far:*



Construction of a *new small log mill* just announced near Flagstaff.

- Small co-generation on-site.
- Fiber-reinforced plastic LVL manufacturing.



**Results thus far:**

Testing underway to enhance wood properties of two PNW “garbage” species with existing LVL operation for new joint venture operation

Technology producers now considering ‘next generation’ processing designs to match appropriate scale.

*And at the national policy level:*

**Requested briefing before the National Leadership Team of the USFS regarding CROP application as a policy direction (June 2004)**

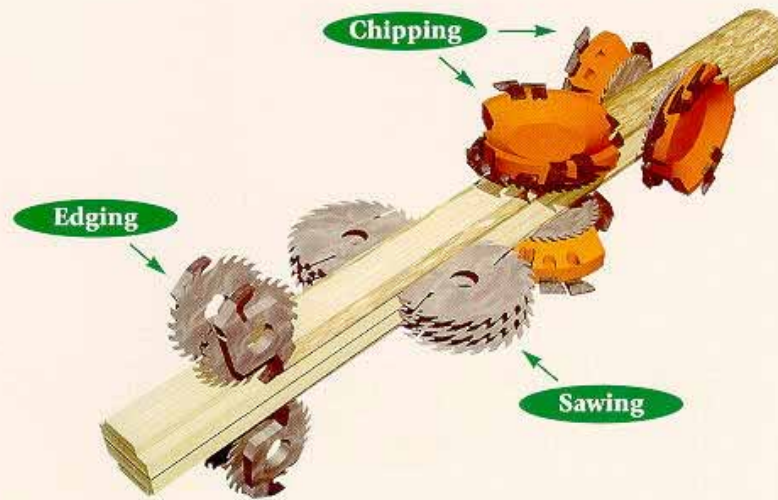
*What about these emerging technologies*  
proposed for CROP supply production?

*Let's take a look . . .*

*Small log processing:*

- Efficiently processes *3” – 12” dbh logs* into lumber through single – pass system.
- Cuts small logs in lengths of *4’ up to 20’*.
- Handles “*sweep*” & “*snake*” in logs by cutting along the curves. Significantly decreases wood loss, increases wood grade.
- Mills report increased recovery of *5% to 30%*.

**The HewSaw Concept...**



**High Recovery. High Production.  
Quality Lumber and Chips.  
All from a single pass machine!**

*Procedure:*

- ✓ *Representative logs:*
  - Restoration site logs (Ponderosa Pine)
  - 6” - 9” small end
  - Taper = 1.5” – 2” in 16’
  - 16’ length
  
- ✓ *No Special set-ups used.*

*5” to 9” 16’ Logs on Log Deck*

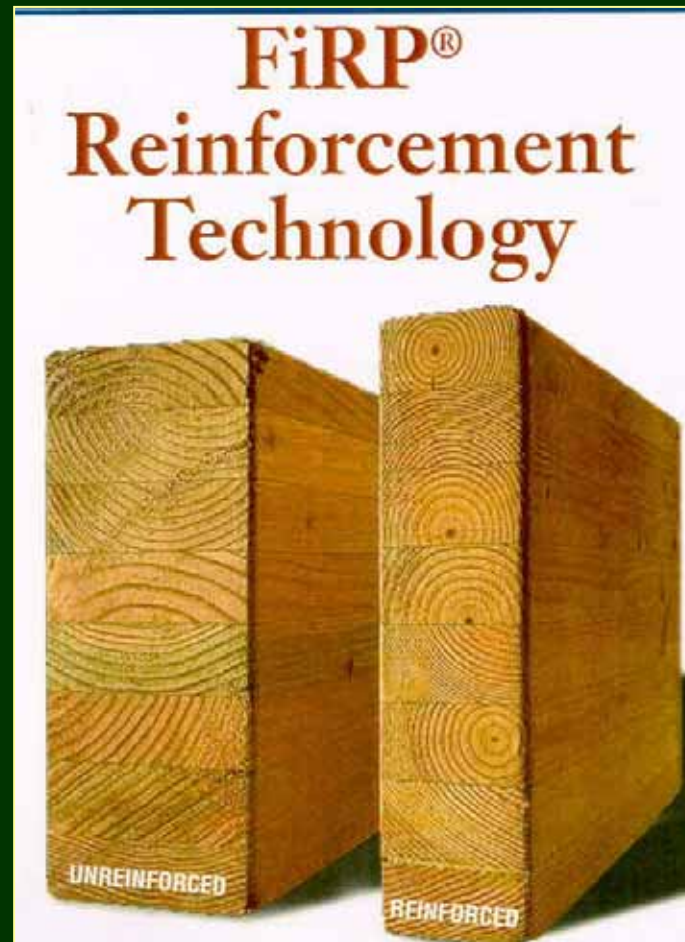


Mill Trial Results . . . .

- ✓ **Scaling defect = 8.5% (lower than normal)**
- ✓ **Overrun = 1.5% (normal)**
- ✓ **Production rate = 15 logs/minute (normal)**
- ✓ **Standard dry kiln schedule (72 – 96 hrs.)**
- ✓ **Kiln & trim loss = 3.5% (normal)**
- ✓ **Grade recovery = 80% 2+ btr.**

*Fiber Reinforced Plastic: (Glulam technology)*

- ✓ Allows use of *small diameter, low grade material* to be matched with high grade stock for *glulam* production.
- ✓ Employs *Greenweld* resin for lamination of reinforced plastic layer.
- ✓ Increased strength through use of FIRP technology allows *40% reduction in wood use*.
- ✓ Very desirable for “*green*” market application (Home Depot).

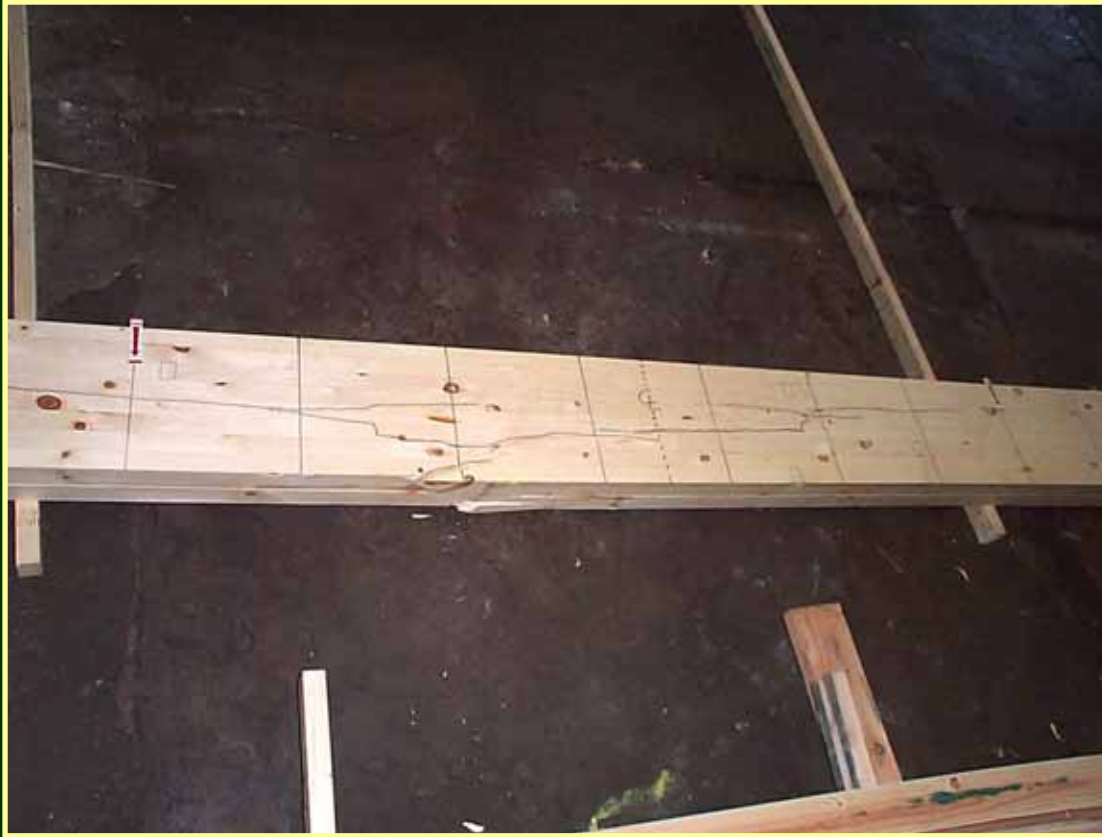






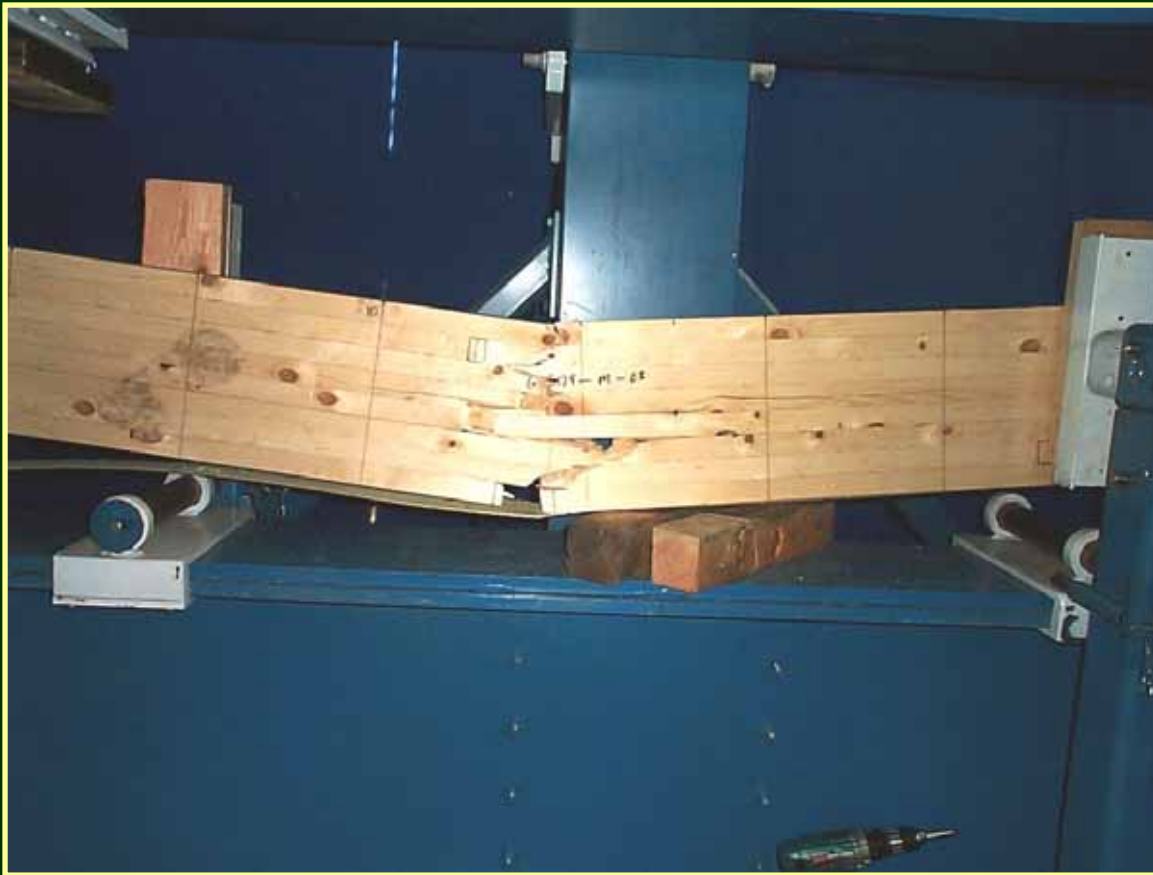






*Unreinforced*

◀ **Break at  
8164 lbs.**



*Reinforced*



**Partial Break  
at 13,489 lbs.**

**Full Break at  
+6,643 lbs.**

# Indurite™

WOOD HARDENING  
TECHNOLOGIES LIMITED

## Process to Enhance Natural Wood

New Zealand researchers have developed a method to improve the performance qualities of low density timbers, like pine, so they can be used in place of the finest quality hardwoods.

The result is an enhanced wood product with a density and hardness similar to hardwoods like mahogany, oak and heart rimu.

The Indurite process retains the natural feel and appearance of wood and has a wide variety of uses. As the world availability of hardwoods diminishes, the Indurite process will ensure that wood from renewable plantation species can take the place of hardwoods in applications ranging from furniture, flooring and joinery to plywood and veneer products.



## Indurite: (Wood hardening)

- Converts pine product to hardwood density for product application.
- Significantly increases fire rating of wood.
- Process application simple & affordable (from kiln to pressure vessel). Treatment completed in 10 days.
- Treated pine can be used in products where limited before (flooring furniture, etc).
- Can qualify as a “green” product (non-toxic, low energy, biologically-based)

## Screw Holding

In all tested cases the modified timber had a greater holding power than the control samples.

- End grain withdrawal increased by 20%
- Edge grain withdrawal increased by 16%
- Face grain withdrawal increased by 8%

## Nail Bearing

- Modified timber increased the shear strength by 67% and the stiffness by 47%. This is reflected by the increase of hardness in the modified timber

## Modulus of Rupture & Elasticity

### MOR

The maximum tensile or compressive stress value (whichever causes failure) in the extreme fiber of a beam loaded to failure in bending. *Increase of 12.5% to 16.8%*

### MOE

The ratio of the stress or load applied to the strain or deformation produced in a material that is elastically deformed. *Increase of 15.0% to 29.7%*

*Test results:*

- Hardness values showed a 27% increase in the heartwood regions and an 89% increase in the sapwood regions. *The weighted average increase in hardness was 64%*
- The density and hardness of the treated sapwood was *determined to meet flooring requirements* for domestic and international markets.
- *Increased fire register rating* to highest possible standard index for any wood species.

Finally, we look at *new project financing options* melded to forest restoration . . .

*. . . worth knowing about!*

## Federal New Markets Tax Credit (NMTC)

- ✓ Alters the economics of owning forestlands (*via lower-cost debt financing*) while assisting in facility development and upgrade.
- ✓ Focused on *low-income areas*.
- ✓ Creates *39% federal income tax credit spread over 7 years*.
- ✓ Fundamental tenants based on *sustainable forest management practices*.
- ✓ Latest funding round (May 2004): *\$6 billion* awarded fostering \$60 billion in total investment.

Cracking the Small Diameter Nut: *Summing up*

- ✓ **CROP and “levelized” supply.**
- ✓ **Emerging technologies.**
- ✓ **New project financing options.**

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