February 20, 1993

Interim Report

NON-COMMERCIAL WOOD SPECIES SLICING AND DRYING PROJECT

Cooperators:

USFS, Winema National Forest (Klamath Falls, OR.)
USFS, Klamath National Forest (Yreka, CA.)
USFS, Forest Products Laboratory (Madison, WI.)
Pacific Power and Light Co. (Klamath Falls office, OR.)
Sycan Forest Products (Dairy, OR.)
Rogue Valley Sash and Door (Grants Pass, OR.)
Western Veneer (Medford, OR.)

Project Purpose:

Increase interest of land managing agencies and private companies, as well as wood product manufacturers, in better utilization of four species which are traditionally considered non-commerical: Juniper (*Juniperus occidentales*), tan oak (*Lithocarpus densiflorus*), California black oak (*Quercus kelloggii*), and Pacific madrone (*Arbutus menziesii*).

Project Objectives:

1. Provide interested parties sliced veneer samples and information from this study to promote interest in better utilization of juniper, tan oak, California black oak, and Pacific madrone, and potential applications for secondary wood products.

2. Determine feasibility and compare guillotine slicer results for juniper, tan oak, California black oak, and Pacific madrone.

3. Provide rough baseline drying information for veneer dried and methods used.

4. Compare results of two different veneer drying methods using sliced veneer from juniper, tan oak, California black oak, and Pacific madrone. The two drying methods are: 1) Combination radio frequency (RF) and gas jet (dryer manufactured by Production Machinery, Inc. [PMI], Bend, OR.); and 2) Heated drums (prototype dryer at the FPL, Madison, WI.).

Sample Selection and Storage:

Bruce Goines, Klamath National Forest (NF), coordinated the procurement and transportation of two logs each of juniper, tan oak, California black oak, and Pacific madrone, to Sycan Forest Products, Dairy, OR. (located about 15 mi. east of Klamath Falls, OR.). Sample tree selection instructions were: 1) No "high-grading" - boles were to be representative of the stand and what was generally available in the area, 2) Minimum diameters at small ends of eight to ten inches, and 3) Ten-foot lengths (to accommodate the saw carriage at Sycan Forest Products). Selection may have been biased by the need for trees cut to be near open roads and able to be yarded using nothing more sophisticated than winches.

Juniper samples were taken from an open stand (80% crown closure) near Yreka, CA. According to locals, juniper had taken over this particular area within the last 40-50 years. Walt McGee, owner of

Sycan Forest Products, characterized the growth rings as "brash" (fast growing). Diameters were 10-14 inches.

Tan oak and madrone samples were taken from a mixed Douglas-fir/hardwoods stand about 40 miles west of Happy Camp, California, in the Klamath River drainage. The stand had 100% Douglas-fir crown closure with an average DBH (diameter at breast height) generally less than 25-inches. About 70% of the basal area of the stand was Douglas-fir and 30% was hardwoods.

California black oak samples were cut closer to Happy Camp, from a stand harvested within the last five years using an "overstory removal" prescription. Essentially, all hardwood samples grew under a canopy closure. Tan oak and California black oak diameters averaged 16-18 inches, and madrone diameters averaged 10-12 inches.

Trees were cut and limbed in early November (1992) and delivered to Sycan Forest Products about 10 days later. Upon arrival, they were stacked in an uncovered area in the mill yard until the mill was ready to process them in mid-December.

During the approximate six-week period the logs were decked, local weather was colder and wetter than normal. Although temperatures in November were only slightly below normal, averaging 36.3 degrees Fahrenheit, and precipitation was slightly above average (1.66 inches), a marked difference was experienced the first two weeks of December. Temperatures were much colder (24 degrees Fahrenheit) and there was much more precipitation than normal (almost 18 inches of snow).

Flitch Manufacture:

Flitches were made from sample boles on December 15, 1992. The wood was essentially frozen when milled. Minor end-checking was observed. No obvious defect was visible to an untrained observer.

Logs were milled using a circular saw head-rig. They were not peeled beforehand. The sawyer was given instructions to cut flitches approximately 6-8 inches by 8-10 inches. One-inch boards were cut as flitches were manufactured. No problems were reported by the sawyer, other than the small size of the logs made handling slightly more difficult.

Examination of flitches after sawing did not reveal any obvious gross defect and they were transported to Rogue Valley Sash and Door the same day (December 15). The one-inch boards resulting from sawing the flitches were split between the Forest Service and Sycan Forest Products. The Forest Service portion was stacked in a heated warehouse (average temperature 65-68 degrees Fahrenheit) with stickers at least every 12 inches. Forest Service dried lumber will be used for other non-traditional species manufacturing process demonstrations.

Flitch Conditioning and Slicing

Flitches were placed under an enclosed overhead sprinkler system immediately upon arrival at Rogue Valley Sash and Door. At that time, David Eckroth, Plant Manager, pointed-out black lines in the Pacific madrone and California black oak flitches which indicated probable defect.

The majority of the flitches were sliced with a guillotine slicer on February 1, 1993. The one exception was a tan oak flitch which was sliced the week before. It was discovered at this time that rather than two

of each species, there were three tan oak flitches and only one California black oak flitch.

Prior to slicing, flitches were placed in a steam bath for 8-12 hours at 190 degrees Fahrenheit. All slicing was done at the end of the day to preserve knife sharpness for normal business. All slices were 1/14-inch (.071 inches) with the exception of the juniper, which was sliced 1/16-inch (.062 inches) because of a previous job set-up.

Total number of slices were:

Madrone (2 flitches) = 152 pieces
Tan Oak (3 flitches) = 294 pieces
Black Oak (1 flitch) = 86 pieces
Juniper (2 flitches) = 173 pieces

Slices were stacked on a pallet, banded, and left in a warehouse until picked-up on February 9, 1993. A minor amount of mold was apparent on the exposed ends of some of the slices at the time they were picked-up.

The following are comments from Carl Tessen, Rogue Valley Sash and Door, who is in charge of conditioning flitches and operates the slicer:

1. Machine Time - Slicing and handling time was about 30-35% greater for the non-traditional species, as compared to pine or Douglas-fir. Total slicer time for six flitches was about one hour.

2. Flitch Milling - A fairly smooth, flat surface is needed to "chuck up" the flitch to the slicer (operates on a vacuum basis). The small juniper and madrone flitches were more difficult to secure firmly.

3. Flitch Preparation - According to Carl, wood needs to be "hot" to slice through knots. He tried putting the black oak flitch directly in the water of the steam bath, but it bent. In the future, he suggested banding flitches together in the steam bath to keep them straight and make them as hot as possible.

4. Slice Handling - Carl said his crew had no trouble handling the black oak or tan oak as slices came off ("tailed off") the knife. However, both the juniper and madrone were "noodly" and had to be restacked. If he were going to slice madrone or juniper consistently, Carl said he would want to consider some type of "slide", so assistants would not have to catch each slice and stack it.

5. Defect - One madrone flitch was full of defect and "fell apart" as it was sliced. The black oak flitch also had extensive defect.

6. Slicer Capabilities - The guillotine slicer at Rogue Valley Sash and Door can take lengths from 24-101 inches. Maximum width for flitches is 8-10 inches and maximum height is 6-8 inches. Minimum face width is 3 inches. Optimum flitch for production purposes is 6 inches by 5 inches by 8 feet.

Veneer Drying:

Approximately half the veneer sliced was dried at Western Veneer, Medford, using a newly installed "Radio Frequency" (RF) dryer made by Production Machinery, Incorporated (PMI) (Bend, OR.). The remainder was shipped to the FPL, Madison, WI., for drying using a prototype "drum dryer". Following is a table of the results and dryer settings for the Western Veneer RF dryer:

Species	Thickness	Moisture Content	Dryer Setting	Results
Pine	1/10"	25-30%	40%/350 degrees	Control. MC=8-10%.
Juniper	1/16"	55-60%	40%/350 degrees	MC=3-4%. Wavy/cracked/brittle.
Juniper	1/16"	45-60%	40%/300 degrees	MC=4-12%. Darker-colored heartwood tending to dry at edges, but not cntr. or knots. Lighter-colored sapwood dried flat with no cracking.
Juniper	1/16"	30-40%	60%/300 degrees	MC=3-12%. Second pass for slices with alot of dark heartwood. Dried fairly flat, but saw a few cracks develop along pin knots in heartwood.
Juniper	1/16"	30-40%	60%/325 degrees	MC=4-12%. Second pass for slices with alot of dark heartwood. Saw a few crack develop along pin knots in heartwood. Came-out slightly wavy.
Madrone	1/14"	60-70%	40%/300 degrees	MC=25-50%.
Madrone	1/14"	35-50%	40%/300 degrees	MC=6-8%. Second run. About 20-30% of material was very dark and cracked easily, even when still 25-30% MC. Based on several runs, did not even try other madrone with this appearance.
Madrone	1/14"	60-70%	20%/300 degrees	MC=6-14%. One run. Very flat and even.
Tan Oak	1/14"	30-80%	20%/350 degrees	MC=3-10%. One run. Very flat and even. No experimentation needed. Samples had very few knots.

Note: *MC = Moisture Content (measured with a handheld hygrometer)

Species	Thickness	Moisture Content	Dryer Setting	Results
Black Oak	1/14"	30-60%	20%/350 degrees	MC=4-12%. One run. Fairly flat and even. No experimentation needed. Defect came out burning, so ended up not putting in about 25% of samples.

Note: Measured juniper thickness after drying to see if could edge-glue with machinery available at Western Veneer. Thickness varied in samples measured from .062-.074 inches, edge to edge of same piece, to .059-.057 inches, edge to edge of same piece. Probably not enough samples measured to say anything, but none were left for any edge-gluing trials. Measured tan oak and madrone thickness after drying - same pieces, edge to edge were .068 to .072 inches; .070 to .071 inches. Several samples of black oak were also measured for thickness after drying - most did not vary much (averaged .070 inches).

Several samples of tan oak, Pacific madrone, and California black oak were left with Mick Icenhower, Plant Superintendent, to try edge gluing. Juniper samples were not left because thicknesses appeared to vary too much for the equipment available. Dried samples were also left for PMI.

Mike later reported that attempts to use Western Veneer's edge gluing equipment with the veneer left were not successful. Apparently, the firm's older-model Dehel edge gluer was not set up for the thickness and edge variation present in the samples.

Shipment to FPL

About half of the sliced, undried veneer samples was covered with two layers of visqueen and shipped to the FPL on February 15, 1992. Samples were strapped with plywood backing. Due to a holiday, samples were left in a warehouse (temperature near freezing) for about one-week before shipping. Samples dried with the RF dryer were also sent.

FPL Observations

Steve Loehnertz reported receiving the sliced veneer samples around the first of March. Drying tests using the prototype heated-oil drum dryer were attempted, however, the veneer was too thick for the current design. In its present configuration, as Steve stated prior to receiving the samples, the drum dryer only heats one side at a time and moisture basically moves back and forth from one side to the other in thicker veneer. The current prototype is more suited for veneers 1/32-inch or thinner, with species which might have problems with buckle and waviness. Steve did comment that the pieces he managed to dry looked very good and the RF dried veneer looked "beautiful".

Preliminary Summary

Three out of the four project objectives were accomplished or are still in progress:

1. Sample Veneer Slice Distribution - Samples were distributed to various organizations and wood products manufacturers throughout Oregon and Northern California. This process will continue as long as samples remain. Besides the cooperators on this project, samples were given to Oregon

State University (Forest Products Department), various manufacturers at a February (1993) Secondary Wood Products Manufacturers Conference in Portland (sponsored by the Oregon Wood Products Competitiveness Corporation [OWPCC]), and representatives of the Forest Service Regional Offices in Portland and San Francisco, Oregon Department of Economic Development (OEDD), Siskiyou Economic Development Council, and Fremont National Forest.

Interest was expressed by various wood products manufacturers in the Rogue and Willamette Valleys in the hardwoods obtained from the Klamath NF, especially the madrone and practically clear tan oak. A meeting is planned to further explore manufacturer interest once preliminary data is summarized about volume, economics, accessibility, and environmental review requirements. This will hopefully be accomplished within the next three months.

Interest was also expressed about juniper by several manufacturers. One supplier of novelty material could see immediate uses, as well as a supplier of lumber for high-quality furniture makers. Surprisingly, no one mentioned use of juniper as a substitute for Eastern red cedar veneer now used in boxes and chests for its supposed insecticidal properties. Followup is planned once preliminary data is gathered about volume, economics, accessibility, and environmental review requirements. A one-day juniper conference, focused on manufacturing process and products, and perhaps potential markets, has been proposed in late September or early October in Bend, Oregon.

2. Guillotine Slicing - Results indicate that using a guillotine slicer on juniper, tan oak, California black oak, and Pacific madrone flitches is feasible, at least for the thicknesses produced for this project (1/14-inch for all species but the juniper, which was sliced 1/16-inch). There was some concern prior to slicing that frequent knots might present problems. However, the conditioning process used by Rogue Valley Sash and Door (see previous description) appears to have addressed this situation.

   The estimated 30-35% increase in machine time required for sample flitches, as compared to carefully prepared clear Douglas-fir or pine flitches, can probably be reduced. For example, defect can be more carefully monitored and a better surface for the vacuum system used to manipulate flitches can be prepared.

   Quality can also be improved. Stanley Niemiec, Wood Products Department, OSU, observed that the quality and appearance of the slices sent to him could have been improved by manufacturing flitches with slicing in mind, and slicing flitches in a manner to expose the most attractive grain.

3. RF Dryer Baseline Information - Results are visible in the chart provided previously. Given previous experience with hardwoods at Western Veneer, RF drying of California black oak, Pacific madrone, and tan oak presented no difficulties. Slices dried flat and moisture content was within acceptable ranges (averaging 8%). Excessive defect in the black oak had to be removed prior to drying, however, and defect present in what was assumed to be madrone heartwood split and cracked no matter what was done.

   Juniper slices were dried in two passes. Evidently, the presence of light sap wood, dark heartwood and numerous knots presents a real challenge for any drying method. It may be possible to dry the juniper in just one pass if other combinations of RF strength and belt speed are used. However, the objective here was not to produce a definitive drying schedule, rather it was to demonstrate feasibility.

4. Comparison of Two Drying Methods - The sliced veneer thickness used in this project were too thick for efficient use of the current design of the prototype heated-drum dryer at the FPL. No comparisons were attempted.

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