#### **INTERIM REPORT**

#### WESTERN JUNIPER UTILIZATION AND MARKETING PROJECT

#### **INTRODUCTION**

Several months ago, a partnership was formed in Klamath County, Oregon, to explore better utilization and markets for Western juniper (*Juniperus occidentalis*). The primary impetus for the project were high demand and costs for a diminishing supply of traditional wood fiber, local economic development interests, and at least one local manufacturer's interest and previous experience with Western juniper. In addition, there is a pervasive feeling in Eastern Oregon and Northeastern California, both in public and private sectors, that at least a part of the juniper being eradicated through programs subsidized by Agriculture and Stabilization Service (ASCS), could be better utilized than simply being knocked over, piled, and burnt.

The partners involved in Phase I were: Oregon Economic Development Department (OEDD) (Bruce Laird), Sycan Forest Products (Walt McGee), Klamath County Economic Development Association (KCEDA) (Craig Rozvar), Pacific Power and Light (PP&L) (Larry Holzgange), and US Forest Service, Winema National Forest (Larry Swan).

#### PHASE I DESCRIPTION

Phase I of the Western Juniper Utilization and Marketing Project consisted of a full day's production run at Sycan Forest Products oriented towards the fence board blank market. Besides testing the fencing market, objectives were to establish: 1) Baseline scaling information for Western juniper in the immediately surrounding subregion; 2) Potential harvest and production rates and costs; and 3) Baseline fiber recovery. Costs will not be discussed in this report due to their proprietary nature. Chris Cornett, a sawmill consultant hired by OEDD, provided many of the observations and recommendations outlined in this interim report.

Sycan Forest Products is a medium-size mill (6-8 million board feet per year capacity) located about 15 miles east of Klamath Falls, in the small unincorporated community of Dairy. The mill previously processed incense cedar, but was suffering a severe raw material shortage as supply decreased from private and government sources.

#### Harvest and Yarding

Western juniper logs utilized for Phase I came from private land within 10 miles of the Sycan Forest Products and were harvested from two types of stands common to the subregion: 1) Open-growing, homogeneous juniper stands (called "Intermediate" juniper by Sycan Forest Products), ranging in density from 25-50 stems per acre, with possibly 20-30% merchantable using Sycan Forest Products transportation and milling constraints (minimum 25 ft. logs, small end of 6 in.); and 2) Mixed ponderosa pine and juniper. It is estimated juniper stems average 30-40 per acre in the mixed pine and juniper stands, with approximately 50% merchantable using the same transportation and milling constraints. Overall, juniper from "intermediate" stands is shorter, and has more taper and branches than juniper mixed in with ponderosa pine. About 4 acres of an "intermediate" juniper stand and about 6 acres of a "mountain" juniper stand were logged for Phase I. Trees were harvested using a conventional system of fallers and grapple-equipped, rubber-tire skidders. Target size of limbed boles was around 25 ft. with 6-8 in. tops. Minimum mill requirements were 10 ft. boles, however, standard log truck "reaches" could only be reduced to allow a minimum 25 ft. bole.

All loads were weighed prior to being spread out in the mill yard for scaling. Load weights were tracked through scaling and total weights for juniper from the two different stands were tracked through final green lumber tally. A total of 10 loads (6 "intermediate" and 4 "mountain") were brought into the mill for Phase I, totaling 354 logs (312,110 lbs).

## Scaling

Certified scalers from the Forest Service, Bureau of Land Management (BLM), and Southern Oregon Log Scaling Bureau, scaled the juniper logs in the Sycan Forest Products mill yard. Logs were separated by load and rolled out. All loads were scaled Eastside Scribner, as presented, and Eastside Cubic, as presented. In addition, one load each from "mountain" and "intermediate" stands were scaled in "preferred lengths" (6 ft. multiples, with a 6 in. minimum small end diameter), Eastside Scribner and Cubic. None of the scalers had previously scaled juniper.

## Processing

Logs were broken down with a circular saw headrig with applied carbide teeth. Minimum length bole into the headrig was 16 ft. Secondary breakdown was accomplished with a twin band mill with computerized line bar set works, 2 edgers with setting saws, and a 16 ft. drop trimmer with 2 ft. saw spacing. Logs were not debarked and waste was processed through a hammer hog and sold for boiler fuel.

Targeted board sizes were 1 5/8 in. by 4 in., 6 in., and 8 in. These sizes were chosen to give a fencing remanufacturer comparable blanks to current supplies. End product targeted was fence boards, 3/4 in. in thickness by 5 or 6 ft. in length. To improve recovery, 4/4 material was also produced.

# Grading

A certified grader from the West Coast Lumber Inspection Bureau graded the boards produced under rules focused on the fence board market.

- 1. #1 Fence Stock Best face graded. Pieces had to contain 2 or more cuttings of #2 plus and better "no hole" fence grade 5 ft. or longer in pieces 12 ft. and longer, and one cutting 5 ft. or longer in pieces 10 ft. and shorter.
- 2. #2 Fence Stock Best face graded. Pieces had to contain one cutting 5 ft. or longer of #2 plus and better "no hole" fence grade 5 ft. or longer in pieces 12 ft. or longer.
- 3. #3 Fence Stock Best face graded. Pieces did not have any cuttings 5 ft. or longer of #2 plus and better "no hole" fence grade.

# Remanufacturing

Remanufacturing of green lumber was done by Fresno Pallet, Inc., located in Fresno, California. Machining consisted of a center sawn vertical band mill, manual swing arm chop saws (with moveable lumber stops), and a "dog ear" machine. Only a sample of the material was remanufactured to fence board specifications due to problems encountered with green juniper stability.

## Drying

Approximately 1600 board feet (bf) of the 4/4 material left over from Phase I processing was air dried at the mill site. Board sizes ranged from 4-8 in. in width (2 in. increments), and 8-16 ft. in length (2 ft. increments), and included a mix of grades. Air dried lumber was placed on stickers about 2 ft. apart, banded, and placed under a high-roofed storage area.

Approximately 7000 bf of 1 5/8 in. juniper was kiln dried in a dehumidification kiln at North Douglas Wood Products, Drain, Oregon. North Douglas Wood Products often deals with different hardwood species, but their primary focus is alder. Kiln dried lumber sizes ranged from 2-8 in. in width (2 in. increments) and 6-12 ft. in length (2 ft. increments). Using the grading rules established for the Phase I production run, the material kiln dried included about 4900 bf of #3 fencing grade and 2200 bf of #2 fencing grade. No #1 fencing grade juniper was kiln dried. After drying to 8-10%, all material was surfaced both sides to a finished thickness of 1 3/8 in. using a helical-head, carbide-tipped hardwoods planer.

# PHASE I RESULTS

# Harvest and Yarding

Sycan Forest Products reported that, for the most part, harvest and yarding were similar to previous experience. Problems encountered centered around the extra time necessary to delimb juniper (from 10-15 minutes per tree) and need for specific bole lengths due to size constraints of conventional log truck "reaches" (minimum 25 ft.). As expected, time and costs associated with delimbing juniper were higher than desirable. One suggestion to reduce delimbing costs was to whole tree skid and use a mechanical delimber. A brief report of a small trial run using a mechanical delimber is included later in this report under Phase II.

# Scaling

Conventional scaling rules are obviously difficult to apply to Western juniper due to taper, deep bark pockets, and some type of fungus (see "Phase I Data Table" for results). For example, net Eastside Scribner, as presented, yielded 10,720 board feet (bf), as compared to the total tallied lumber output of 36,828 bf. Results were improved by using cubic scaling rules.

Even a better method, however, may be establishment and use of a correlation between yield and weight. Reasons for this include: 1) There are commonly 30-35 boles per load; 2) Juniper presently has little or no value;, 3) There is a high amount of defect (as defined by current rules); 4) There is little relation between standard scaling results and tallied lumber output; and finally, 4) Use of scales is far cheaper for the purchaser or manufacturer than having a scaler on duty. Of course, further work would have to be completed to ensure consistency between subregions and types of juniper.

Scalers noted obvious differences overall between "mountain" and "intermediate" juniper. "Mountain"

juniper has larger and longer boles, greater number of bark pockets and seams, and more defect in general. In fact, one observer remarked, after seeing the mill run, that it may not make sense to bring logs to the mill over 24 in. DBH, based on recovery. "Intermediate" juniper, on the other hand, has greater taper than "mountain" juniper, less defect, smaller and shorter stems, and more knots. Grade recovery, as migh be suspected, was higher for the "intermediate" than the "mountain" juniper.

## Manufacturing

No major problems were reported in manufacturing. One area of concern was the effect of juniper knots and harder wood in general (at least than incense cedar or pine) on equipment. No obvious signs of increased wear were evident, however, when sawyers checked saws after the 2-day run. In fact, the sawyer on the headrig thought juniper sawed easier than incense cedar, in part due to tighter knots.

In terms of recovery, material coming into the mill weighed 321,110 lbs. Hog fuel total weight was 167,340 lbs. and the weight of mill yard trimmings was 16,740 lbs. (or 10% of total waste). After subtracting these two measures of waste from the beginning green weight of all material, the remainder is 137,030 lbs., which is assumed to represent a reasonable estimate of recovery by weight (about 43%). Recovery could be improved by bucking logs in the woods to milling lengths determined by end product requirements (assuming something other than standard log trucks are available), and retrofitting the mill to handle shorter log lengths. As a side note, at least one of the two purchasers of hog fuel from Phase I (power generation plant at Honey Lake, California) welcomes juniper waste and currently has two logging crews chipping juniper near Alturas, California.

# Grading ·

It appears juniper is graded best under rules similar to incense cedar, yielding 3 and 4 Common. A percentage of the material would also make "Select Tight Knot" (STK), a grade used by redwood, incense cedar, and western red cedar manufacturers. Additionally, a percentage of the lumber form the outside portion of the bole could be graded under shop rules for clear rips or cuttings, or "Paragraph 99" for finger joint cutting (per Chris Cornett, OEDD consultant).

Under the rules used, about 29.2% of the production run was graded #1, 31.6% as #2, and 35.0% as #3. About 4.2% was 4/4 miscellaneous and not graded. According to Calvin Wytcherley, West Coast Lumber Inspection Bureau. the "intermediate" juniper has by far a larger percent of higher grade fencing (estimated increase of 20% +) than the "mountain" juniper.

# Remanufacturing

Initial results of Phase I were encouraging at the mill: Recovery, appearance, and grade were better than expected, with a high percentage of boards yielding #2 "no hole" fence grade or better (totaling over 66% of the production run). Unfortunately, the green juniper began displaying characteristics during the remanufacturing process which raises questions about its instability in green lumber form (bow, crook, and warp), which probably renders it unsuitable for the fence board market.

Fencing panels were constructed at Fresno Pallet, Inc. to test initial impressions gained from the first samples sawn. After 2 days, unacceptable distortion was evident. Basic reasons for distortion appear to be a high percentage of pieces with large amounts of heartwood, large edge knots, and natural grain twist in a small percentage of the material. Observations made about 45 days after the panels were constructed

suggest that pieces with less than 10% heartwood may "bow" or "warp" very little. Based on these initial results, the remanufacturer suggested testing the juniper on hand for one-way pallets. According to reports received and observations made of sample pallets, this suggestion appears promising. There are also reports that pallets are currently being made of a different juniper species in Phoenix, Arizona.

# Drying

The material left at Sycan Forest Products for air drying dried much more quickly than expected. For example, 4 days after the mill run material to be air dried was stacked, stickered, and banded. By that time, sap wood moisture content (MC) averaged 30% and heartwood MC 22% (for comparison, MC of recently harvested green juniper was about 40%). Within 3 weeks, MC in both sap and heartwood evened-out around 12%. According to the person taking MC readings, conditions at the mill site were ideal for air drying for about a week - light to moderate, warm, dry winds. No excessive shrinkage or cracking were observed, and boards appeared to remain straight.

The kiln dried material also dried faster than expected. Due to several power outages, however, an exact kiln schedule is unavailable. Average MC when removed from the kiln was between 8-10%. Following are comments of Chris Cornett, OEDD consultant on this project:

- 1. Although dehumidification kilns are considered to dry more gently than conventional gas jet kilns, they lack the capability to equalize or condition charges, which may prove critical to reduce warp, checking, and hard casing.
- 2. No extensive shrinkage was observed (perhaps 1/8 in. in thickness), and boards appeared to remain basically flat and straight.
- 3. Shorter and narrower pieces showed less distortion (according to Mike Grimes, North Douglas Wood Products, probably less than 2-3% of the sample kiln dried warped to any noticeable degree, and most of this was due to grain twist).

Overall, Cornett reported that the drying defects he observed were common to all species with high heartwood to sapwood ratios.

Remanufacture of Dried Material

Planing results of the kiln dried material appeared good, although some knots and certain grain patterns appeared to raise and fuzz. One observation was that in many instances, this appeared on the sides of boards cut by the circular saw headrig, and not the band saw. There was also some variation in board thickness resulting from initial processing.

A sample of kiln dried juniper was finger-jointed and edge-glued at North Douglas Wood Products (about 1,900 bf). According to Mike Grimes, the juniper sample acted much like "cedar" during set-up (somewhat "springy"), but was harder. He also said there were no problems with knots along edges. However, a <u>much</u> lower than expected recovery (10-15%) resulted due to fine splits and cracks in both heart and sapwood (as compared to alder, which averages 40% recovery from lumber to finished product). The cause(s) of the fine splits and cracks are unknown at this time. It does not appear to be present in the air-dried material, but closer examination and comparisons are necessary.

Both air and kiln dried juniper lumber will be remanufactured by other secondary wood products manufacturers in Oregon and California. About 5,200 bf of the kiln dried lumber and 1,600 bf of the air dried lumber were distributed in July to interested manufacturers. A variety of products will be produced, ranging from finger-jointed, edge-glued panels to high-end furniture, and novelties to tongue-and-groove, edge-matched paneling. All manufacturers receiving dried juniper have agreed to appear, show products, and discuss results at a "Juniper Forum" planned for September 1, 1993, in Bend, Oregon (Shiloh Inn).

#### PHASE II DESCRIPTION

Phase II of the Western Juniper Utilization and Marketing Project was smaller in scale than Phase I, and focused on two problem areas identified in Phase I: Harvest practices and costs, and green lumber market niches. Partners participating in Phase I were the same, with the addition of Huffman-Wright Logging.

#### Harvest Practices and Costs

One area of concern when harvesting Western juniper is the high costs relative to volume harvested, at least when compared to harvest costs of current commercial species. For example, due to the large number of limbs, it takes an average 10-15 minutes for a faller to fall, limb, and buck a standard merchantable tree (12-16 in. DBH and 30-40 ft. in height), which may only have 75-100 bf tallied lumber output after initial processing.

In June, 1993, a mechanical delimber owned and operated by Huffman and Wright Logging was used on private land in an "intermediate" stand of juniper near Dairy, Oregon. The delimber was mounted on a Linkbelt tracked carriage and had a "Denis" (sp?) head. A grapple-equipped, rubber tired skidder was used to whole-tree skid to the delimber from a logging area of about 10 acres. Harvested trees averaged 12-14 in. DBH and 30-35 ft. in height. About 85 trees were delimbed during the trial.

#### Manufacturing

The primary focus of the second mill run was landscape timbers (6 in. by 4-8 in., in 2 inch increments). As a byproduct, 7/4 by 3 3/4 in. and 5 3/4 in., and 4/4 by 3 3/4 in. and 5 3/4 in., boards were produced (random lengths). A total of 175 boles were processed. The reasons for the focus on the landscape timber market were: 1) Sycan Forest Products desired a green lumber market; 2) Documented anti-microbial properties and rot resistance of juniper heartwood; and 3) Interest expressed by potential purchasers of this product. Approximately 8,000 bf of timbers and 4,000 bf of 7/4 and 4/4 boards were produced in Phase II.

#### PHASE II RESULTS

#### Harvest Practices

The mechanized delimber trial exceeded production and quality expectations. Previous to seeing the delimber work, the assumption was that some difficulty might be expected from large and springy limbs common to Western juniper, and also fiber pullout around knots. This was not the case though. The delimber appeared to have no problems with delimbing juniper, and according to the experienced operator, juniper delimbed more easily than hardwoods.

Production with the delimber averaged one bole per minute, and according to one estimate, could save

\$500-1,000 per day in logging costs. The only difficulties observed were: 1) Delimber production exceeded the ability of one skidder to provide material (due to branches, the skidder could only "grapple" two stems per trip), and 2) Large piles of accumulated slash. Fiber pullout was minimal around knots, with almost all evidence removed during the squaring-up of the log for processing. Copies of a video documenting the delimber trial are available in VHS format from Larry Swan, Winema National Forest (blank tapes needed with each request).

#### Manufacturing

No problems were reported with landscape timber production. As might be expected, waste was reduced due to fewer cuts per bole and efficiency was less than average due to inexperience with this type of product and temporary mill crew. By one estimate, about 75% of the "intermediate" juniper boles consisted of heartwood. Improved utilization is predicted if the mill was set-up for shorter logs (6-8 ft. in length, rather than the current minimum of 10 ft.).

No feedback is available from potential customers of juniper landscape timbers, however, there has been strong demand for the 7/4 and 4/4 material produced as a byproduct.

# LOGICAL RESEARCH AREAS

Phase I and II of the Western Juniper Utilization and Marketing Project were narrow in scope due to a focus on the capabilities and markets for a particular manufacturer and subregion of the Western juniper range. However, based on initial results, several key areas logically require more attention:

- 1. Silviculture No demonstration areas are available to show landowners and loggers optimum management practices for achieving common objectives, such as watershed, forage, and wildlife habitat improvement. For example, there appears to be consensus among scientists that some thinning and removal of juniper is recommended for improving watershed, range forage, and wildlife habitat, however, it is not clear how much is enough or too much.
- 2. Inventory Only broad scale juniper inventory data have been gathered and only some of it has been published. The Forest Service Pacific Northwest Forest and Range Experiment Station completed similar broad scale Western juniper inventories in both California and Oregon, but only the data for California have been published. The researchers did not sample National Forest System lands and results do not necessarily address the question of how much may be commercial.
- 3. Harvest Methods and Costs Mechanical delimbing results look promising for reducing costs of harvesting merchantable Western juniper. However, more attention needs to be given to: 1) Slash disposal; 2) Refinement of equipment type and optimum usage; and 3) Better coordination of acceptable bole criteria based on end-result wood products.
- 4. Processing More work is necessary to achieve optimum conversion of juniper logs to final products. Part of this will be accomplished in the mill, however, different Western juniper subregions need to be sampled and logs processed to define different characteristics, if any.
- 5. Drying The small samples air dried and kiln dried raised more questions than were answered. Further breakdown and tracking of results is necessary by type of kiln, schedules, sizes, grade, and end-processing needs. For example, although very low recovery was reported from converting kiln

dried lumber to edge-glued, finger-jointed panels (10-15%), higher grades and refinement of drying schedules could significantly improve results.

- 6. Finishes and Preservatives Very little is known about optimum finishes and preservatives for Western juniper. The Forest Service Forest Products Laboratory (FPL) has agreed to complete an initial overview, however, further investigations based on specific products will be required.
- 7. Wood Waste/Residuals Better utilization of waste can probably be achieved. The FPL will be making composite samples from chips and performing basic strength and flex tests, but a more structured approach based on market research is probably needed. In addition, the disposal of slash poses interesting questions, centered around a potential conflict between optimal utilization of biomass for watershed improvement (based on recent research), and recovery of value by chipping slash for the chip market or processing for extractive oils.
- 8. Structural Integrity/Engineered Wood Products Virtually nothing has been down with Western juniper in these areas. Some parallels can probably be drawn from work with Eastern red cedar (*Juniperus virginiana*), but how well results apply is unknown.
- 9. Markets Results of various manufacture test runs and market research using air and kiln dried lumber produced in Phase I and II should yield refinement in potential end-product utilization. It is assumed a "Juniper Forum" planned for September 1, 1993, in Bend, Oregon, will encourage an exchange of ideas, successes, and problems between manufacturers, and possibly suggest future market research efforts, as well as potential Western juniper raw material production needs.

#### **SUMMARY**

Brief descriptions of Phase I and II of the Western Juniper Utilization and Marketing Project were given above. In addition, results were summarized and area for future research identified. Although the Western Juniper Forum planned September 1, 1993, in Bend, will be a first step in improving communication between manufacturers, managers, and scientists, better coordination will more quickly yield positive results for local communities within the Western juniper range. Timing appears right for an active integrated and coordinated approach to the Western juniper resource, given wood fiber prices and supply, and manufacturer interest.

# WESTERN JUNIPER UTILIZATION AND MARKETING PROJECT

# PHASE I DATA TABLE

# Recovery Data

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	<u>Logs</u>	Net Wt. Before <u>Milling/Trimming(lbs)</u>	Net Wt. After <u>Milling/Trimming(lbs)</u>	Output ( <u>Bd_Ft_Tallied)</u>
Intermediate Mountain	208 146	175,490 145,620	(?) (?)	19,810 17,018
Total	354	321,110	137,030	36,828

Scaling Data

# Scale As Presented

	Eastside Scribner		Eastside Cubic	
	<u>Gross (BF)</u>	Net (BF)	Gross (cu ft)	Net (cu ft)
Intermediate Mountain	6,890 6,890	6,100 4,620	2,477 2,270	2,257 1,784
Total	13,780	10,720	4,747	4,041

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