PHYSICAL PROPERTIES AND COMMERCIAL USES OF WESTERN JUNIPER

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ABSTRACT

Western juniper (Juniperus occidentalis Hook.) has several properties which could be commercially marketed. Historically, western juniper has been used for fenceposts, decorative boughs, and firewood. Volatile and essential oils can be extracted from foliage and terminal branches as well as from the wood of western juniper. These oils are valued as flavoring and scenting agents. Presently the wood is being used for making furniture as well as paneling. The wood can be successfully dried, cured and made into products. The wood of juniper has a very attractive smooth finish with pleasing coloration and aroma. Veneer, hardboard and particleboard have all been successfully manufactured from juniper.

Keywords: Juniper, properties, oils, wood, lumber, utilization.

INTRODUCTION

The intent of this paper is to present information on the physical properties of western juniper (Juniperus occidentalis Hook.) as well as some of its properties which limit its commercial usefulness. The paper was going to be fashioned around future potential commercial uses of western juniper. However, the crystal ball is out of order and "future" implies that there are no present commercial uses of juniper. Presently, there are no large concentrated markets for western juniper. Like any other material or product which is marginal, these markets need to be developed. Will there be markets for windfall gains for those whose lands are overtaken by western juniper? Not likely! There are many costs involved with harvest and manufacture of juniper which negate the likelihood that it will be a valuable species on the stump in the near future.

HISTORIC PRODUCTS

Some of the historic products for which western juniper has been used are: fenceposts, decorative boughs, and firewood. Within western juniper's range it is touted as a fencepost. According to results from Oregon State University's post farm (Miller and Graham 1971), western juniper posts have lasted as long as 40 years in western Oregon's damp climate. The average life of posts which had decayed by that time was 22 years. This indicates an exceptionally good service life, especially when compared to lodgepole and ponderosa pine in the same area which have an untreated service life of between 3 to 6 years. It should be noted however, that the post farm was set up in 1927 and the posts used contained a high percentage of heartwood. Today, many juniper posts are being used that are largely sapwood. Untreated, these have no more decay resistance than lodgepole pine.

Western juniper is a good fuel wood, burning clean with little smoke and ash. One complaint is that in windy desert areas the shaggy bark tends to pick up wind blown sand and debris, therefore dulling chainsaws more rapidly than other fuel woods. In protected areas this is no problem. Decorative boughs are marketed every year around Christmas time.

INSECTS AND DISEASE OF WESTERN JUNIPER

Western juniper is commonly host to two mistletoes. They are dense mistletoe (Phoradendron densom Torr.), and constricted mistletoe (P. ligatum Trel.). While the mistletoe may sometimes cause witches'-broom, there are at least two rusts attacking western juniper that also commonly cause witches'-broom. These are Gymnosporangium kernidium (Bethel) and G. betheli (Kern).

There are at least two rots which commonly attack western juniper, sometimes rendering the wood unsuitable for any product. These are juniper pocket rot (Fomes juniperinus V. Schr.), a white pocket rot, and a brown cubicle rot usually found in the basal portions of the trunk. The pocket rot generally will extend farther up the tree than will the brown cubicle rot. A few feet of "long butting" will often get rid of the brown cubicle rot. Some trees which have been affected for long periods of time are hollow for most of their length. In some trees both rots occur and other times they appear singularly.

A longhorned wood borer (Callidium californicum Casey) attacks western juniper; the larvae bore into wood, both wet and dry. Kiln drying kills the larvae of this roundheaded borer, but if material is air dried, the insect will eventually work its way out. There are also some flatheaded borers which occasionally attack western juniper.

PHYSICAL PROPERTIES

Oils

Fahey and Kurth (1955) completed a chemical analysis of the volatile oils from the foliage and terminal branches of western juniper in 1953. They found that the volatile oils included the following: α-pinene, β-phellandrene, dipentene, ρ-cymene, sabinene, terpinolene, α-terpinene, terpinen, δ-borneol, borneolacetate, cadinene, acetic acid, phenols, and traces of aldeydes.

In 1972 and 1973, the Four Corners Regional Commission funded a juniper oil demonstration project (1973). This project was an economic pilot project to produce essential oils from Juniperus osteosperma (Torr.) and J. scopulorm (Sarg.). Professor Walter H. Johnson of Utah State University isolated essential oils from these species in 1964. The essential oils are valued as a flavoring or scenting agent in soaps, aerosols, insecticides, beverages, medicines, and many other products. The volatile oils from western juniper are quite similar to the volatile oils that were collect from Juniperus osteosperma and J. scopulorum. There are markets for these oils.

Kurth and Ross (1954) extracted essential oils from western juniper wood in 1954. Entire trunks and bark were used in this experiment. The major oil derived was cedrol. At that time adequate amounts of cedrol could be extracted from juniper wood to make an economic process, but western juniper cedrol contains an oily odor which is not desirable for scenting or flavoring. The investigators however, obtained crystalized cedrol with a pleasant odor by using low steam pressures. The investigators commented that the oily odor could probably be removed from cedrol obtained under higher pressure to make it competitive in the essential oil market. A substantial increase in total amounts of oil recovered occurred under higher pressures.

Lumber

Logs coming into the mill are rough with rapid taper and short lengths. Most of the logs are extremely limby except those grown on better sites among ponderosa pine and Douglas-fir. On most sites bark inclusions go deep into the wood. The logs have insect and disease problems along with nails, lead, wire, and the like.

Juniper has a reputation of warping and twisting when drying, being difficult to plane smooth, and for splitting. It does not deserve this reputation. The wood has been air dried by entrepreneurs for making furniture and novelty products for many years. The wood, especially if cut into fairly thin boards, kiln dries very well. Kozlik (1976) reports on kiln drying schedules for western juniper. Besides kiln drying, any slow drying process appears to work quite well for juniper.

During 1973 and 1974, Gary Johnson, State Service Forester, and the author attempted air drying by several methods with varying results. Rough lumber in 1-inch, 2-inch, and 4-inch stock was dried. The methods of drying were principally a slow, even drying process through different means (Brown 1976). One sample included juniper wrapped in a tarp and hung in a shed where air drying wouldn't remove moisture too rapidly. Other methods of air drying included storing under a dry building and curing in dry sawdust. Drying resulted in little warp or checking in the 1-inch boards. In the 2-inch and 4-inch boards, cracking and splitting was substantial except in the sample wrapped in a tarp. One craftsman recommends drying on end in the shade out of the breeze. Drying juniper properly is no mystery. Craftsmen who suggested these techniques were mostly from central Oregon and include Ralph Bailey and T. D. Sexton of Bend and Bill Koi of Sisters.

Finishing sawn products causes some difficulty. Juniper grain continually picks up when planed. Gary Gumpert of Juniper Products, Inc. in Prineville solved this problem by using abrasive planers, essentially a series of industrial sanders, to obtain a satisfactory finish. While abrasive planing is not commonly used in this area, it is not, by any means, a new method used in the wood products industry.

The color of the wood can vary a great deal. The most common colors found are a strikingly white sapwood with heartwood which varies from a light yellow to a yellowish orange and rarely almost red. In some areas individual trees may be close to red, some close to black and some may be greasy in composition. The wood has a pleasant aromatic quality but it is not as aromatic as many members of the cedar family. If the aroma fades over time, it can be revived by sanding.

Veneer

Juniper can be either turned or sliced to obtain a high quality facing product for plywood. Barger and Ffolliott (1972) report on physical characteristics of some juniper species in New Mexico and Arizona stated that veneer turned or sliced makes an attractive product. The Edward Hines veneer mill in Mt. Vernon, Oregon, rotary cut some juniper veneer. The Edward Hines Plywood plant at Hines, Oregon dried and glued the veneer. The lathe was set for cutting Douglas-fir at three-sixteenths of an inch. Consequently, there was some cracking and splitting of veneer which would not take place if the bolts were either steamed before turning or the lathe pressure changed slightly. Mr. Asher, Manager of the Plywood Plant, was of the opinion that there would be no difficulty in successfully turning juniper.

Manufactured Boards

Frashour and Nixon (1956) of the Oregon Forest Research Laboratory in Corvallis produced some hardboard from extracted juniper chips. The juniper chips were the ones from which Kurth and Ross had extracted essential oils. The hardboard obtained possessed superior bending strength and water resistance but did not have toughness properties that some other western species have. An advantage to using juniper as hardboard was the uniformly colored and semi-glossy finish obtained without the use of water spray. Frashour and Nixon indicated that the inferior toughness could probably be traced to the extended chip steaming in order to obtain volatile oils.

A technical action panel of Wheeler County headed by Mr. Hubert Asher of Spray looked into the feasibility of producing particleboard from whole juniper trees. This project took place in the period of 1964 to 1966. The results of the study reported by Ray Currier, Oregon Forest Research Laboratory, were that the particleboard could easily be formed and did possess aromatic qualities. At that time the amount of material available as residue for mills for particleboard outcompeted the harvesting of juniper for this type of product.

COMMERCIAL USES OF JUNIPER

The Forest Products Laboratory at Madison, Wisconsin, conducted a brainstorming session on utilization of juniper and developed the following ideas: toys, sporting goods, compost, jewelry boxes, chicken feed to make gin flavored eggs, block flooring, patio flooring, stems for plastic trees, condiment for cooking, wildlife feed, suitcase liners, humidors, pipe bowls from roots, furniture, decorative fences, planters, inlay products, paneling, Christmas decorations, novelties, closet liners, additive for men's cosmetics, volatiles, flavoring, bedding from shavings, condiment for cooking game from berries, and signs. The California Division of Forestry has shipped some logs to Japan which were peeled and finished by sanding to a high gloss and used as exposed interior studs. The extent of this type of market is unknown. There has been interest expressed by an eastern cedarchest manufacturer in using juniper for chests.

What are some of the more feasible juniper products? Aromatic oils may be a possible market. Western juniper oils may need some refining before they are competitive with oils from eastern redcedar (Juniperus virginiana L.) and Mexican juniper (J. ashei Bucholz). The pilot plant in Blanding, Utah was successful in extracting volatile oils which were saleable. However, the company formed to take over the pilot project on a full scale basis never did that. This does not mean that is is not economically feasible. More times than not, pilot projects of this sort are not followed up even though they prove out to be economically feasible.

Juniper Products, Inc., in Prineville is manufacturing a three-eighths inch tongue and groove sawn paneling for use on both walls and closets. Presently their product is being sold in Washington, Oregon and California. This is a family operation, and consequently they are not selling large quantities. Some marketing research has shown that there is a market for the product if there were enough suppliers to produce it in larger quantities.

Another product being manufactured by Juniper Products, Inc., and other craftmen in the area is furniture. The easy workability, good color, and fine finish of juniper makes it an excellent furniture wood. In fact, it is in the same genera as the eastern redcedar used for cedarchests and other fine furniture and closet liners. The aromatic qualities are not as good as eastern redcedar, but they are nonetheless present.

Juniper's fine finishing qualities also lend it to veneer manufacture. The veneer could be manufactured either by rotary lathe or by slicer. Total recovery in this process, as in sawing, would not be high. Expected recovery rates would be in the 40 to 60 percent range.

It is feasible to manufacture aromatic particleboard from juniper using the total tree. However, until particleboard plants run out of residue materials from mills which produce other wood products, it is not likely that juniper will be used for this process.

The wood of juniper makes excellent wood pencils. One of the difficulties in manufacturing this product is attempting to find enough clear stock without knots with straight grain from which to make the pencils. The wood apparently has excellent qualities as far as wood pencils are concerned.

Another small continuing market that is always available is for decorative boughs. Around Christmas time buyers are always around juniper areas buying boughs that are well laden with berries for use in the Christmas market.

Other product possibilities for smaller markets are the novelty products which are already being produced over quite an extensive area as well as fenceposts and even charcoal.

MARKET POTENTIAL

The technology is available to make products from juniper. Juniper is not an impossible wood with which to work. It is economical to make products from juniper. There is a branch of economics that will have to be dealt with before many people start manufacturing juniper. This is market research and development. The market research and

development done by Juniper Products, Inc., for instance, in manufacturing of paneling and furniture indicates that there are people desiring to purchase substantial amounts of products made from juniper at present prices.

Logging and handling of juniper is an expensive process and recovery rates are low. However, the cost of handling and manufacturing are not the criteria which define whether a product is economic to market. The important criterion is whether the value of the product is able to cover those costs plus the needed profit margin.

Before many years there likely will be a substantial market for juniper products. Historically, it takes 5 to 10 years following an innovator and entrepreneur who opens the market for a product before the product really sells. Because Juniper Products, Inc., started operating in 1974, I would predict that by 1984 there will be a fair sized market for juniper products. A curious thing about these types of markets is that Juniper Products, Inc., quite likely will not be one of those supplying this market. New, more conventional manufacturers will probably supply the market. The market for juniper products will develop faster if and when a good housing boom occurs, or if there is an upswing in the economy of either the United States or Japan.

MANAGEMENT IMPLICATIONS

One of the reasons for giving this paper is an attempt to set some management criteria for juniper, especially if it is going to be looked at from a products standpoint. The management implications for juniper products would vary depending on the product for which you are trying to manage. For instance, if boards and veneer are the desired product, it would be best to manage juniper on the moister end of its range, although not necessarily in deep soil. A straighter, taller tree with fewer small branches and not as much bark inclusion seems to be produced where juniper grows in mixed stands with other forest trees. Quite often the heartwood is a deeper color which gives better grain contrast as far as these products are concerned.

If juniper is to be managed for lumber or veneer products, insects and diseases would need some control. Both the longhorned wood borer and the pocket rots and brown cubicle rot are problem areas.

If management is for production of oils, juniper on open grown or invasion-of-rangeland conditions may be the best. These junipers tend to produce many branches and needles from which more essential oils can be extracted. Branches and needles tend to give more of the aromatic flavor that may be desired in a particleboard product.

Unless the market for juniper products becomes much larger and much more stable than predicted from present conditions, juniper stands should not be managed for a product. Instead management might include eradication methods while riding on the novelty of juniper markets. This way the wood will be utilized and perhaps the cost of range rehabilitation will be decreased.

RESEARCH NEEDS

Research needs mentioned here are in regards to products made from juniper. These needs certainly are not listed in order of importance as the importance will depend somewhat on the eventual development of markets.

1. Insect and disease incidence.
2. Influence of environmental factors on quality of product.
3. Veneer slicing. Contact with one veneer slicing mill found them reluctant to try slicing juniper. They did not think there was a large enough supply to keep them going in this market.
4. Marketing of products. As indicated earlier in this paper, this may be the most important research need at this time.
5. Research on the modification of the properties of cedarwood oils from western juniper. This would make them more competitive with oils from other junipers.
6. Product research to find uses for western juniper oil in its natural condition.
7. Inventory of amount and quality of juniper. This would be necessary information for market development.

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