Part 2. Species Selection

Adaptability of Some *Eucalyptus* Species in Southwest Oregon[1]

Lee O. Hunt[2]

Abstract: Professional and official attitudes and reports discourage the use of exotics in the Northwest. Not only will the small woodland owner fail to make a reasonable return on his investment in growing native trees, he may not live long enough to harvest a crop. Short rotation alternatives are sought by using certain species of Eucalypts. Adaptability of such species is sought by outplanting plots in Douglas County. Considerable data has been accumulated on cold tolerance, survival, juvenile growth and deer damage to the species planted. Certain species appear to be adapted in southwest Oregon.

One of my forestry professors in the late twenties expressed the view that by midcentury all the commercial timber in western Oregon would be cut. His definition of commercial timber was strictly old-growth Douglas-fir within easy reach of the major waterways. He was substantially correct since logging trucks, cats, mobile skidders, and loaders, etc., had yet to appear on the scene.

As late as the early seventies no less an authority than Dr. Roy Silen, Principal Geneticist of the Pacific Northwest Forest and Range Experiment Station expressed the view that there was no place in the Northwest for exotic forest tree .species. On the basis of his studies at the Wind River Experimental Forest in central Washington, he indicated that no exotic species of forest trees could successfully compete or produce the volume and quality of timber that Douglas-fir and associated conifers can.

Only about a year ago the Oregon State Department of Forestry agreed to recognize any hardwood species as acceptable to meet the reforestation requirements of the State's Forest Practices Act. Further, in their standards for qualifying under the Western Oregon Small Tract (Forest) Optional Tax program they set a rotation of 60 years for Site Classes I and II, Douglas-fir, and 90 years for Site Classes III through V. Forest land taxes in Oregon are substantially higher than those for Washington. Over 93 percent of forest land in southwest Oregon is Site III or below; over two-thirds of this is in the two lower Site Classes, IV and V.

Several cost and return workshops on growing Douglas-fir forest crops have shown that using a discount rate of 8 to 10 percent and a 60-year rotation will inevitably fail to yield the grower a reasonable return on his investment.

With that background of professional and official policies and attitudes, there were virtually no incentives for the non-industrial forest land owners to grow crops of trees which they would have little likelihood of harvesting in their lifetimes. The screening of trials of Eucalyptus species were a part of a personal program to try to find some alternatives to the 60- to 90-year rotations considered necessary to grow a crop of merchantable trees.

One can wonder why anyone in their right mind would consider spending money to grow Eucalyptus in southwestern Oregon with the professional and official attitudes plus the lack of specific knowledge on the silviculture of growing Eucalypts and an unknown market. Other disincentives include the lack of a nearby pulp market, lack of nursery stock sources, and the general antipathy toward trying untested and largely unknown species. There is a common attitude that there are no cold tolerant Eucalypts and thus they won't grow in Oregon. Even if they would survive, the wood is thought to be useful only for a low grade of firewood. This attitude is the more surprising when one sees, as I did last fall, vast areas of native Maritime pine, (Pinus pinaster Ait.) in Spain being converted to Eucalyptus and Monterey pine (Pinus radiata D. Don). Some 60 percent of the output of rayon, paper pulp and hardboard in Spain is from Eucalyptus. The expansion of Eucalyptus plantations is exploding throughout the world's milder climatic areas.

Several timber supply surveys and programs, such as Beuter, McClean, and Forestry Program for Oregon, predict as much as a 22 percent decline in timber supplies in Oregon by the end of this century. Can Eucalyptus and other short rotation tree crops fill the hiatus between the end of the old-growth native forests and the second crop? Just two years ago only about 1,000 cords of firewood were shipped from Douglas County, Oregon to California. This past season some 20,000 cords were shipped south, mostly to the San Francisco Bay Area, and almost entirely consisting of oak and madrone.

There has been a phenomenal increase in the harvesting of hardwoods, chiefly oak and madrone, in southwest Oregon in the past couple of years. Government agencies have sharply increased charges for firewood cutting permits from federal and state lands. The high cost of fossil fuels and electricity has brought on a wave of interest in wood as a fuel source. Thirty-two small woodland owners have purchased Eucalyptus seedlings this

[1]Presented at the Workshop on Eucalyptus in California, June 14-16, 1983, Sacramento, California.

[2]Private Consulting Forester and Tree Farmer

Gen. Tech. Rep. PSW-69. Berkeley, CA: Pacific Southwest Forest and Range Experiment Station, Forest Service, U.S. Department of Agriculture; 1983.

past season from my small backyard nursery for the express purpose of growing firewood. As I make each sale and suggest some site and cultural requirements I shudder a bit because of the lack of specific data on species requirements, growth, yield, wood properties, and, of course, their cold and drought tolerances. However, I can take some consolation in the fact that at my age I probably won't be around to face the consequences of those recommendations.

Please forgive the lengthy introduction. I do believe we must recognize that we are entering a new field, one in which few professional foresters are interested or will accept. Now let us take a look at the chain of events that has brought us the limited amount of information on the adaptability of Eucalypts in southwest Oregon. Correspondence with CSIRO (Commonwealth Scientific and Industrial Research Organization), the research group in Australia, brought 14 packets of Eucalyptus seed to us in 1971. These species are included in table 1.

Table 1--List of Eucalyptus Species in Original Field Trials

E. amygdalina	E. grandis
E. dalrympleana	E. nitens
E. delagatensis	E. obliqua
E. fastigata	E. ovata
E. fraxinoides	E. regnans
E. flaucenscens	E. subcrenulata
E. globulus	E. viminalis

These species were recommended as being the better timber species with some cold tolerance. They were grown in Spencer-LeMaire Tinus Root-trainer containers for one growing season. They were out-planted in the early winter of 1972-73 in replicated plots at elevations of about 500 to 2,500 feet. Perhaps fortunately, the midwinter following these out-planting recorded the lowest temperatures in about two decades. Lows at 0°F and below occurred in all plot locations. All species were killed outright or frozen back to the ground. Only a few specimen of Eucalyptus dalrympleana, delagatensis, glaucescens and nitens survived at all. These four species were replanted in new plots during the 1974 through 1977 seasons. Temperatures during these four years were moderate with minimums of 12° to 15°F. Only minor frost damage was noted and growth was generally good.

Early season rains occurred in late August and early September of 1978. This was followed by warm sunny weather for the next six weeks. The trees continued to grow vigorously during this early fall period. During the second week in November temperatures dropped 40° to 50°F over night to lows of 5° to 10°F. Almost all trees of all species were wiped out. Some few larger trees from earlier plots were killed, others badly damaged. All of these plots were in the interior valleys and foothills of Douglas County. One plot located near Bridge, along Highway 42 on the west slope of the Coast Range, showed only minor frost damage to a few trees of any of the species at a minimum temperature of about 140°F. These trees have shown remarkable growth even with considerable native hardwood competition. Insofar as the interior valleys and foothills of southwest Oregon were concerned we were again back at square one.

Another plot was established in the spring of 1978 on the Schofield Creek drainage near Reedsport, Oregon, some 10 miles from the coast. This was Site Class II land owned by Douglas County and had been previously planted to Douglas-fir. nursery stock. Table 2 indicates the survival and average growth of the species at the age of 5 years, along with the seed source elevations in feet.

Table 2--Survival and Average Growth of Species, Age 5 years

Tree Species Tree Species Name	Source Elev. Seed	Averages for trees Survival Percent	Ht. Ft.	DBH Inch
E. dalrympleana	3800	79	27.6	5.4
E. delegatensis	4500	67	35.6	6.0
E. gunnii	3200	71	22.6	2.9
E. johnstoni	1800	67	29.5	3.3
E. nitens	4000	75	30.8	5.8
E. urnigera	3000	71	24.3	2.9

In the coastal areas of southwest Oregon, these three Eucalyptus species appear to be out-growing Red Alder by almost 2 to 1, as shown in figure 1. The widespread use of Eucalyptus species throughout the world would make one suspect that they are superior to red alder for chip production, both in volume and quality.

Additional plots were established in late summer and early fall of 1979 on our tree farm near Winston, Oregon. Species planted again included E. dalrympleana, delagatensis, gunnii, and nitens. New species were added, including archeri, pauciflora, and urnigera. The following winter saw temperatures drop to 2°F at the planting sites. Table 3 shows an evaluation of the frost damage that was sustained by these species.

The winters of 1981 and 82 were very mild and no additional frost damage was observed at minimums above 15°F. These results would indicate that only E. archeri, gunnii, glaucescens, and urnigera can be considered suitable at this time for the interior valleys of southwest Oregon.

Several other species have been out-planted for cold tolerant screening the past two years, but

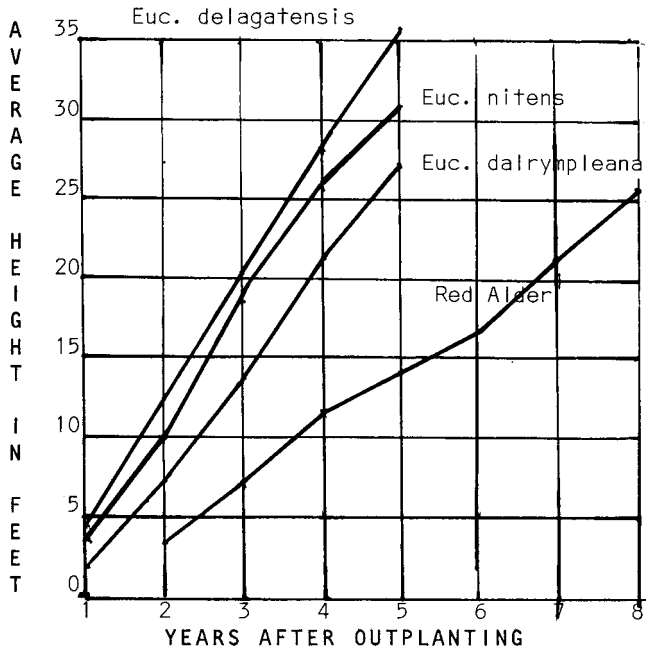

Figure 1--Comparison of early growth for three of the Eucalyptus species and that of Red Alder (Alnus rubra Bong).[1]

[1]Data from: DeBell, Dean S. and Wilson, Boyd C. Natural Variation in Red Alder. Utilization and Management of Alder (Symposium Proceedings) 1978. Published by PNW Forest and Range Experiment Station, Portland, Oregon.

they have not gone through even a moderately severe winter. Thus, they have not had a sufficient test to evaluate them. Included in these last out-plantings are Eucalyptus camphora, cinerea, divaricata, globulus (Barnback seed source), irbyl, nova-anglica, stellulata, subcrenulata, and viminalis. Only Eucalyptus globulus sustained frost damage at the 16°F temperature of two years ago and the 21°F of this past winter.

Table 3--Evaluation of Frost Damage

Species Name	Damage in Percent by Class[1]				
	0	1	2	3	X
E. archeri	81	16	3	0	0
E. dalrympleana	6	22	19	12	41
E. delagatensis	5	19	21	31	24
E. glaucescens	23	10	7	19	31
E. gunnii	96	4	0	0	0
E. nitens	2	14	34	34	16
E. pauciflora	0	0	8	79	13
E. urniqera	98	2	0	0	0

[1]Damage classes are: 0 - no damage observed; 1 - slight damage shown by tender tips frosted; 2 - tender tips frosted and up to 50 percent of the leaves frozen; 3 - severe, total tree frozen and killed back to the ground, but subsequently re-sprouted; X - tree killed and failed to resprout.

R.L. Tichnor of the North Willamette Experiment Station, Oregon State University, has recorded more specific data on a greater number of Eucalyptus species than any other worker with whom I'm familiar. Even most of the hardier species he tested, such as Eucalyptus gunnii, pauciflora, and urniqera he found were killed by temperatures of 5° to 8°F.

Another serious problem is deer damage, both from browsing and horning of the stems of young trees. There is a wide variation to susceptibility from deer damage as indicated by table 4, compiled from a survey made in may of this year.

Table 4--Deer Damage to Certain Eucalyptus Species

Species Name	Age Yrs.	Surv Pct.	Damage Class			
			0	1	2	3
E. archeri	5	45	0.0	12.8	41.0	46.2
E. archeri	3	55	0.0	0.0	0.0	100.0
E. dalrympleana	3	50	66.7	13.3	13.4	6.6
E. divaricata	2	65	0.0	0.0	0.0	100.0
E. glaucescens	3	43	68.8	13.7	11.7	5.8
E. globulus	2	45	100.0	0.0	0.0	0.0
E. gunnii	3	33	0.0	0.0	15.4	84.6
E. irbyi	2	93	0.0	23.0	20.5	56.5
E. nitens	3	69	95.0	0.0	5.0	0.0
E. nova-anglica	2	74	100.0	0.0	0.0	0.0
E. subcrenulata	2	70	100.0	0.0	0.0	0.0
E. urniqera	3	33	7.8	23.0	30.7	38.5

Deer Damage classes are: 0 - no damage observed; 1 - light damage showing less than 40 percent of side branch tips browsed with no visible reduction in height growth, 2 - 41 to 75 percent of twigs including the leader browsed, some stunting of growth visible; 3 - severe damage with virtually all twigs including leader and most of leaves eaten, almost no height growth since planting, occasionally horned trees were girdled and killed.

A few additional species were grown this past year (1982) from seed furnished by Dr. Stanley Gessel of the University of Washington on his return from a visit to CSIRO in Australia. Dr. Gessel is carrying on some testing of Eucalypts in the Seattle area. The species included Eucalyptus cinerea, coccifera, camphora, dalrympleana, delagatensis, stellulata, and viminalis. All but two were out-planted in three separate areas in central Douglas County this late winter of 1983. They have been subjected to no less than 28°F to date and have had no substantial deer pressure.

Dr. Nicholas Malajscuk, Mycologist with CSIRO at Perth, Australia, spent a year working with Dr. James Trappe, Principal Mycologist with the Pacific Northwest Forest and Range Experiment

Station at the Forest Science Laboratory in Corvallis, Oregon, on mycorrhizae of Eucalyptus. Eucalyptus archeri, glaucescens, gunnii, and urnigera were innoculated with three species of mycorrhiza, Hynangium carneum, Scleroderma albidum and Hymenogaster albellus. Besides laboratory tests, innoculated seedlings were out-planted on our Willis Creek Tree Farm. Preliminary findings indicate that in the laboratory only Hydnangium carneum produced abundant mycorrhiza and it did so on all four of the Eucalyptus species. Field surveys will be made this year and findings will be published probably next year.

So where are we in this scramble for information on growing Eucalyptus in southwest Oregon? From observations to date, our screening tests indicate that in the interior valleys and foothills only Eucalyptus archeri, glaucescens, gunnii and urnigera have consistently shown sufficient cold tolerance to withstand our more severe winter temperatures. Of the four, Eucalyptus urnigera appears to be the fastest growing and is adapted to a wider range of sites. In four years of growth Eucalyptus dalrympleana, delagatensis and nitens show greater diameter growth than does Eucalyptus urnigera but not as much height growth. At this point my major production, if you can call some 5000 to 7000 seedlings per year a major production, is concentrated on Eucalyptus urnigera and to a lesser extent on glaucescens. Both are inherently larger trees than the other two, are about equally cold tolerant and much less susceptible to deer damage. I do find considerable frost tolerance variation among trees in the same species and even within the same seed lot.

Along the coastal strip there are greater opportunities for using other species that may yield higher volumes and perhaps better wood quality. If chips for paper pulp or hardboard is the objective of the plantations, then it would appear that Eucalyptus dalrympleana and johnstoni would be preferable since Eucalyptus nitens and delagatensis are non-sprouters. If a truly cold tolerant provenance of Eucalyptus globulus could be found it would, no doubt, produce greater volume than almost any other species. There appears to be little chance that the highly prized species, Eucalyptus grandis or regnans can be grown in the Northwest, although I still have three of the latter alive after four years. The one surviving Eucalyptus grandis has frozen back to the ground every year but this past winter. With the number of species in the genus there may be others that will prove to be valuable and adapted to this area.

I have avoided being specific about site conditions at our out-planting sites. This is due to a lack of detailed soil surveys and rainfall records in the immediate vicinity of the plantations. Generally, rainfall in the interior valleys and foothills varies from about 28 to 40 inches per year at elevations under 2000 feet. Snow is usually light and remains on the ground only a few days during the few times that snow does occur. At the Bridge site the rainfall approaches 70 inches and in the Reedsport area from 80 to 90 inches; both areas rarely receive any snowfall.

Coastal soils tend to be deeper, more fertile and better drained than those in the interior. Soils in the interior valleys and foothills vary widely, but largely are moderate to heavy clays and clay loams, often shallow on the hills. Of special interest is the apparent ability of Eucalyptus urnigera to tolerate dense clay soils with impeded drainage. In low areas water may stand around the trees, even when young, for several days at a time without ill effects.

So far as I have been able to learn, only one timber company has initialized trials of Eucalyptus, along with cottonwood, for biomass fiber production. International Paper Company is investigating the possibility of growing Eucalyptus species on its coastal lands near their pulp mill at Gardiner. There is no firewood market for Eucalyptus in the Northwest since there are no established stands of a size to harvest. While it is premature to draw specific conclusions from the limited research I have carried on, there is a developing interest and demand, and people can be expected to plant Eucalyptus trees.

REFERENCES

Beuter, John H.; Johnson, Norman K.; Scheurman, H. Lynn. Timber for Oregon's tomorrow, an analysis of reasonably possible occurrences. Research Bulletin 19. Corvallis, OR: Forest Research Laboratory, Oregon State University; January 1976. 111 p.

Hall, Norman; Johnson, R. D.; Ghippendale, G. M. Forest trees of Australia. Canberra, Australia: Australian Government Publishing Service; 1975.

Hunt, Lee O.; Cate, Rufus. A survey of private non-industrial woodland owners of Douglas County, Oregon. Roseburg, OR: Douglas County Board of Commissioners; 1977.

Jacobs, Maxwell R. The genus eucalyptus in world forestry. Seattle, WA: College of Forest Resources, University of Washington; October 1970.

MacLean, Colin D. Timber resources of Douglas County, Oregon. Resource Bulletin PNW-66. Portland, OR: Pacific Northwest Forest and Range Experiment Station, Forest Service, U.S. Department of Agriculture; 1976. 42 p.

Metcalf, Woodbridge. Eucalyptus species for California. Berkeley, CA: University of California Extension Service; 1967. 23 p.

Oregon State Department of Forestry. Forestry program for Oregon, timber supply today and tomorrow. Phase 1. Salem, OR: State Department of Forestry. Prepared for the people of Oregon, submitted to the Board of Forestry by State of Oregon Department of Forestry; 1977. 161 (80) p.

Oregon Department of Energy. The Oregon woodheat handbook. Salem, Oregon; 1980.

Standiford, Richard; Donaldson, Dean R.; Breece, James R. Planting eucalyptus for firewood.

(Leaflet 21297). Berkeley, CA: Univ. of California, Div. of Agric. Sci.; 1982. 4 p.
Ticknor, R. L. Landscape tree performance. Circular of Information 622. Revised. Corvallis, OR: Agricultural Experiment Station, Oregon State University; May 1974.
Turnbull, J. W. (Letter). 1975. Forestry and Timber Bureau, Department of National Development, Yarra lumla, ACT, Australia.
Vall, Charles W.; Fraser, Malcom D.; Henry, Jean-Francois. Higher productivity through energy plantations. Chicago, IL: American Society of Agricultural Engineers; 1975.
Walduck, Tom. The potential for growing eucalyptus pulpwood on the U.S. west coast. July 1976. Unpublished paper. Kingston, Tasmania.