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Tree Planting for *Control of Gorse* on the Oregon Coast

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RECOMMENDATIONS

1. Consider tree planting as a control measure for gorse only if there is reasonable chance that the land will not be needed for purposes that would require removal of planted trees within the next 40 years.
2. Prepare for planting by burning and mechanical removal of gorse. Before planting, if possible, spray germinating and resprouting gorse with 2, 4, 5-T at rates of 2-4 pounds to the acre to give seedlings a good start.
3. Do not use Picloram where there are established conifers or on imperfectly drained soils.
4. Use large Monterey pine or Douglas-fir planting stock, with at least 18-inch tops and diameters of 5/16 inch at the root collar.
5. If you remove gorse but do not want to use chemicals initially, plant as soon as the area is cleared. If you plan to spray germinating and resprouting gorse, in a successful plantation, follow up after two years with 2, 4, 5-T in March.
6. Maintain adequate fire breaks around the plantations. Without these, you greatly increase the risk of losing the plantation to fire.

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Tree Planting for Control of Gorse on the Oregon Coast

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INTRODUCTION

Gorse was introduced as an ornamental shrub near Bandon, Oregon, in the late nineteenth century. Since then, the plant has spread widely in coastal areas of southern Oregon. It has become a serious pest because of its aggressiveness and inflammability. Perhaps the greatest problem that gorse poses is its potential for spread. If left unchecked, it could become firmly entrenched along the entire Oregon coast because of the apparent lack of natural control in this environment.

Methods of control are available. Choice of a particular one will depend primarily on the purpose for which the land is being used. The planting of rapidly growing trees to shade out gorse is a promising approach to control on land not suited or wanted for agriculture. Available information concerning this form of control is summarized in this report. Recommendations made here are based largely on experimental plantations established between 1946 and 1964 by the Oregon State Forestry Department and the Forest Research Laboratory of Oregon State University.

Distribution of Gorse

Gorse (Ulex europaeus L.), or Irish furze, is a leguminous shrub that grows erect to a height of 10 feet. It resembles Scotch broom, especially when it is covered with bright yellow blossoms. But unlike Scotch broom, gorse is covered with sharp spines that make gorse thickets almost impenetrable.

The genus Ulex is composed of about 20 species of woody plants in northern Africa and southern and western Europe. Today, gorse is probably the most widely distributed species of this genus. In Europe, gorse occurs in the British Isles, Ireland, and along the Atlantic coast from Portugal to Norway (8). The plant is found in North America along the Atlantic seaboard from Massachusetts to Virginia, on the Pacific coast from California to British Columbia, and in the Hawaiian Islands. Gorse was introduced into Australia, New Zealand, and Tasmania in the middle of the nineteenth century and by 1900 was declared a noxious weed in those countries (5).

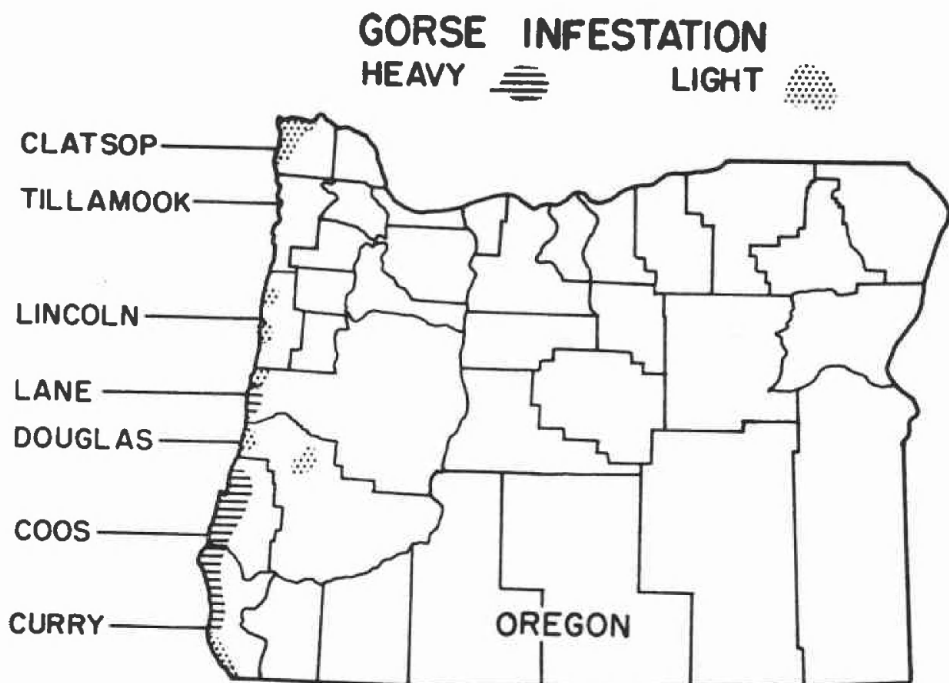


Figure 1. Distribution of gorse in coastal counties of Oregon. About 30,000 acres are heavily infested (solid stands) and 15,000 acres are lightly infested (gorse scattered among other vegetation).

Distribution of gorse in Oregon is shown in Figure 1. The heaviest concentrations are on Heceta Head in western Lane County, in the vicinity of Bandon in Coos County, and along the Elk River in Curry County. The acreage in Oregon occupied by gorse is not known exactly, but it is estimated at 45,000 acres. Two-thirds of this area is considered as heavily infested.

Wherever gorse occurs, it invades most easily infertile or disturbed sites. Sand dunes, over-grazed pastures, logged areas, and burned-over forest lands are the principal habitats of gorse along the Oregon coast. The ease with which this plant occupies infertile sites is probably related to its ability to fix atmospheric nitrogen. Once gorse has become established, it begins to exclude other vegetation.

Propagation of gorse is primarily by seed, although vegetative reproduction from roots does occur. Seeds ripen in late summer and, after discharge from seed pods, are often further distributed by animals and man. The amount of seeds produced by stands of gorse is large: sampling in different areas has indicated 4-9 million seeds to the acre in the surface inch of soil. The seeds have hard coats and can lie in the ground for many years without losing viability. Estimates of longevity range from 25-40 years.

Initial growth of gorse is relatively slow in Oregon. After the second or third year following germination, growth accelerates both vertically and laterally. The plant may reach the height of 6 feet within a period of 8 to 10 years.

Control of Gorse

If gorse infestations comprise only a few plants, control can be achieved quickly. Simply remove the top of the plant and apply a brush-killing chemical to the stump, or drench the top with a 1:100 emulsion of 2,4,5-T ester in water.

Once gorse has formed solid stands, control will require greater effort. Removal by bulldozer, burning, or a combination of both, is usually necessary before actual measures of control can be initiated. Control measures may consist of application of soil sterilants, chemical treatment of sprouts or newly germinated plants, tillage at regular intervals, or pasturing with sheep and goats. These practices are described in detail elsewhere (2, 6).

Biological control of gorse has been studied intensively, especially in the southern hemisphere (1, 11). The gorse seed weevil (Apion ulicis) has received particular attention because of its potential for biological control. The insect feeds on the spines and flowers of gorse and lays its eggs in the pods where, after hatching, the larvae feed on the seeds. Under favorable conditions, weevil populations may destroy up to 90 percent of the seed. However, observations in New Zealand, Hawaii, and California (3) have shown that the weevil's activities are not sufficient to control gorse. The deep taproot with its large food reserves enables the plant to recover rapidly even after serious injury. Furthermore, pods partially destroyed by insects are more easily carried by wind and so the spread of gorse may be enhanced.

Another approach to control is based on the intolerance of gorse to heavy shade. Trees are planted on gorse-infested land to form, in time, a dense stand of timber. Shade of such a stand can be expected to control gorse and the timber would provide a monetary return when the timber is cut.

EXPERIMENTS AND RESULTS

Beginning in 1946, experimental plantations were established in gorse-infested areas of Coos and Curry Counties to test shading as a means of gorse control on land unsuited or unwanted for agriculture (4). Planting trials, made after burning gorse-infested areas, employed 2-0 seedlings of Douglas-fir in 1946, maritime and shore pine in 1949, and Port Orford cedar in both years. The Douglas-fir seedlings were quickly destroyed by the rabbits that find excellent shelter in the low cover of gorse. Pines of both species grew too slowly to compete successfully with gorse. Port Orford cedar was unattractive to rabbits and had a rate of growth that enabled it to hold its own against gorse, but the seedlings were killed by cedar root rot (*Phytophthora lateralis*).

In 1953, 2-0 Port Orford cedar and 1-0 Monterey pine were interplanted in 1-foot-high gorse that had been treated with sodium arsenite and borax, a soil sterilant, or sprayed with 2,4,5-T. The soil sterilant killed the trees as well as the gorse, but the spraying held back the gorse enough for the trees to become established. The Port Orford cedar proved so vulnerable to cedar root rot that it was eliminated from further trials. Monterey pine on sprayed areas grew well, attaining heights up to 25 feet by 1960. This performance encouraged further trials with Monterey pine.

In 1961, a planting study was started on the southern Oregon coast to test the potential of Monterey pine for keeping ahead of re-sprouting gorse, resistance to plant and animal pests, and commercial wood yield.

A 10-acre area just south of Bandon was selected as the site for the trial. This land once supported a mixed stand of Port Orford cedar, Douglas-fir, and shore pine. Repeated fires destroyed the forest, and gorse invaded the area. Interspersed with an occasional shore pine, gorse formed a dense cover from 4-6 feet in height when the land was cleared for planting in 1961 (Figure 2). The wind-rowed gorse had to be left unburned because of an extended period of extremely wet weather. Soil in the selected area is a groundwater podsol with sandstone as parent material. Drainage is poor in most of the area.

In March 1961, the cleared area was planted with 1-0 Monterey pines whose tops varied in length from 3 to 14 inches. Seedlings were planted without sorting, with a spacing of 8 by 8 feet. Planted trees were checked every year for survival and infestation by insects, diseases, and other forms of damage. Growth was measured annually on 1100 marked trees.



Figure 2. Removal of gorse before tree seedlings were planted.



Figure 3. Monterey pine, nearly 18 feet tall, after seven growing seasons with gorse.

The Monterey pine seedlings grew well after they had overcome the transplant shock. Trees averaged nearly 9 feet in height 7 years after planting. The largest trees were 18 feet tall (Figure 3). The pines were able to stay ahead of the gorse, which resprouted and grew rapidly on most of the cleared area.

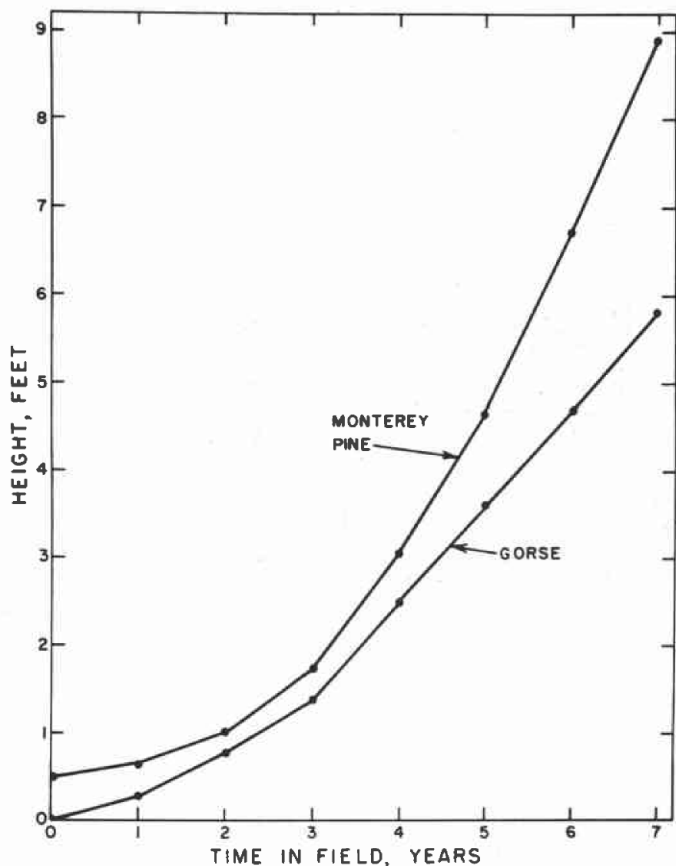


Figure 4. Average annual growth of Monterey pine and gorse.

Average annual growth of Monterey pine and gorse is shown in Figure 4. The rapid development of gorse and the need for fast growing trees able to compete successfully with gorse is illustrated by photographs taken at intervals from one of the camera points in the plantation (Figure 5).

Survival of the Monterey pine seedlings was excellent; less than 10 percent died in the first 7 years after planting. Most of the losses were caused by a fire in an adjacent stand of gorse, which burned trees along the edge of the plantation. Other trees were killed by 2, 4, 5-T that drifted into the plantation from the spraying of a power-line right-of-way. Only 1 percent of the trees were killed by the deer and rabbits that abound in the area. Most of the other pines that died were small seedlings overtopped by gorse.



Figure 5. Recovery of gorse in the 7 years since the land was cleared.

In its first 5 years, the plantation remained free of diseases. During the sixth and seventh growing seasons, about 30 percent of the trees became infected with western gall rust (Peridermium harknessii). This rust stimulates formation of witches' brooms and cankers on branches and stems (Figure 6). Infections were not serious enough to retard growth. A few trees partially defoliated by caterpillars of the silver-spotted halisidota moth (Halisidota argentata) have recovered.

Developments in the chemical control of brush prompted a trial, in 1964, of the feasibility of tree planting in fairly tall gorse after it was sprayed. Specific objectives of the 1964 test were to determine the effectiveness of Picloram and 2,4-D for control of gorse higher than 3 feet to permit establishment of planted trees, the Picloram tolerance of conifers planted, and a suitable planting stock for use with chemical treatment of gorse.

¹ 4-amino-3,5,6-trichloropicolinic acid, also known as Tordon.

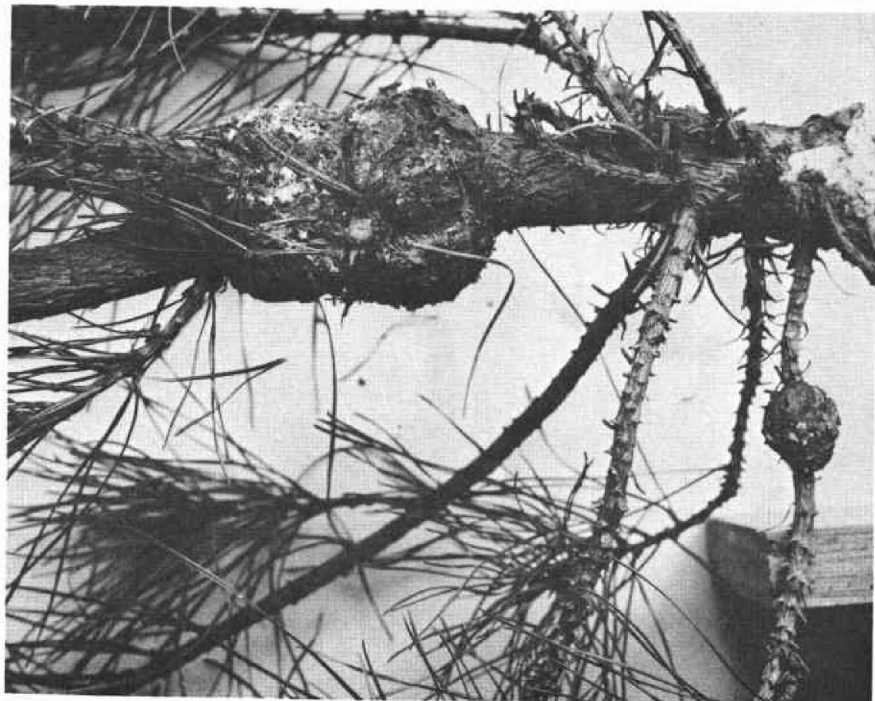


Figure 6. Monterey pine infected with western gall rust.

Table 1. Tree Survival and Brush Recovery Three Years after Spraying Gorse Area and Planting Conifers.

Treatment		Brush recov- ery	Survival				
			2-2 Douglas - fir	2-0 Douglas - fir	2-0 Grand fir	1-0 Monterey pine	1-0 Giant sequoia
2,4-D	Pic- loram						
Lb per acre			Percent				
0	1.0	80	32	44	18	26	14
4	1.0	80	82	70	56	24	10
4	0.5	50	76	58	44	38	12
2	0.5	80	16	26	28	28	14
4	0.25	40	62	62	56	24	42
4	0.125	60	58	76	42	36	14
4	0	30	84	74	66	36	56

On an area where gorse was 3 to 7 feet high, located about 5 miles southeast of Bandon, Oregon, fourteen 4-acre plots were sprayed by helicopter in July 1964. The soil, which had developed from old sand dune terraces, had drainage that ranged from poor to good. Replicated treatments consisted of seven different concentrations of Picloram and 2,4-D (Table 1). To observe development of trees topped by gorse that was recovering from chemical treatment of differing severity, test plantings were made of each of the following types of stock: 2-2 Douglas-fir, 2-0 Douglas-fir coated with Thiram, 1-0 giant sequoia coated with Thiram, 2-0 grand fir, and 1-0 Monterey pine. Seedlings were planted 6 months after gorse was sprayed.

None of the treatments led to complete kill of gorse. Density of gorse was reduced by Picloram applications of 0.5 pounds or more to the acre. None of the plantings were able to grow sufficiently in the 3 years to get their tops above the gorse. Plantings appeared to be in good condition on well-drained sites. By contrast, trees on poorly drained sites, where Picloram had been applied at rates of 0.5 pounds or more to the acre, showed malformation of needles and shoots. Survival of trees was influenced by their tolerance to Picloram residues in other than well-drained soil, tolerance to shade, and vulnerability to browsing, but not to the rate of herbicide application to gorse.

CONCLUSIONS

The planting trials during the last 20 years have provided information for planning of gorse control.

Choice of Planting Stock

Selection of planting stock capable of rapid growth is essential for success of plantations on gorse-infested land. Of all planting stock tested, only 1-0 Monterey pine and 2-2 Douglas-fir met this requirement. The Monterey pine grows faster, is less sensitive to poorly drained soil, and is cheaper and easier to obtain than 2-2 Douglas-fir. If seedlings are to be planted without complete removal of gorse, however, Monterey pine should not be chosen because of its low tolerance to shading.

Large seedlings have a better chance to survive than small seedlings because they are less vulnerable to cutting by rabbits and have the advantage of extra growth over gorse if planting is preceded by clearing. Stock is best suited for gorse land reclamation if diameter at the root collar is at least 5/16 inch and top height exceeds 18 inches. One-year-old Monterey pine of that size can be raised in nurseries, and if properly root-pruned, can be planted without difficulty.

Monterey pine is the fastest-growing, available tree that is adapted to the climate of the coastal belt of Oregon. Unfortunately, planting of Monterey pine entails risks that cannot be accurately gauged. Almost 90 insect pests, five of which can be classed as tree killers, are recorded for Monterey pine (9). Over 70 diseases are listed as occurring in native stands and plantations of Monterey pine in western North America (7). The "red band needle blight" (*Dothistroma pini*), which has been very destructive in plantations of Monterey pine in East Africa, has recently been found on Monterey pine in California (10). Spread of this disease to Oregon can be expected. Economic value and low risk of disease may improve attractiveness of Douglas-fir as a gorseland, conversion-crop species.

Preparations for Planting

The best preparation for planting of an infested area is to burn the gorse as completely as possible, to remove the remaining stalks, and to spray the newly germinating and resprouting plants for several years. Picloram at rates of 0.5 pounds to the acre, and in mixture with 2 or more pounds of 2,4-D, will control gorse for at least 2 years. Picloram should not be used at all where conifers are already present,

however, because it is extremely damaging to coniferous trees when it touches their foliage. Shore pine is the only conifer known to be Picloram-resistant.

Such preparation provides three major advantages: access is easy; shelter for animals is removed so that browsing and clipping are reduced; and plantings are given a good start.

If gorse is less than 3 feet high and burning or mechanical removal is not possible, planting should be done in combination with herbicide treatment. Under these conditions, access to planting spots may present difficulties and slow the work of planting crews.

Planting trees in live gorse taller than 3 feet is not advisable. Dried material accumulates underneath the green crown and creates an acute fire hazard. If gorse is killed through application of chemicals, the danger of fire increases. The sharp, long spines make moving through thickets of tall gorse extremely difficult. Planting crews must either hack through with machetes, or access must be provided by chaining and wallowing with heavy equipment. Whichever of these methods is employed, the fire hazard remains.

Growth of plantings in tall gorse will be slowed because of reduced light, and the seedlings will be subject to severe damage by animals, particularly rabbits. A comparison of mortality of Monterey pines planted in 1961 and in 1964 demonstrates the disadvantage of planting in tall gorse. Rabbits killed less than 1 percent of the Monterey pines on a well-cleared area, but nearly 50 percent of those planted under a canopy of gorse.

Decision to Plant

Control of gorse through tree planting should be attempted only in areas that are to be kept as forested land for several decades. Planted trees will probably need 20 to 30 years before they can shade out gorse, although this period may be shortened somewhat by close spacing of planted seedlings. If trees are harvested at ages below 40 years, little or no return will be received for the investment made in establishment of the plantation and maintenance of fire breaks.

Maintenance of adequate fire breaks around plantations in gorse is essential because of the ever-present danger of fire. This can be done by periodic removal of vegetation in a strip around the plantation, or by annual spraying of the fire break with 2,4,5-T. Continued application of this chemical will gradually eliminate gorse and will favor salal and huckleberry, which provide a rather effective fire break.

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