Quercus falcata Michx. Southern Red Oak

Fagaceae Beech family

Quercus falcata Michx. var. falcata Southern Red Oak (typical)

Roger P. Belanger

Quercus falca ta var. *pagodifolia* E l l. Cherrybark Oak

R. M. Krinard

Southern red oak *(Quercus falcata)* has been divided into two varieties, the typical southern red oak *(Q. falcata* var. *fulcatu)* and cherrybark oak *(Q. falcata* var. *pugodifoliu).* There are enough differences between the two to warrant separate discussions here.

SOUTHERN RED OAK

Southern red oak *(Quercus fulcutu* var. *fulcutu),* also called Spanish oak, water oak, or red oak, is one of the more common upland southern oaks. This medium-size tree is moderately fast growing on dry, sandy, or clay loams in mixed forests. It is also often found growing as a street or lawn tree. The hard strong wood is coarse grained and used for general construction, furniture, and fuel. Wildlife depend upon the acorns as food.

Habitat

Native Range

Southern red oak (figs. 1, 2) extends from Long Island, NY, southward in New Jersey to northern Florida; west across the Gulf States to the valley of the Brazos River in Texas; north in eastern Oklahoma, Arkansas, southern Missouri, southern Illinois and Ohio, and western West Virginia. It is comparatively rare in the North Atlantic States where it grows only near the coast. In the South Atlantic States its primary habitat is the Piedmont; it is less frequent in the Coastal Plain and is rare in the bottom lands of the Mississippi Delta *(8).*

The authors are Principal Silviculturist, Southeastern Forest Experiment Station, Asheville, NC, and Mensurationist, Southern Forest Experiment Station, New Orleans, LA.

Climate

Southern red oak grows where the climate is humid and temperate, characterized by hot summers, mild and short winters, and no distinct dry season. Average annual precipitation is between 1020 and 1270 mm (40 and 50 in), half of which occurs during the April to September growing season. Throughout the major part of its range, the average annual temperature is between 16" and 21" C (60° and 70" F), with daily extremes near -18" C (0° F) to about 38" C (100° F). At the northern extreme of its range the average annual temperature is between 10" and 15" C (50" and 60" F), with extremes of -23" to 38" C (– 10" to 100" F).

Soils and Topography

Southern red oak is characteristically an upland tree, growing on dry, sandy, clay soils *(1).* It is also found widely on sandy loam, sandy clay loam, and silty clay loam soils. Occasionally it grows along streams in fertile bottoms and here reaches its largest size. Overall, southern red oak is most commonly found growing on soils in the orders Ultisols and Alfisols.

Throughout its range, southern red oak is most frequently found at elevations up to 610 m (2,000 ft) above sea level in both the Coastal Plain and Piedmont regions (16). It usually grows on dry ridgetops and upper slopes facing south and west, rather than on moist lower slopes and bottom lands, or north and east aspects *(16).*

Associated Forest Cover

Southern red oak is found in nine forest cover types *(5).* It is a major component of Virginia Pine–Oak (Society of American Foresters Type 78) and Shortleaf Pine-Oak (Type 76). It is a minor component of Virginia Pine (Type 79), Loblolly Pine–Shortleaf Pine (Type 80), Loblolly Pine (Type 81), and Loblolly Pine-Hardwood (Type 82). Occasionally it is

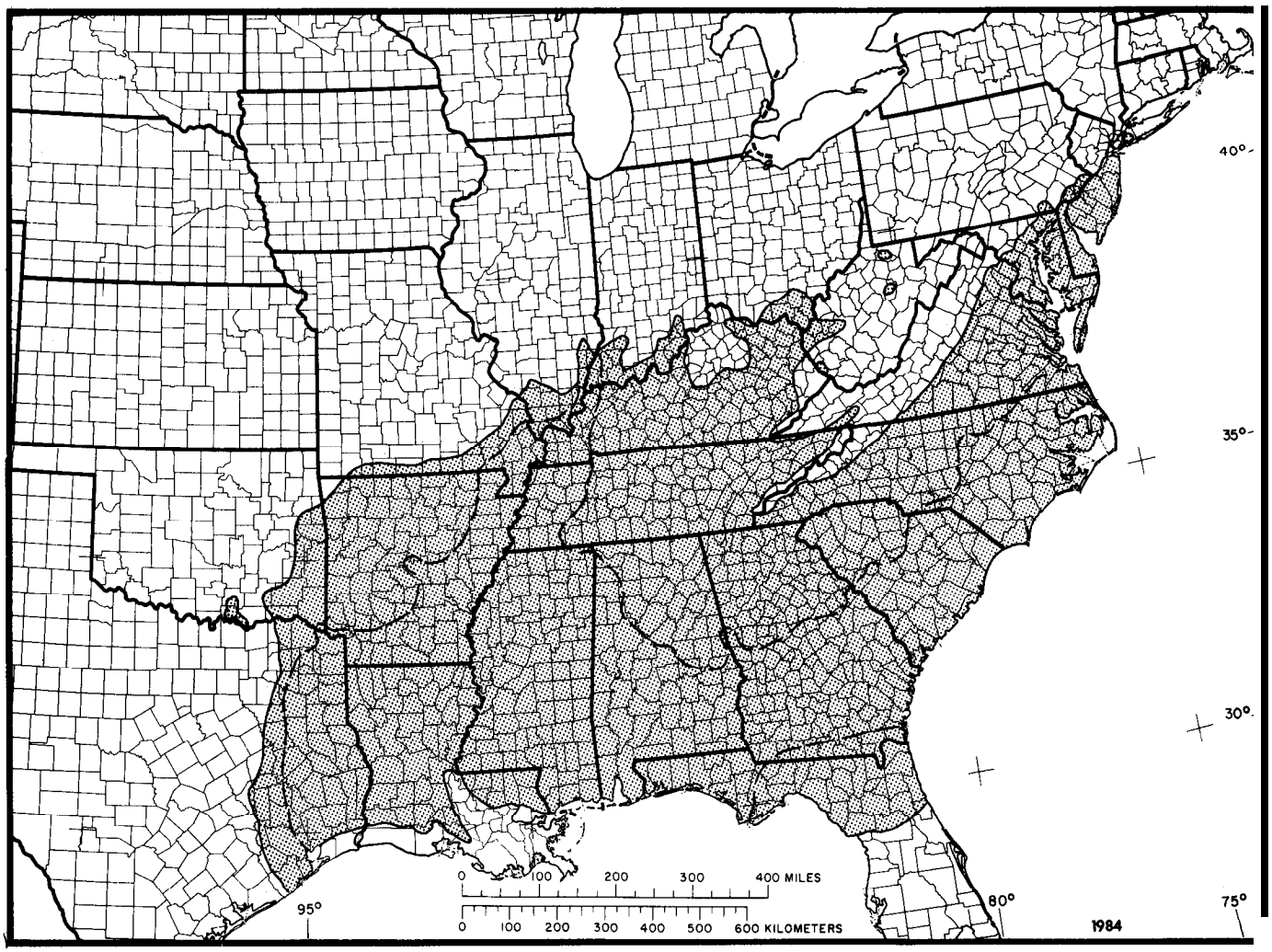

Figure *l-The native range of southern red oak. Broken lines indicate the approximate northern and southern limits of cherrybark oak, which also grows in scattered localities northward.*

found with Longleaf Pine (Type 70), Swamp Chestnut Oak-Cherrybark Oak (Type 91), and Post Oak-Blackjack Oak (Type 40).

Throughout most of its range, southern red oak is usually found as individual trees in mixed stands. It is commonly associated with white oak *(Quercus alba),* black oak *(Q. velutina),* scarlet *oak (Q. coccinea),* post oak *(Q. stellata),* blackjack *oak (Q. marilandica),* sweetgum *(Liquidambar styraciflua),* blackgum *(Nyssa sylvatica),* and hickory *(Carya* spp.). Along the foothills of the Appalachians, Virginia pine *(Pinus virginiana),* pitch pine *(I? rigida),* and chestnut oak *(Quercus prinus)* are common associates. Other associates are shortleaf pine *(Pinus echinata)* in the Piedmont, loblolly pine *(P. taeda)* in the Coastal Plain, and both shortleaf and loblolly pine in eastern Texas, southern Arkansas, and Louisiana.

Occasionally associated with southern red oak are swamp chestnut oak *(Quercus michauxii),* cherrybark oak *(Q. falcata* var. *pagodifolia),* white ash *(Fraxinus americana),* slash pine *(Pinus elliottii),* longleaf pine *(P. palustris),* yellow-poplar *(Liriodendron tulipifera),* southern magnolia *(Magnolia grandiflora),* American beech *(Fagus grandifolia),* red maple *(Acer rubrum),* flowering dogwood *(Cornus florida),* and persimmon *(Diospyros virginiana).*

Life History

Reproduction and Early Growth

Flowering and Fruiting-Southern red oak is monoecious; unisexual flowers of both sexes are borne on the same tree. Flowering occurs during

Figure 2—*Southern red oak.*

April and May throughout most of the range. The staminate flowers are borne in naked aments (catkins) and the pistillate flowers solitary, or in two- to many-flowered spikes.

The fruit is solitary or paired; the nut is enclosed one-third or less in a thin, shallow cup. The fruit ripens in September and October, the second season after flowering, and seedfall occurs during these months.

Seed Production and Dissemination-Seed production usually begins when a tree is about 25 years of age, but maximum production is usually between the ages of 50 and 75 years. Cleaned seeds average 1,190/kg (540/lb). Fall seeding of oaks is preferred to spring seeding in the nursery *(17)*. To obtain the highest first-year survival, it is recommended the acorns be planted not less than 1/2 inch deep and at seedbed densities of 12 to 15 evenly spaced sound seed per square foot ***(13).*** Fall beds should be mulched with leaves or straw held in place by hardware cloth covers or other effective materials. The covering also serves as a protection against rodents. It is usually not necessary to produce seedlings older than 1-O for field planting, but 2-O seedlings are planted occasionally to obtain larger, vigorous stock with more extensive root systems.

In natural stands, dissemination of acorns by gravity is important on steep slopes. The hoarding habit of squirrels is also important in the dispersal of seed of oaks.

Seedling Development-The seed of southern red oak germinate under natural conditions in the spring following seedfall. Cool, moist stratification is required for best results. Germination is hypogeal *(17)*.

Vegetative Reproduction-Southern red oak sprouts vigorously from the stump when the top has been killed or cut back *(6,16)*. Sprouting is most prevalent on young stems 25.4 cm (10 in) or less in diameter. With well established root systems, growth of sprout-origin stands is rapid, regardless of site quality, for about 20 years ***(18).*** Equations have been developed using sprout height at age 5 which predict the diameter growth and competition success of coppice-regeneration at ages 12 and 30 *(11)*. Clones of southern red oak can be propagated from cuttings of rooted stump sprouts and mature branches (4). Cuttings from branches root better than cuttings from stump sprouts. Root initiation is increased when cuttings are treated with the growth hormone IBA and the fungicide folpet, and when cuttings 6.4 mm (0.25 in) or larger are taken from the first flush after it hardens off and just before second flush bud break. Survival after rooting is also increased when larger cuttings are used.

Sapling and Pole Stages to Maturity

Growth and Yield-At maturity, southern red oak is a medium-size tree, usually from 20 to 25 m (70 to 80 ft) in height and 60 to 90 cm (24 to 36 in) in d.b.h. In forest stands it develops a long, straight trunk and upward-reaching limbs that form a high, rounded crown *(16)*. Natural pruning is excellent in well-stocked stands ***(19).*** Maximum age attained is about 150 years.

Equations are available for predicting green weights, dry weights, and green volume of sapling, pole-size and sawtimber southern red oak trees, using d.b.h. and total height classes *(3,12)*. Seventy percent of the average tree's green weight is in stem material to a 10-cm (4-in) top, and 30 percent is in crown material. Total-tree wood has an average specific gravity of 0.604, average moisture content of 74 percent, and average green weight of 1057 kg/cm^3 (66 lb/ft^3). The weight of wood and bark averages 1297 kg/cm^3 (81 lb/ft^3) for the entire above-ground portion of the tree.

Growth and yield data are not available for stands of southern red oak.

Rooting Habit-No information available.

Reaction to Competition-Southern red oak is classed as intermediate in shade tolerance *(2)* or as intolerant *(16)*, when compared with its associates.

Epicormic branching is profuse on southern red oak, especially on recently released crop trees. This reduces the quality of the timber and suggests that good quality occurs only in dense stands.

The shelterwood method is recommended for regeneration (7). Early removal of the overstory following stand establishment eliminates suppression from residual seed trees and prevents degrade from epicormic branching.

Damaging Agents-Southern red oak is susceptible to injury by fire because of its thin bark. As a result of fire scars and other injuries, this species often is subject to heart rots *(16)*. Cankers and rot caused by ***Polyporus hispidus*** are common. Other common rot fungi affecting this species include ***Hydnum erinaceus, Polyporus sulphureus, F! obtusus,*** and ***Fomes everhartii.***

While southern red oak is highly susceptible to oak wilt caused by ***Ceratocystis fagacearum,*** this disease is virtually unknown south of the 35th parallel *(9)*. Several species of ***Hypoxylon*** have been found to colonize the trunk sapwood of wilting trees, producing a yellow decay *(14)*. Apparently ***Ceratocystis fagacearum*** is unable to compete with the *Hypoxylon* spp.

Drought has been identified as a cause of southern red oak decline and death along the South Carolina coast ***(15). Hypoxylon atropunctatum*** was also partially responsible for these losses.

Leaf blister caused by ***Taphrina caerulescens*** and leaf spots caused by ***Actinopelte*** *dryina* or ***Elsinoe*** *quercus-falcatae* can severely mar the foliage of southern red oak (9).

The seedlings are damaged and often killed by the hickory spiral borer, *Agrilus* ***arcuatus torquatus,*** and the oak stem borer, *Aneflormorpha* ***subpubescens*** *(16)*.

As in many of the oaks, the acorn is subject to damage by acorn weevils, such as ***Curculio longidens, C. pardalis,*** and ***Conotrachelus posticatus,*** and the filbertworm, ***Melissopus latiferreanus.***

Southern red oak is readily susceptible to borers and bark scarrers when trees are wounded or growing on poor sites. Wood-boring insects attacking this tree are ***Agrilus bilineatus, Corthylus columbianus,*** and ***Cossula magnifica.*** The defoliators ***Anisota senatoria*** and ***A. stigma*** also do considerable damage.

Special Uses

The uses of oak include almost everything that mankind has ever derived from trees-timber, food for man and animals, fuel, watershed protection, shade and beauty, tannin, and extractives (17).

Genetics

Nine hybrids of southern red oak have been recognized ***(10).*** They are crosses with ***Q. ilicifolia, (Q. x caesariensis*** Moldenke); ***Q. imbricaria (Q. x anceps*** Palmer); ***Q. incana (Q. x subintegra*** Trel.); Q. ***Zaevis (Q. x blufftonensis*** Trel.); ***Q. laurifolia (Q. x beaumontiana*** Sarg.); ***Q. marilandica; Q. nigra (Q. x garlandensis*** Palmer); ***Q.*** *phellos* ***(Q. x ludoviciana*** Sarg.); ***Q.*** *velutina* ***(Q. x wildenowiana*** (Dippel) Zabel, ***Q. x pinetorum*** Moldenke).

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CHERRYBARK OAK

Cherrybark oak *(Quercus falcata* var. *pagodifolia),* also called bottomland red oak, red oak, swamp red oak, swamp Spanish oak, and Elliott oak, is the high-value red oak in the South. It is larger and better formed than southern red oak and commonly grows on more moist sites. The heavier stronger wood makes it an excellent timber tree; it is used for furniture and interior finish. Many wild animals and birds use the acorns as food. This tree is also a pleasant shade tree.

Habitat

Native Range

Cherrybark oak (fig. 1) is found in the Atlantic and Gulf Coastal Plain, from southeastern Virginia to northwestern Florida; west to eastern Texas; and north in the Mississippi Valley to extreme southeastern Oklahoma, southeastern Missouri, southern Illinois and southwestern Indiana *(26).*

Climate

Cherrybark oak grows in a humid, temperate climate characterized by hot summers and mild winters. Through most of the tree's range, the growing season varies from 210 to 280 days, with average annual temperatures of 16" to 21" C (60" to 70" F). Average annual precipitation ranges from 1140 to 1520 mm (45 to 60 in) (38). The lower Mississippi Valley tends to have less growing season rainfall and therefore more frequent droughts during the summer than the Atlantic Coastal Plain (25).

Soils and Topography

Cherrybark oak is widely distributed on the best loamy sites on first bottom ridges and on well-drained terraces and colluvial sites (27). These sites occur along both large and small streams of the Southeastern Coastal Plain and the Mississippi Valley north into Missouri and Illinois, although the tree is rare in the lower Mississippi Delta.

Cherrybark oak develops best on a loamy well-drained soil. Although uncommon on clay soils, it is generally of good form and quality on such soils if the drainage is good but very inferior where drainage is poor. Cherrybark oak is found mostly where surface soil pH is acid to medium acid *(10).* It is a lowland tree but is seldom numerous on wet or swampy soils.

Cherrybark oak also grows in Coastal Plain hummocks. These localized areas, which may be raised above surrounding terrain, are not necessarily associated with any stream but are usually well drained and have a deep soil of good texture. The species is also found on certain upland sites. Included are areas of loessial soil such as the Brown Loam Bluffs bordering the eastern edge of the Mississippi River alluvial plain from Louisiana north. Other favorable sites are found in the rolling hills of the lower Piedmont and certain uplands of the upper Coastal Plain. Here the species grows well in branch heads, coves, and slopes with deep surface soils *(27).*

Overall, cherrybark oak grows most commonly on soils of the order Alfisols and Inceptisols.

A site index predictive model for cherrybark oak based on measurable soil variables accounted for less than half the variation in site index. Most significant soil variables were depth to mottling, depth of topsoil, and presence or absence of fragipan (9).

A combined objective and subjective approach to site evaluation for cherrybark oak plantations has been developed that is based on soil physical conditions, nutrient availability, moisture availability during the growing season, and aeration. Site index values obtained should be within 1.5 m (5 ft) of measured values 95 percent of the time (2).

Associated Forest Cover

The main forest cover type that includes cherrybark oak is Swamp Chestnut Oak-Cherrybark Oak (Society of American Foresters Type 91) *(14)*. Typically the composition varies widely, and cherrybark oak and swamp chestnut oak *(Q. michauxii)* are often only indicator trees, although they may be the most abundant of the oaks present. Other prominent tree species are white ash *(Fraxinus americana)*, shagbark hickory *(Carya ovata)*, shellbark hickory *(C. laciniosa)*, mockernut hickory *(C. tomentosa)*, and bitternut hickory *(C. cordiformis)*. Less numerous are blackgum *(Nyssa sylvatica)*, white oak *(Q. alba)*, Delta post oak *(Q. stellutu* var. *paludosa)*, and Shumard oak *(Q. shumurdii)*. On first bottom ridges sweetgum *(Liquidambar styraciflua)* may be important. Minor associates include southern red oak *(Q. falcata* var. *falcata)*, southern magnolia *(Magnolia grandiflora)*, yellow-poplar *(Liriodendron tulipiferu)*, American beech *(Fagus grundifoliu)*, willow oak *(Q. phellos)*, water oak *(Q. nigra)*, post oak *(Q. stellutu)*, American elm *(Ulmus americana)*, winged elm *(U. alata)*, water hickory *(C. aquatica)*, nutmeg hickory *(C. myristiciformis)*, and occasionally loblolly pine *(Pinus taeda)* and spruce pine *(P. glabra)*.

This cover type is widely distributed over the alluvial flood plains of the major rivers, occurring on all ridges in the terraces and on the best, most mature, fine sandy loam soils on the highest first bottom ridges. It extends on first bottom ridges to a few well-drained soils other than sandy loam. These sites are seldom covered with standing water, although, if there are hummocks, the sites between them may be wet.

White oak is the predominant tree in Swamp Chestnut Oak-Cherrybark Oak on the most mature terrace soils. In very limited situations cherrybark oak is found with loblolly pine on terraces, and with spruce pine on terraces and stream fronts and ridges in the first bottoms of small streams of the Coastal Plain east of the Mississippi River. It is found with yellow-poplar and beech only in the second bottoms of small secondary streams and in the Brown Loam Bluffs.

Cherrybark oak may be an associated tree on better drained areas in the cover type Willow Oak–Water Oak-Diamondleaf Oak (Type 88) and on moist sites in Loblolly Pine (Type 81) and Loblolly Pine–Hardwood (Type 82).

Other trees associated with cherrybark oak are red buckeye *(Aesculus pavia)*, devils-walkingstick *(Aralia spinosu)*, American hornbeam *(Carpinus caroliniana)*, red mulberry *(Morus rubru)*, southern bayberry *(Myrica ceriferu)*, Carolina basswood *(Tilia caroliniana)*, eastern hophornbeam *(Ostrya virginiunu)*, pawpaw *(Asiminu triloba)*, eastern redbud *(Cercis cunudensis)*, flowering dogwood *(Cornus florida)*, witch-hazel *(Hamamelis virginiana)*, American holly *(Ilex opaca)*, hawthorns *(Crataegus* spp.), Hercules-club *(Zanthoxylum clava-herculis)*, roughleaf dogwood *(Cornus drummondii)*, and snowbell *(Styrax* spp.) *(27,30)*.

Common understory plants include giant cane *(Arundinuriu gigunteu)*, blackberry *(Rubus* spp.), and hydrangeas *(Hydrangea* spp.), along with vines such as redberry moonseed *(Cocculus carolinus)*, southeast decumaria *(Decumaria barbara)*, peppervine *(Ampelopsis arborea)*, Virginia creeper *(Parthenocissus quinquefoliu)*, and grape *(Vitis* spp.) *(30)*.

Life History

Reproduction and Early Growth

Flowering and Fruiting-Cherrybark oak is monoecious; staminate and pistillate catkins are borne separately on the same tree, with the staminate catkins clustered and the pistillate flowers in a solitary position or several together. They are borne on stalks from leaf axils of the current growth. The flowers appear from February to May, depending on latitude. The acorn is about 13 mm (0.5 in) long, globular or hemispheric, with up to one-third of its length enclosed in a shallow thin cap. Seeds per kilogram range from 440 to 1,650 (200 to 750/lb). Acorns mature from August to November of the second year. In central Mississippi, acorns in their second year grew at a steady rate from June through August. Maximum acorn size was reached in September as storage food content increased rapidly and moisture content dropped from 60 to 40 percent. At full physiological maturity, in late October or early November, acorns had attained maximum dry weight

and were dark brown, easily separated from their cups, 15 to 20 percent crude fat, 25 percent carbohydrate, and 35 to 40 percent moisture (7).

The best method of determining germinability of cherrybark oak acorns is by flotation combined with visual inspection. Both floaters and those with weevil blemishes on the shell or dark, dull cup scars are considered nonviable *(8)*.

Moisture content of cherrybark oak acorns is a critical factor. Acorns stratified over winter and then air-dried for more than 4 days did not germinate. Therefore, fall-collected acorns should either be sowed immediately or promptly placed in moist cold storage (23).

Cherrybark oak acorns may be stored for up to 18 months at temperatures slightly above freezing if the seeds, at 45 to 50 percent moisture content, are kept in polyethylene bags of at least 0.01 cm (4 mils) thickness, although some will sprout during storage *(6)*.

One study showed that the germination percentage of cherrybark oak acorns is significantly reduced by submersion in water for 34 days (27).

Seed Production and Dissemination—Seed-bearing begins when the trees are about 25 years old, and optimum production is reached when they are between 50 and 75 years of age. Good crops are frequent, occurring at 1- or 2-year intervals, with light crops in intervening years. A freeze in April 1955, after the flower buds opened, resulted in a complete crop failure over much of the tree's range in 1956. Dissemination largely depends on hoarding activity of animals, especially squirrels, In certain situations (first bottoms) dissemination by flooding is possible. Gravity is a minor means of dissemination on the steeper terrace margins (27).

Seedling Development-Cherrybark oak regenerates naturally on areas protected from fire and grazing. Being intolerant of shade, it requires full light for development, which in turn induces heavy competition from annual weeds, vines, briars, and brush. It often makes its best development in old fields on well-drained loamy soils (27). Typically, seeds remain dormant after falling and do not germinate until the following spring. Germination is hypogeal.

Several studies have involved direct seeding of cherrybark oak acorns. Repellents (arasan, endrin, and anthraquinone) were found to reduce germination (4). One recommendation was to sow 4,940 acorns per hectare (2,000/acre) to obtain 1,230 established seedlings per hectare (500/acre), although elimination of weeviled acorns would reduce seed requirements *(21)*. In South Carolina, direct seeded acorns averaged 30 percent survival, with seedlings 51 cm (20 in) tall after 3 years on sandy loam soils associated with first and second bottoms of small coastal streams. Height growth, which was greater in the open than in the shade, was indicative of natural regeneration development *(27)*. In an Arkansas trial, only 2 percent of cherrybark oak acorns seeded under a deadened low-quality gum and oak stand resulted in established seedlings. High germination over a 3-month period was negated by grass competition, heavy grazing, and severe drought *(11)*. Success of direct seeding in starting stands, therefore, is dependent on favorable climatic and soil conditions together with limited plant and animal competition.

Cherrybark oak seedling development has been studied in nurseries and outplantings. The highest percentage of plantable seedlings per unit weight of seeds came from the lowest seedbed density, where densities varied from 43 to 108 seedlings per square meter (4 to 10/ft^2) (3). Survival of cherrybark oak seedlings decreased as severity of root and top pruning increased (40). Seedlings started in kraft paper tubes had less growth and survival than bare rooted seedlings when outplanted. The container seedlings were smaller and the tubes restricted root growth (22). In another test of seedlings planted in containers, it was found that after 3 years, those seedlings planted with bare roots or in milk cartons had a better survival rate than those that had been planted in cardboard tubes (33).

Pot planting studies of first-year seedlings rated cherrybark oak intolerant of flooding and saturated soils. Seedlings did not develop adventitious roots, as did tolerant species, and leaf mortality was related to moisture deficits *(18,19,20)*.

A l-percent solution of gibberellic acid in lanolin applied to new shoot growth of l-year-old seedlings significantly increased height growth over a 41-day observation period *(31)*.

Growth of planted cherrybark oak seedlings in minor bottoms has been variable, but best growth is usually obtained where vegetative competition is controlled by cultivation. In an Arkansas planting, trees disked annually averaged 4.3 m (14 ft) in 5 years, with 75 percent survival (24). Trees planted in Louisiana were 2.4 m (8 ft) tall after 6 years, and 4.9 m (16 ft) tall after 9 years, with 93 percent survival *(1)*. A Carolina coastal plain planting of cherrybark oak averaged 1.4 m (4.6 ft) and 46 percent survival after 5 years (36).

In a test where site preparation consisted of deadening residuals, planted cherrybark oaks were

smaller and fewer in number than the natural regeneration after 11 years ***(13).***

Amount of cherrybark oak reproduction is mainly determined by seed supply but is also influenced by microclimate, soil factors, and stand variables. Seedling development is related to overhead release, with large openings needed ***(17).***

Restricted understory development beneath cherrybark oak trees is apparently caused by leaching of salicylic acid, an inhibitor, from the oak crowns by rain. Reduced germination and growth of seedlings was also shown in greenhouse studies using soil obtained from under cherrybark oak trees ***(12).***

Vegetative Reproduction-The tree is reported to sprout from the stump when the shoot has been killed or cut back (27). However, sprouting is not considered a dependable means for obtaining desirable natural regeneration. Seedlings and smaller trees (advance reproduction) sprout more than larger trees, and more sprouting occurs on lower quality sites. Like most oaks, this species is difficult to propagate by cuttings, although in Mississippi air layering has succeeded in April and June *(5)*. Greenwood apical cuttings from 1- to 4-month-old cherrybark oak seedlings have been rooted in 4 weeks under mist after treatment with indolebutyric acid ***(15).***

Sapling and Pole Stages to Maturity

Growth and Yield—Cherrybark oaks (fig. 3) often attain heights and diameters of 30.5 to 39.6 m and 91 to 152 cm (100 to 130 ft and 36 to 60 in), respectively, which classes them with the largest of the southern red oaks. It is one of the hardiest and fastest growing oaks and grows well on more sites than any other bottom-land oak except the willow and water oaks. Diameter growth rates range from 7 to 15 cm (3 to 6 in) in 10 years (27). As a guide, the maximum gross cubic volume growth per year has been estimated to range from 13 to 19 m^3/ha (188 to 275 $ft^3/acre$) on good sites (site indexes from 32 to 40 m (105 to 130 ft) at base age 50). Only one-half to two-thirds of these yields could be expected from good extensive management practices (32).

Rooting Habit—Cherrybark oak is classified as having poor windfirmness (30). In the root system of most oaks, the taproot dies back and sinker roots arising from the laterals take over the vertical root function.

Reaction to Competition-Cherrybark oak is often found as individual trees in mixed stands but is sometimes found in groups, and occasionally, with Shumard oak, it dominates a stand. It cannot live under complete shade, however, and is usually found in a dominant or codominant position. It is classed as intolerant of shade and probably becomes established only in openings (27).

This oak usually has a relatively branch-free merchantable bole in contrast with other bottom-land red oaks such as pin and willow oak. Often it is conspicuous for this reason, and because of its good form and quality it is regarded as one of the best red oaks *(27)*.

Following release or injury this oak produces epicormic sprouts but to no greater degree than many other oaks.

Damaging Agents-Wood-boring insects often cause much damage in fire-scarred cherrybark oaks and in overmature trees. Moreover, on poorly drained clay flats or other poor sites, the mature trees are often infested with borers or the wood is mineral streaked. Fires and hurricane winds seem to be instrumental in introducing the borers and mineral streaks (27).

Trunk boring insects found in cherrybark oak are the carpenterworm ***(Prionoxystus robiniae),*** red oak borer ***(Enaphalodes*** *rufulus)*, oak clearwing borer ***(Paranthrene*** *simulans)*, and the living-beech borer ***(Goes*** *pulverulentus) (34,35).* Oak twig galls (multiple species) are a common occurrence in the loessial hills and coastal plain sites. Insects identified as attacking southern red oak probably also attack cherrybark oak; these are the defoliating Anisota oakworms ***(Anisota*** spp.), the twolined chestnut borer *(Agrilus bilineatus)*, Columbian timber beetle *(Corthylus* ***columbianus),*** and pecan carpenterworm *(Cossula* ***magnifica).*** Other probable cherrybark oak insects are the hickory spiral borer ***(Agrilus arcuatus*** var.

Figure *3-Large cherrybark oak trees in South Carolina.*

torquatus) and the oak-stem borer *(Aneflormorpha* ***subpubescens) (27).***

Hispidus canker ***(Polyporus hispidus)*** is common on cherrybark oak. Rot fungi attacking southern red oak and possibly cherrybark oak are ***Hericium erinaceus, Laetiporus sulphureus,*** and ***Daedalea quercina.*** Leaf blister caused by ***Taphrina*** *caerulescens* occurs frequently. Cherrybark oak is susceptible to oak wilt ***(Ceratocystis*** *fagacearum) (27,28,29,39).* Heart rot in standing cherrybark oak trees generally is greater on poor sites than on good sites (37).

As in most of the oaks, the acorn is subject to damage by nut or acorn weevils, such as *Curculio* ***baculi, C. longidens, C. pardalis,*** and ***Conotrachelus posticatus,*** and the filbertworm ***(Melissopus*** *latiferreanus)* ***(27).***

Pine voles have destroyed cherrybark oak seedlings in outplantings in the loess hills.

Special Uses

Within the range of this oak, animals and birds include acorns as a substantial part (10 percent or more) of their diets. Among these the heaviest eaters are the gray squirrel, wild turkey, and blue jay, followed by the wood duck, red-bellied woodpecker, red-headed woodpecker, white-breasted nuthatch, common grackle, raccoon, white-tailed deer, and eastern fox squirrel (27).

Genetics

Stands of cherrybark oak in west Tennessee and central Mississippi averaged 0.601 specific gravity and 1.49 mm (0.06 in) fiber length. Most variation was from tree-to-tree differences within stands, indicating that field selection of breeding material should be on an individual tree basis *(16).*

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