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Live Oak Health Care: Planting, Pruning & Pests

Dr. Kim D. Coder, Professor of Tree Biology & Health Care / University Hill Fellow
University of Georgia Warnell School of Forestry & Natural Resources

Live oak (Quercus virginiana) is a great tree of the Coastal Plain in the South-central and Southeastern United States. It can be massive and wide-spreading, or scrubby and small, depending upon the site where it grows. Live oak is both a cultural and an ecological asset in landscapes. Proper health care is essential for a sustainable and structurally stable tree. This publication will cover some of the more important parts of starting, growing and taking care of a live oak.

Collect & Sow

Growing live oaks from seed must be completed with care. Live oak acorns can be collected after October from trees. Acorns on the ground have a much lower germination percentage due to pests (like weevils) and from drying. Figure 1. Remove any acorn caps attached and float test acorns in a bucket of water – discarding floating acorns, caps and debris. Also, remove any acorns with small holes, shell cracks, or fungal growth. Do not use hot water baths or microwave heating to kill weevils within acorns as germination is severely impacted. Figure 2.

The larger the acorns, the greater success in germination and early growth. Immediately sow gathered acorns in fertile, well-drained but moist, mineral soil. Acorn storage is not recommended, as fungal pests and drying quickly destroy germination potential. Short storage periods under cool, moist (high relative humidity not wet) conditions can be used for several weeks. Do not allow acorn moisture contents to drop below 35%.

Live oak acorns have no cold requirement before germination and should be quickly planted in Fall. Sow acorns eight inches apart and cover with 1/3 inch of mineral soil and 1 inch of a low density, organic mulch on top. Protect the germination area from animal thieves and beware of fungal rots initiated by over-watering. Germination should begin within days and be completed in four weeks.

The new radicle (root) will quickly expand into soil and grow on nutritive materials extracted from acorn cotyledons. The embryo at this stage is extremely prone to both under-watering and over-watering damage. Partial shade on a site can be beneficial because it allows for germination, but helps prevent emerging radicals from drying out. Transplant strong growing seedling live oaks with large lateral root systems (i.e. a number of large diameter roots) to field growing areas. Grow live oaks seedlings 2-8 years to meet management objectives.

Planting

Successful planting of live oak is similar to other trees. Some of the most important differences are reviewed here. The site should be open with full sun. Live oak produces few shade leaves even when young and needs full sunlight to grow. Little interference from other plants, especially turf, vines, and shrubs is essential. Either use chemical and physical weeding, or a light mulch, to maintain a plant free zone around live oak stem base. Be cautious in using herbicides to not damage tree roots or stem base. The site must be moist with adequate water supplies but must also be well drained. Poor soil drainage kills many young and newly planted live oaks.

If not self grown, any live oak selected should come from a reputable nursery which used local genetic stock. Young live oaks in a nursery setting need to be root pruned a number of times as they grow, and hardened off before planting. Hardening means holding the root pruned, dug trees in the soil for several months. Late Summer, Fall or early Winter digging is successful as long as the tree has been root pruned multiple times. Non-root pruned trees have poor survival compared with root pruned trees. Do not use Fall transplanting with live oaks. Spring transplanting assures good root colonization.

Usually field grown and ball-and-burlapped (B&B) live oaks which have been root pruned multiple times and hardened off survive better, and significantly out-perform, container grown trees. If containerized trees are used, the outer inch of the container soil should be shaved away with a sharp shovel at planting time. Smaller container trees tend to out-perform larger container trees due to root constraint problems being magnified as tree are transferred to progressively larger containers. These root constraints can last a long time after planting. There is no size difference advantage across trees which are root pruned, hardened, and field grown.

Go Shallow & Wide

Excavate a large planting saucer (wide not deep). Make vertical slices all the way around the saucer into surrounding soil to provide root growth channels. Cultivate the site ahead of time, if no tree roots are present from other trees. It is critical trees are not planted any deeper than the middle of lateral root tops, except in course textured sand where slightly deeper (1-2 inches below grade) planting depth is not detrimental. Figure 3. Usually, primary lateral roots should be clearly visible 1-2 inches above the soil surface at the tree base. No intermixed, layered, or surface applied soil amendments should be used in live oak planting saucers. Minimize fertilization, if any is used at all, for the first year.

Irrigation should be started immediately with the amount determined by site drainage. Apply water over the root ball with extra over the surrounding saucer area and native soil. Water should always be allowed to pass down through the planting site, not accumulate around roots. Irrigate live oaks a minimum of two times a week for the first growing season, and once a week for the second growing season and during extended drought periods. It is critical to provide good drainage throughout the entire soil depth. Control competing weeds for at least the first three years. Maintain a clear soil surface area closely (4-6 inches) around the base of a newly planted tree.

Established ?

Live oaks can be considered established on their site based upon root to crown spread ratio. Figure 4. As root spread to crown spread ratio reaches 3-4, measured around the tree at multiple points, live oak is considered to have been successfully established and is well connected to the ecological system which will sustain the tree into the future. The more horizontal root spread and open soil surface area provided, the greater chance for success. Providing more soil depth is not usually valuable for live oak because of limitations in drainage and aeration.

Planting Summary

Proper planting when root growth can be quickly started is essential. Spring planting is effective. Field grown, root pruned, and hardened young trees make great candidates for planting. Plenty of water, paired with great soil drainage, in a large, shallow, and wide-spread planting area is ideal. Do not amend the planting saucer backfill soil. Do not fertilize in the first growing season. Use a thin layer of a lightweight, non-compressible organic mulch over the planting site except for the six inches immediately around the stem base. Key components to good management of live oak throughout its life will be water, space, training, great soil, and wound prevention.

Training

Training is difficult in live oak because it requires intensive pruning early to prevent young live oaks from becoming more bush-like. But do not abusively prune young trees. Patience is required! Crowns in small trees should be raised only slowly. Figure 5 suggests the slow pace of any required crown raising. Keep as many green branches on a tree as possible. Abridge / subordinate (node-centered branch reduction) any branch approaching 1/3 the diameter of the main stem at the point where it is connected (i.e. stem-branch confluence).

If abridging or reduction pruning is needed, it must be substantial in order to keep remaining branches growing well. At least 40% of a side branch need to be reduced to effectively shift growth to the rest of the branch and tree. Try to conserve a single dominant stem pathway from stem base to the highest point in the crown. In oak wilt areas only, use a commercial pruning paint on wounds, and do not prune in Spring and early Summer. As a tree matures to fit its available soil and air volume, small amounts of directional pruning can be used at intervals to maintain shape and site objectives.

Aging live oaks will tend to develop spreading low branches. Be sure to allow enough space for this natural process or keep the tree well trained throughout its life. Always prune branches growing in undesirable directions before they reach 1/3 the diameter of the stem (where branch is attached) in order to minimize decay and discoloration, and maximize effective growth over the pruning wound. There are upright cultivars for use in relatively narrow spaces.

Knowing Limitations

Environmental factors such as freezing temperatures, hot summer droughts, and fires can severely damage or kill live oak. Young live oaks are especially susceptible to fire damage. Live oaks do best in groups or clumps where each tree shades the base and soil of surrounding trees. Sustaining soil health under live oak includes: good soil organic matter delivered as compost in a thin layer over the soil surface several times a year; good soil drainage and minimizing compaction (fence or place other plant materials to prevent vehicular parking and pedestrians); adequate water supplemented any time of year during drought periods; and, carefully planned light fertilization and liming based upon the tree's life stage, and soil and tissue testing.

Old growth trees need plenty of space to mine for resources with plenty of water throughout the Spring and Summer. Soil drainage is one of the most important features of sustaining good live oak growth. Soil compaction, pavements, building activities and grade changes can all negatively impact soil drainage and initiate many, quickly compounding problems in old trees. Preventing both soil and tissue damage is key to sustaining old tree survival and growth.

Traditional Competition

Beware of over-planting the wide understory beneath old trees. Traditional landscapes were successful because many competing root systems were not stacked on top of each other beneath live oak crowns. Go light with the stocking density of plant materials beneath live oaks, especially old trees. Live oaks should not be covered with vines. If vines are used at all, they should be maintained below six feet up the tree's trunk. Do not allow vines to climb the trunk, especially to the first branch union. Do not allow a dense ground cover to live under a tree if the ground cover receives full sun during large portions of the day. Well tended but thin organic mulch and compost layers beneath live oak accentuates tree beauty and size, as well as providing an ecologically healthy soil.

Live oak is particularly light demanding because it generates few, if any, shade leaves. This puts live oak at a competitive disadvantage when surrounded by more shade tolerant species of trees which can steal light resource space and grow taller than live oak. Interference of other trees with live oak crown areas can be severe and cause live oak loss. Figure 6 shows live oak growth plummets with increasing crown interference. Live oak should be placed in an open-grown landscape position. Ground, side, and overtopping trees and plants must be disturbed, disrupted and cleared often. Low intensity burning, grazing, chemical control, and weeding are important treatments in live oak culture.

Conserving Crowns

Middle-aged and older live oaks redirect height growth energy and utilize wide spreading crowns to gather resources and control sites. Once this crown width to tree height geometry is set, live oak rarely regains height growth capabilities even if forced from side competition. Traditional open grown live oaks approach a crown width to tree height ratio of around 1.2 - 2.0, symbolizing a wide-spreading large tree rather than a compact tall tree. If side and overtopping interference from other trees are allowed to impact live oaks, live oaks will begin showing significant crown decline and dieback over 10-20 years leading to a decline spiral. Figure 7 shows how crown interference can compromise live oak health. A decline spiral initiated by more than 50% crown interference usually is unrecoverable, even if immediately remediated.

Old live oak trees should not be propped, have hardware installed such as lights, or have trunk periderm painted – as immediate and long-term tree injuries can result. The old tradition of white-wash liming of trunks may disrupt some of the soil-overwintering pests, but should be avoided as a tree damaging treatment. Good arboricultural practices required to make trees biologically efficient and structurally sound should be applied by skilled arborists. Cable and bracing, and lightning conduction hardware installation are common and valuable therapeutic treatments. Seeking pest and stress management expertise is a great investment.

Storm Survival

Live oaks grow in hurricane prone areas. Live oak is cited as being resistant to hurricane wind forces and surviving with only minor to moderate damage. In one major hurricane event, 30% of live oaks were undamaged, 50% had bent and broken limbs, 16% were heavily defoliated, 5% had broken tops, 2% had broken stems, and 3% were uprooted or knocked down. In another storm event, live oaks were found to uproot rather than break. Arborists were able to successfully lift some of these uprooted trees back into place (in cases where prompt actions and carefully designed cable support systems could be applied — associated with relatively minor root damage.) A good pruning program helps live oaks be more resistant to winds, especially through reduction pruning.

In summary, live oaks tend to loose leaves and small branches, escaping major damage in most storms. In other words, within the live oak forest and landscape, short and fat survives over tall and thin.

Live Oak Pests

Live oak has relatively few serious pests other than humans. Most pests found in live oak are secondary to other key stresses generated by climatic and soil changes. Abiotic problems, especially cold, construction damage, poor soil drainage, and summer droughts make live oak more susceptible to a number of pests.

Figure 8 provides pest names, descriptions, and impact ranking in landscapes, along streets and in parklands. Figure 9 provides a reorganized list of the same pest names by impact rankings. Note local pest problems can occur in any area, but not represent widespread impacts across live oak's range. Pests with local consequences would receive a lower impact ranking in these figures than pests with potential range-wide impacts. These figures list the most probable non-vertebrate pests across the native range of live oak. This list is not comprehensive but covers most important pests of live oak as defined in the literature.

Number One !

Live oak has a limited number of pests which cause serious damage. Foremost among live oak pests is oak wilt caused by fungi Ceratocystis fagacearum. Oak wilt is especially damaging in the Western portion of live oak's native range. Oak wilt was first described in 1944 with its initial discovery in Wisconsin. The pathogen is believed to be a recent introduction into the United States. Oak wilt is a vascular pathogen which colonizes water conducting vessels in the outer ten or so annual increments of sapwood. Almost all new tree infections in live oaks are caused by the fungus growing from one tree through roots into other trees. Live oaks tend to grow as sprouts from a shared root system (clonal) and develop root grafts with other live oaks in the area. The oak wilt fungus can travel through root grafts and spread up to 100 feet per year. Chemical and physical root barriers can be installed in trenches to control fungal spread.

In rare cases, oak wilt fungi generates fungal mats on infected live oaks. Insects (i.e. Nitidulide beetles) feed upon these mats on warm Spring days and then move to other trees and initiate new infections. Wounds from logging, pruning, galls, bark borers, or other types of periderm damaging events can draw many insects and be the initiation site for new oak wilt infections in live oaks. Pruning wounds covered with wound paint interferes with insect colonization and feeding, minimizing infections. Live oak wood, dead less than one year, can still harbor living fungi capable of infecting new trees. Firewood should not be moved from infection areas.

Live oak symptoms of oak wilt infection include stunted leaves on trunk sprouts, leaves wilting in late Spring, veinal death in leaves, and massive twig dieback progressively spreading throughout the crown. The most susceptible trees usually die in 4 - 6 months, others survive for several years. Approximately 10% of the stricken trees survive the infection altogether with major crown loss. Tree survivability suggests a limited form of native resistance is present within live oaks. Oak wilt is heavy in Texas live oak (Q. fusiformis) of Central Texas, moderate in Texas live oak / live oak (Q. fusiform / Q. virginiana) hybrids, and lighter in typical live oak (Q. virginiana). Live oak as a species is only now being challenged. Over time, oak wilt should continue to expand its range throughout the live oak range.

Other Pests

Live oak has a number of additional serious pests which can cause problems. These major pests which can have a significant impact on live oak are: Cryphonectria parasitica — Chestnut blight; oak decline syndrome; Hypoxylon atropunctatum – Hypoxylon canker; Phytophthora cactorum – bleeding canker; and, Curculio spp. – acorn weevils destroying a high percentage of the acorn crop.

Live oak has many pests which at times take advantage of a weakened or damaged tree. These pests include: anthracnose; Armillaria mellea — shoe string root rot; Botryosphaeria rhodina — bot canker; Callirhytis operator – wooly flower gall; Clitocybe tabescens – mushroom root rot;

Coryneum japonicum – Coryneum twig canker; Diplodia — diplodia canker; Enaphalodes rufulus — red oak borer; Endothia gyrosa – endothia canker; Phoradendron serotinum — mistletoe; Prionoxystus robiniae – carpenterworm; and, Xyletta fastidiosa — bacterial leaf scorch.

Epiphytes

Live oak periderm surfaces provide a rich ecology in support of many living things. There are three noticeable and common epiphytes associated with live oaks. These are Spanish moss (Tillandsia usneoides), ball moss (Tillandsia recurvata), and resurrection fern (Pleopeltis polypodiodes). They are not parasitic, but instead live only upon what rain and tree periderm can provide. They occupy crown volume and periderm area, and so can become so dense as to shade tree foliage and increase wind loading. After major storm events, epiphytes tend to increase in numbers for several years and then return to pre-storm numbers as live oak foliage density and crown structure recovers.

For example, the two Tillandsia species (of the pineapple family) absorb water through their surfaces, requiring regular rainfall and relatively high humidity to grow well. Both of these epiphytes depend upon specific lichen communities on periderm surfaces for fixed nitrogen and other materials. Tillandsia species maximize their growth around ½ full sunlight, opening stomates and absorbing carbon dioxide only at night, or for short periods immediately after rain in the daytime. There are a number of other epiphytes which occupy live oak periderm surfaces, ranging from common algae to endangered orchid species.

Summing Up Problems

As in all other tree species, the biotic and abiotic features of the environment conspire to damage and kill live oak. Both shortages of essential resources (as in drought) and abusive site resource enrichment (like over-fertilization) can accentuate tree stress. Neighboring biological systems (biotics) survive by taking resources, or by adding toxins to resources, used by live oaks stressed in the environment. Although most pests have principally secondary and tertiary roles, they deserve managerial notice and treatment within a professional tree health care program.

Conclusions

To keep live oak healthy and structurally sound, educated management must be used. Sustainable live oak trees are a significant asset to any landscape. Investing in careful health care, with good seasonal observations, quick resource enrichment when needed, and protection from abiotic and biotic stress will generate a great live oak tree. If you are a responsible care-taker of a live oak, it should always out-live you and yours by several generations!

Citation:

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germination percent =
{0.94 - [0.031 X (acorn weight loss percent)] } X 100

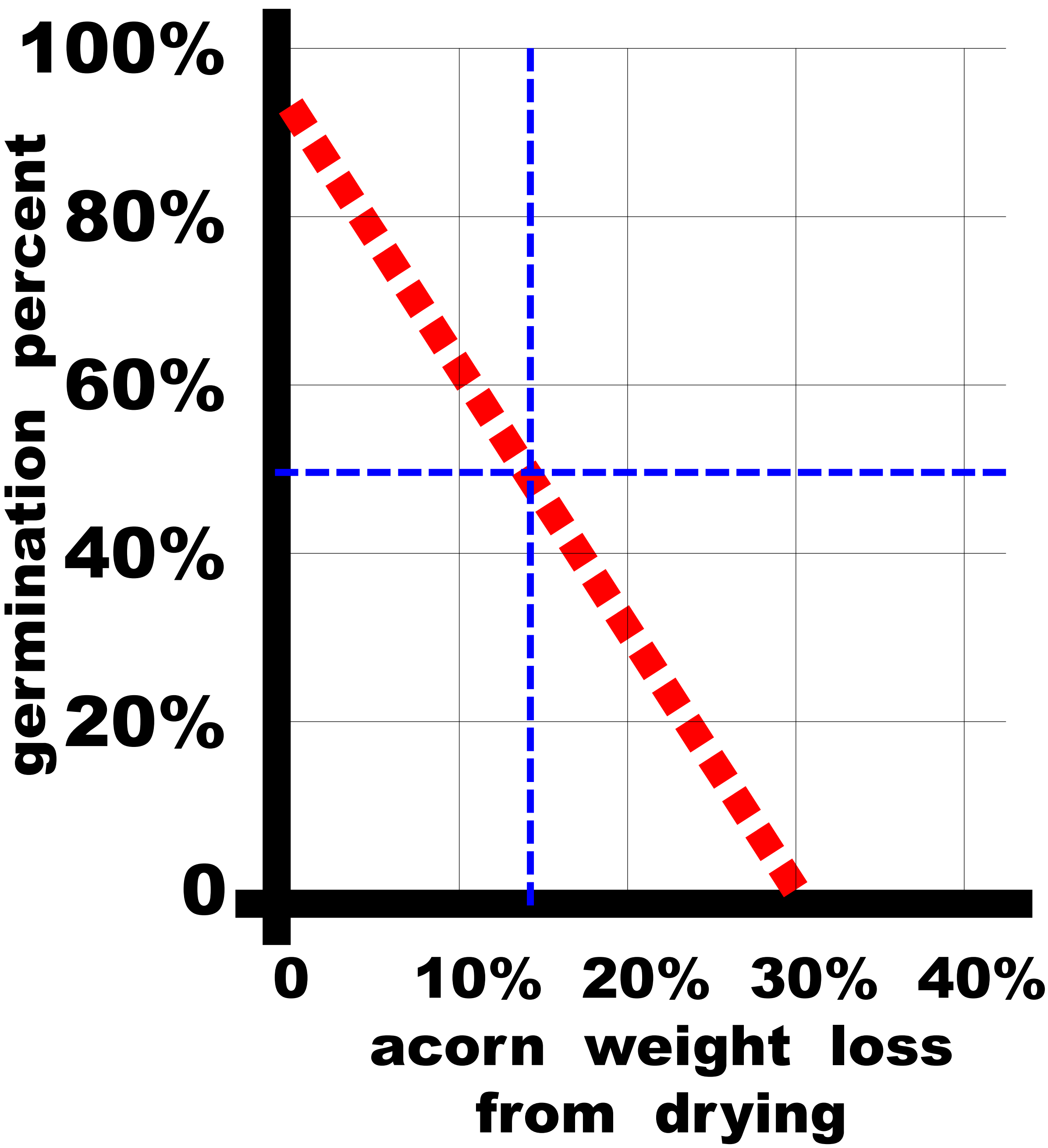

Figure 1: Estimated live oak acorn germination percentage as acorns dry.
Note a 50% reduction in germination percentage is reached as acorn weight drops 14% from green, on-tree weight.

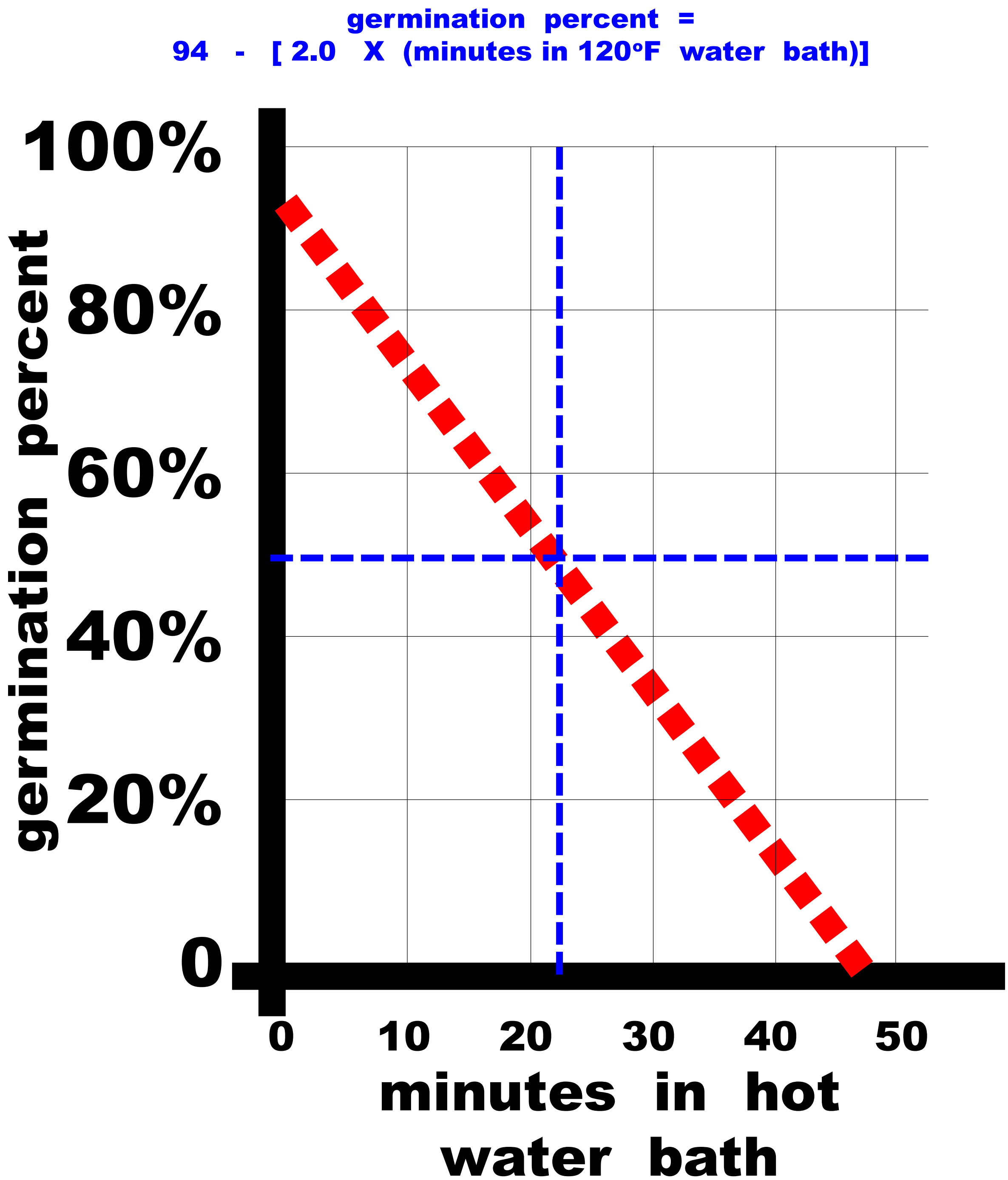

Figure 2: Estimated live oak acorn germination percentage as acorns are heated in a 120°F water bath in order to kill internal insect pests. Note 50% reduction in germination as acorns are bathed for 22 minutes. Hot water baths or microwave heating are NOT recommended for live oak acorns to kill pests before planting.

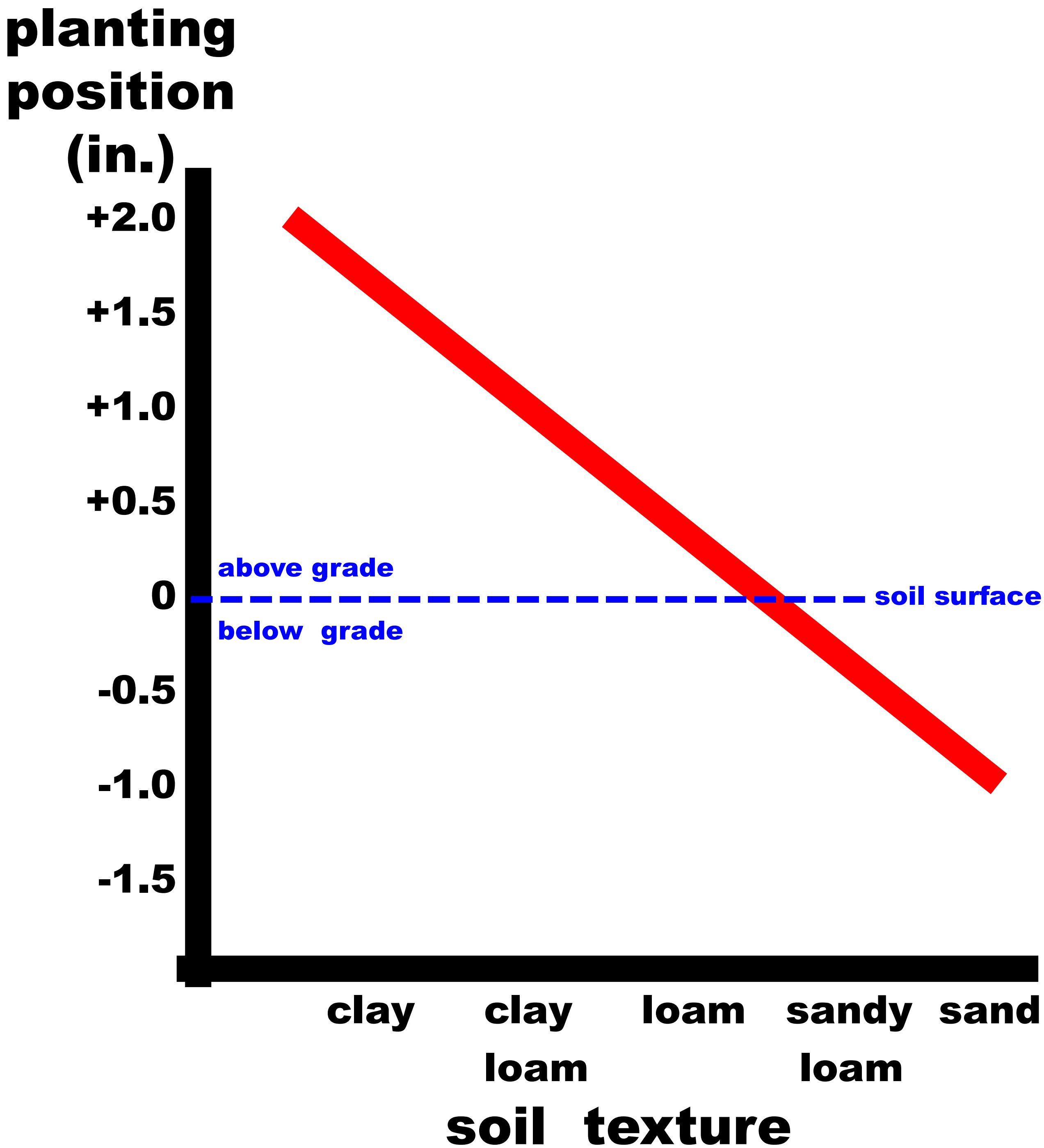

Figure 3: Planting position below or above grade for live oaks based upon soil texture. The planting position is measured between the stem base where 2-3 large lateral roots diverge and the surrounding mineral soil surface.

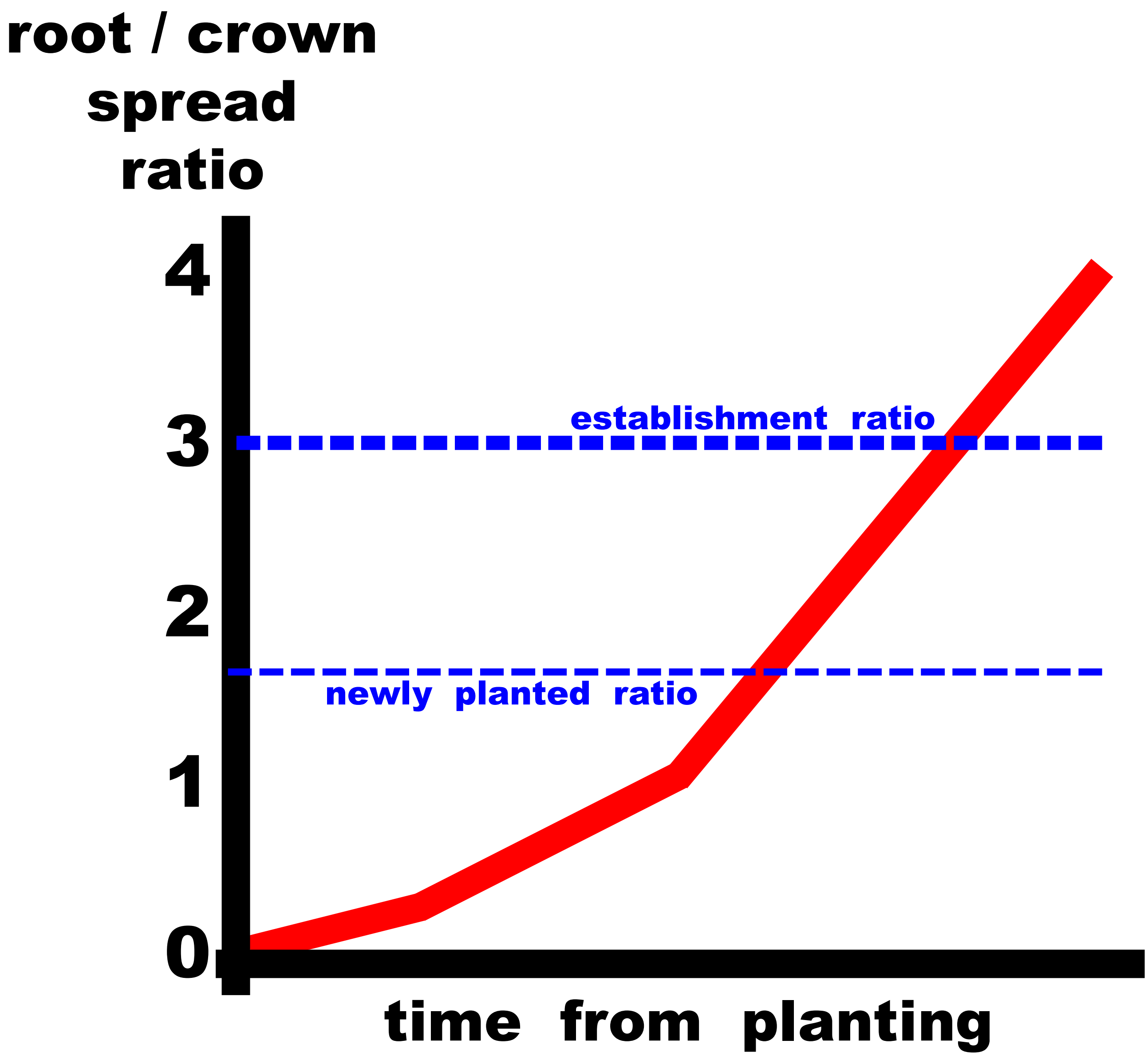

Figure 4: Live oak establishment time after planting based upon root spread to crown spread ratio. A live oak is considered to be established when root/crown spread ratio reaches or exceeds 3.0. (from Gilman et.al. 2010)

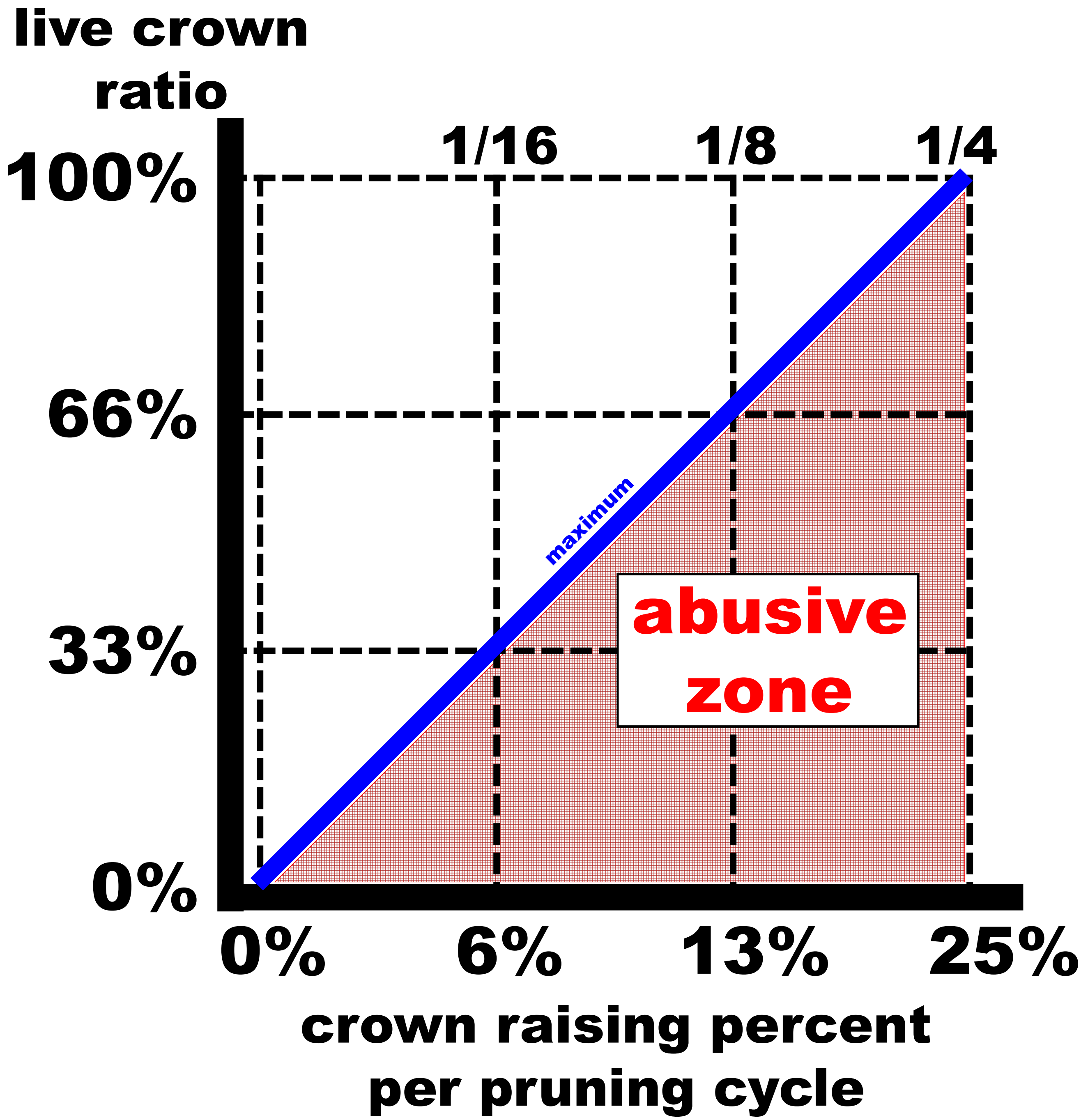

Figure 5: Coder Crown Raising Dose Assessment per pruning cycle for live oaks. Graph is the percent of live oak crown (live crown ratio basis) that can be raised / removed, if warranted, every pruning cycle in a crown raising process.

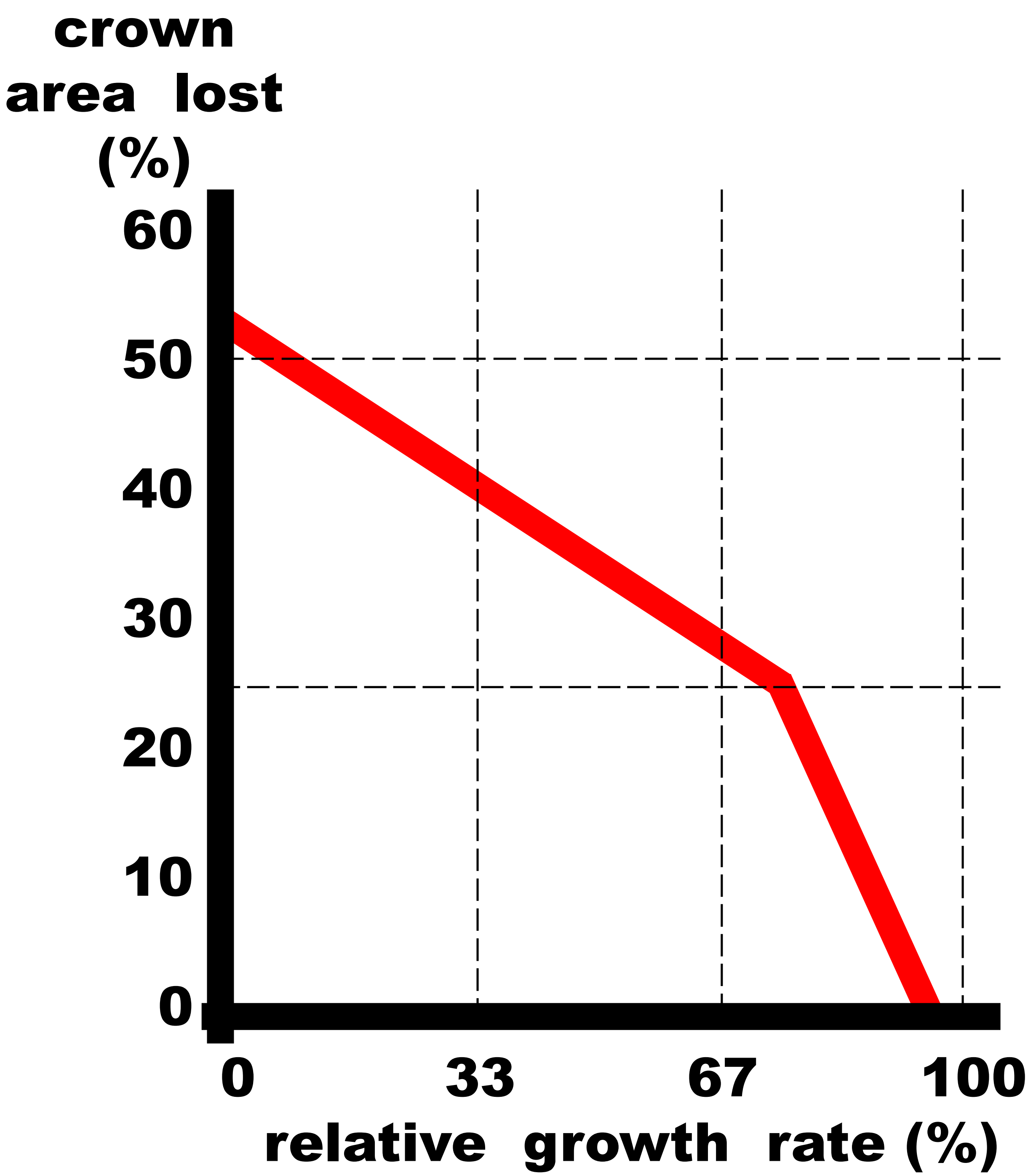

Figure 6: Live oak crown area (percent) lost to side and overtopping light interference from surrounding trees and associated relative growth rate.
(derived from Spector & Putz 2006)

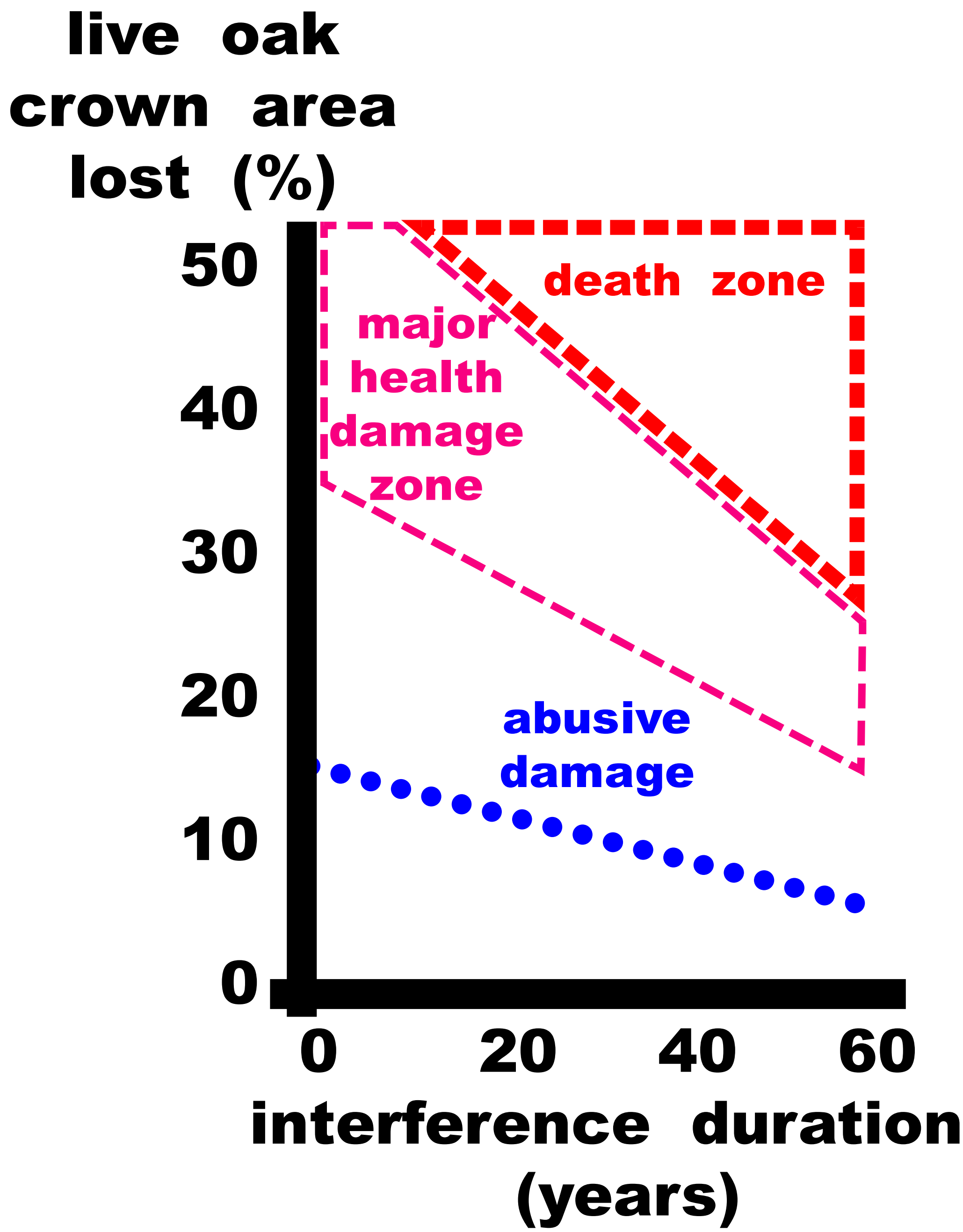

Figure 7: Live oak crown interference problems from side and over-topping trees by percent live oak crown loss and years of interference.
Note these values are not from crown raising or reduction pruning, which represents much less crown loss before tree damage presents.
(derived from Spector & Putz 2006)

Note, importance is not based upon frequency with which a pest is found, but represents impact on long term tree health and structure across live oak's range. Great potential pest impacts on tree health or structure would receive a high ranking. Some pests have small impacts and would receive a low ranking.

Pest impact importance rankings: A = most impact on tree health; B = moderate impact on tree health; and, C = small impact on tree health.

scientific name of pest	common name of pest	impact rating	simple description
Insects & Mites:			
Andricus kingi	cynipid gall wasp	C	general gall former
Andricus laniger	live oak wooly leaf gall	C	general gall former
Anomoea laticlavia	locust leaf beetle	B	both adults and larvae feed on leaves
Archodontes melanopus	live oak stump borer	B	eggs are laid just below the soil surface at tree base with larvae eating into stump base and major roots causing a large gall to form and stump sprouts to form – a big larva up to 3.5 inches long
Argyrotaenia quercifoliana	oak leaf roller moth	B	defoliates trees as a light green caterpillar (<1 inch long) with amber yellow head
Arnoldiola atra	gall midge	C	attacks buds of live oak
Brachys tesselatus	scrub oak leaf miner	B	adults and larvae feed on leaves
Callirhytis cornigera	horned oak gall	B	gall formed on twigs
Callirhytis operator	wooly flower gall	B	causes galls on male catkins and then emerge to infest current acorn crop
Cameraria spp.	oak leaf miner	B	moth larvae leaving splotched bleached foliage similar to some leaf necrosis diseases in appearance -- rake up and discard fallen leaves

Figure 8: Live oak pests and general impact importance ranking value.

scientific name of pest	common name of pest	impact rating	simple description
Insects & Mites: (continued)			
Cincinnus melsheimeri	Melsheimer's sack bearer	C	larvae makes leaf shelter for itself and moves it as feeds on leaves
Curculio spp.	acorn weevils	A	most of acorns are lost – larvae are off-white, fat and roll into a cupped shape.
Disholcaspis cinerosa	gall wasp	C	gall forming wasp whose generations alternate between branch galls and leaf galls
Enaphalodes rufulus	red oak borer	B	bark borer damaging trees larger than 2 inches in caliper and doubling attack for every inch larger tree grows in size
Johnella virginiana	vagrant eriophyid mite	C	initiates leaf curl but no gall
Mesolecanium nigrofasciatum	terrapin scale or black-banded scale	B	crawlers in early Spring moving to main leaf veins and then in late Summer scales move to twigs – adults dark orange in color with radiating black lines
Odontocynips nebulosa	root gall wasp	B	subterranean wasp initiating large galls on absorbing roots
Oiketicus abbotii	bagworm	B	relatively large bag (2-3 inches long) with twig pieces attached around the exterior
Orgyia leucostigma	white-marked tussock moth	B	in late Spring eggs in old grey cocoons hatch and larvae skeletonize leaves then later move to eating entire leaf blade – orange head with yellow body and tufts of hairs
Paleacrita vernata	Spring cankerworm	C	larvae dark colored with two yellow stripes skeletonizing leaves at branch tips
Parallelodiplosis florida	Florida gall midge	C	causes elongated swellings (galls) on leaf veins

Figure 8: Live oak pests and general impact importance ranking value. (continued)

scientific name of pest	common name of pest	impact rating	simple description
Insects & Mites: (continued)			
Platycotis vittata	oak treehopper	C	sucking insect but worst damage is the female cutting open slits in twigs to lay eggs - slits callous over leaving scars
Prionoxystus robiniae	carpenterworm	B	wood boring insect with a long life cycle in live oak – large larvae is hairy and dark pink hatching on bark surface and boring into the tree – mature larva is greenish white with a dark brown head – starts life in sapwood then expands late in larval life to heartwood, always keeping an open tunnel entrance free from callous growth
Stilbosis quadricustatella	leaf miner	B	skeltonizes live oak leaves
Disease & Higher Plants:			
Armillaria mellea	shoe string root rot	B	golden honey-colored mushrooms at the tree base and dark brown "shoe-string-like" bands of hyphae under bark
Apiognomonia quercina Discula quercina	anthracnose	B	wet weather in Spring generates large irregular dead areas on leaves – begins on low shady branches and causes leaf defoliation and some blade distortion, with occasional shoot dieback
Botryosphaeria quercuum	oak bot canker	B	bark lesions in Summer cause twig flagging, wilting and browning of leaves, and dieback – an usual bark resident
Botryosphaeria rhodina	common bot canker	B	takes advantage of oak wilt damage, pruning wounds, and stress in trees to cause bark lesions or cankers -- an usual bark resident

Figure 8: Live oak pests and general impact importance ranking value. (continued)

scientific name of pest	common name of pest	impact rating	simple description
Disease & Higher Plants: (continued):			
Cassytha filiformis	cassytha plant	C	parasitic vine (higher plant) on harsh sites -- vine is orange-brown in color with a tangle of long runners twinning counter clockwise around host tissue
Ceratocystis fagacearum	oak wilt	A+	systemic vascular disease which causes tree wilting with leaf bronzing and discoloration eventually leading to dead leaf tips, twig dieback, and tree defoliation -- death can take from 4 months to several seasons -- dieback is progressive through crown
Clitocybe tabescens	mushroom root rot	B	far Southern version of Armillaria mellea root rot
Coryneum japonicum	Coryneum twig canker	B	twig and branch dieback, distortion of the leaves, and premature leaf drop
Cryphonectria parasitica Endothium parasitica	chestnut blight	A	trunk and branch cankers under bark and hard to see until the bark falls off – causes crown decline and chlorotic leaves
Dendrothele acerina Hyphoderma baculorubrense	smooth patch	C	rots off outer periderm areas which fall off leaving smooth looking periderm patches
Endothia gyrosa	endothia canker	B	started by wounds on limbs, trunks and exposed roots, and by drought stress – sunken, slightly orange canker with small bumps on its surface
Hypoxylon atropunctatum	hypoxylon canker	A	irregular canker which invades weakened trunks and branches producing thin, light brown to grey fungal mats exposed as bark falls away
Monochaetia desmazierii	late leaf spot	C	large brown spots on leaves in late Summer

Figure 8: Live oak pests and general impact importance ranking value. (continued)

scientific name of pest	common name of pest	impact rating	simple description
Disease & Higher Plants: (continued):			
Perenniporia phloiophila	bark rot	C	decays outer periderm without leaving smooth patches on large limbs and trunks – pore surface is cream color to pale brown – flat fungal mats grow between periderm ridges
Phoradendron serotinum	American mistletoe	B	parasitic plant spread by birds and successful on stressed, slow growing trees
Phytophthora cactorum	bleeding canker	A	root collar rot which destroy living cell connections in tree causing leaf yellowing, premature leaf drop, leaf stunting, twig dieback, and oozing liquids from lesions
Polyporus dryophylus	heartwood rot	C	heartwood decay organism
Tillandsia usneoides	Spanish moss	C	epiphyte (higher plant) which, in great abundance, shades out live oak foliage
Xyletta fastidiosa	bacterial leaf scorch	B	tree defoliation, flushes of distorted leaves with dead margins and tips, and twig dieback
((many causes))	oak decline syndrome	A	many organisms and stress factors combine to make tree less effective and efficient in gathering resources to the point of twig & branch death, slow growth, and stunted chlorotic leaves. A combination of poor wound reactions, soil compaction, poor soil drainage, summer drought, and constant stress year after year cause loss of resource space and lack of internal controls for growth and defense.

Figure 8: Live oak pests and general impact importance ranking value. (continued)

scientific name of pest	common name of pest	impact rank
Ceratocystis fagacearum	**oak wilt**	**A+**
Cryphonectria parasitica	**chestnut blight**	**A**
Curculio spp.	**acorn weevils**	**A**
Hypoxylon atropunctatum	**hypoxylon canker**	**A**
Phytophthora cactorum	**bleeding canker**	**A**
((many causes))	**oak decline syndrome**	**A**
Apiognomonia quercina	anthracnose	B
Discula quercina	anthracnose	B
Armillaria mellea	shoe string root rot	B
Anomoea laticlavia	locust leaf beetle	B
Archodontes melanopus	live oak stump borer	B
Argyrotaenia quercifoliana	oak leaf roller moth	B
Botryosphaeria quercuum	oak bot canker	B
Botryosphaeria rhodina	common bot canker	B
Brachys tesselatus	scrub oak leaf miner	B
Callirhytis cornigera	horned oak gall	B
Callirhytis operator	wooly flower gall	B
Cameraria spp.	oak leaf miner	B
Clitocybe tabescens	mushroom root rot	B
Coryneum japonicum	Coryneum twig canker	B
Enaphalodes rufulus	red oak borer	B
Endothia gyrosa	endothia canker	B
Mesolecanium nigrofasciatum	terrapin or black-banded scale	B
Odontocynips nebulosa	root gall wasp	B
Oiketicus abbotii	bagworm	B
Orgyia leucostigma	white-marked tussock moth	B
Phoradendron serotinum	mistletoe	B
Prionoxystus robiniae	carpenterworm	B
Stilbosis quadricustatella	leaf miner	B
Xyletta fastidiosa	bacterial leaf scorch	B

Figure 9: Pest list categorized by live oak health and structure impact rank.

scientific name of pest	common name of pest	impact rank
Andricus kingi	cynipid gall wasp	C
Andricus laniger	live oak wooly leaf gall	C
Arnoldiola atra	gall midge	C
Cassytha filiformis	cassytha plant	C
Cincinnus melsheimeri	Melsheimer's sack bearer	C
Dendrothele acerina	smooth patch	C
Disholcaspis cinerosa	gall wasp	C
Hyphoderma baculorubrense	smooth patch	C
Johnella virginiana	vagrant eriophyid mite	C
Monochaetia desmazierii	late leaf spot	C
Paleacrita vernata	Spring cankerworm	C
Parallelodiplosis florida	Florida gall midge	C
Perenniporia phloiophila	bark rot	C
Platycotis vittata	oak treehopper	C
Polyporus dryophylus	heartwood rot	C
Tillandsia usneoides	Spanish moss	C

Pest impact importance rankings:
A = most impact on tree health;
B = moderate impact on tree health;
C = small impact on tree health.

Figure 9: Pest list categorized by live oak health and structure impact rank. (continued)