



# *Tree Maintenance*

*Fourth Edition*

*P.P. Pirone*

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# *Foreword to Original Edition*

The care of trees is a never ending obligation, more insistent each year because appreciation of them is increasing. The owner of the tree carries the responsibility of his own account and he then naturally extends his concern to trees that stand on public property and need the interest of citizens.

One's responsibility is met only when one recognizes the cause of injury and disease and is informed on the remedies and proper procedures. Even if one has been taught these subjects in school he nevertheless needs to be informed on the newest difficulties and the latest approved practices. The difficulties increase. Thus it comes that new and authoritative books are always needed.

Therefore I am glad to see this book on Maintenance of Shade and Ornamental Trees by Dr. P. P. Pirone, whose work I have known for many years. He is investigator and teacher. He has an eye to the immediately practical, as evidenced by the simplicity of the writing, clearness of the directions, and the significant pictures. It is an important presentation of the subject.

L. H. BAILEY

*Ithaca, N.Y.*

*March 1, 1941.*



The Bedford Oak, *Quercus alba*, near Bedford, New York, is said to be nearly 500 years old. The circumference of the trunk, four feet above ground, is 18 feet, its height 60 feet, and its branch spread 132 feet.

# Preface

Twelve years have passed since I prepared the third edition of this book on tree maintenance. In that brief period great changes have occurred in the field of arboriculture.

The recent banning of the so-called 'miracle' insecticide DDT in many states has made many Americans more keenly aware of the dangers involved in the promiscuous or careless use of many pesticides. In her book, *Silent Spring*, published in 1962, the late Rachel Carson was among the first to bring to national attention the danger DDT presented to wildlife, especially when the pesticide was used with abandon.

In the present edition, then, I have eliminated not only DDT from the insect control schedules, but also a number of other pesticides including dieldrin, heptachlor, mercury compounds, and toxaphene, either because of their extreme toxicity or their high degree of indestructibility. Chlordane and lindane, two chlorinated hydrocarbons that decompose more quickly than DDT, are recommended with limitations, and only until such time as equally effective substitutes are found.

In the past ten years Americans have also become more 'green' conscious. That is, they have begun to appreciate the importance of green plants in their daily lives, whether these are blades of grass or giant trees. All green plants help to replenish our supply of life-supporting oxygen while at the same time use up carbon dioxide exhaled by man and animals. Hence there is now a concerted drive, spurred on by ecologists, to 'Make America Green.' It is estimated that a 25-foot-square plot of grass releases enough oxygen to sustain life day after day for a grown person. Each year an acre of trees can produce enough oxygen to keep 18 persons alive. This trend to help improve our environment and 'Keep America Beautiful' can be enhanced by planting and maintaining more trees in urban, suburban, and rural areas.

In earlier editions, I described primarily the diseases and pests of trees

## PREFACE

grown in the northeastern and north central states. In the present edition I have included problems pertaining to trees growing in the southern parts of the country including the Florida peninsula and the gulf, southwestern and western states.

The trend toward planting low-growing trees to fit in with the decor of ranch-type homes and along streets where they would not interfere with utility lines, has continued during the past twelve years. Edward Scanlon of Olmsted Falls, Ohio, editor and publisher of *Trees Magazine*, continues to be the outstanding spokesman for such kinds of trees. Other well-known persons who also favor the planting of low-growing trees are Jake Gerling of the Rochester, New York, Department of Parks; Professor Clarence Lewis of Michigan State College; Dr. Henry Skinner, Director of the National Arboretum, Washington, D.C.; and Dr. Donald Wyman, emeritus horticulturist of the Arnold Arboretum, Jamaica Plains, Massachusetts.

The present edition also includes treatment of the newest machinery for digging and transplanting trees, the newer concepts on feeding trees, and the latest information on spraying equipment and practices. I have also expanded the chapter on diagnosing tree troubles (Chapter 9) to help not only the professional arborist but the owner of a few trees as well.

As in earlier editions I have tried to incorporate my experiences with tree maintenance problems—experiences involving personal examinations of literally thousands of trees.

I have also attempted to follow a course midway between the technical and the popular. That is, I have tried to be not too technical for the beginner in tree maintenance work, and not too elementary for the professional arborist, nurseryman, landscape architect, and the college student enrolled in a course on tree maintenance. I trust I have satisfied most of my readers in both groups. The student, in particular, should like the bibliographies—one appears at the end of each chapter.

Many persons have lent a hand in the preparation of this edition. My dear wife heads the list, because without her constant help, encouragement, and care I could not have prepared the book and carried on my regular duties at The New York Botanical Garden during these many months. Next comes a good friend, Mrs. Herminie B. Kitchen of South Royalton, Vermont, Specialist Emeritus in Agricultural Information at Rutgers University, who helped edit the present volume and who made many valuable suggestions. Then comes my very efficient secretary Ellen Hayes who typed all of the new material.

I am also greatly indebted to Edward H. Scanlon for many excellent suggestions in revising Chapter 8.

My son Joseph and my assistant Fran Maiello had a hand in checking and proofreading the manuscript. Others who provided material new to this edition include: Doctors J. C. Carter, George Hepting, Craig Hibben, Thomas Pirone, John Schread, Henry Skinner, and Professor Gordon King.

I also want to express my gratitude to the many professional arborists and agricultural scientists whose publications are listed in the bibliographies. Without their contributions, a book of this type could not have been written.

Finally I wish to thank the following persons and organizations for the illustrations listed:

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**P. P. PIRONE**

*New York, New York*

*December 1971*

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ACACIA: Canker. Leaf spots. Powery mildew. Root rots. Cottony-cushion scale. Caterpillars.  
ALDER: Canker. Leaf curl. Powdery mildew. Leaf rust. Woolly alder aphid. Flea beetle.  
Lace bug. Psyllid.

ALMOND, FLOWERING: Blossom blight and die-back. Leaf drop. Other diseases.

ASH: Dieback. Witches' broom. Anthracnose. Leaf spots. Cankers. Rust. Borer. Brown-headed sawfly. Carpenter worm. Lilac leaf miner. Lilac borer. Fall webworm. Flower gall. Oystershell scale. Scurfy scale.

AVOCADO: Anthracnose. Root rot. Scab. Other diseases.

BANANA: Diseases.

BIRCH: Leaf blister. Leaf rust. Leaf spot. Canker. Die-back. Wood decay. Aphids. Witch-hazel leaf gall aphid. Case bearer. Leaf miner. Skeletonizer. Bronze birch borer. Seed mite gall.

CALLIANDRA: Root rot. Rust. Aphid.

CAMELLIA: Black mold. Canker. Flower blight. Leaf blight. Leaf gall. Leaf spot. Root rot. Spot. Bud drop. Chlorosis. Oedema. Sunburn. Salt injury. Viruses. Florida red scale. Fuller rose beetle. Mealybugs. Spotted cutworms. Tea scale. Thrips. Weevils. Other insects. Root nema.

CHASTE-TREE: Leaf spot. Root rot.

CHERRY, JAPANESE FLOWERING: Shot-hole. Leaf spot. Black knot. Powdery mildew. Witches' broom. Virus disease. Physiological disease. Asiatic garden beetle. Peach borer. Oriental fruit worm. Pear-slug. Planthoppers. Eastern tent caterpillar. San Jose scale. Waterlily aphid. White peach scale. Root nema.

CORK TREE: Insects.

CRABAPPLE, FLOWERING: Fire blight. Canker. Rust. Scab. Periodical cicada. European red mite.

CRAPEMYRTLE: Powdery mildew. Other fungus diseases. Florida wax scale. Aphid.

DOGWOOD: Crown canker. Flower and twig blight. Leaf spots. Powdery mildews. Twig blights. Other diseases. Borers. Club-gall. Leaf miner. Scales. Whitefly. Other insects.

EMPRESS-TREE: Leaf spots. Mildew. Wood decay. Twig canker.

FRANKLIN-TREE: Leaf spot. Black mildew. Root rot. Scales. Giant hornet wasp.

FRINGE-TREE: Leaf spots. Powdery mildew. Other diseases. Scales.

GOLDENCHAIN: Leaf spot. Twig blight. Laburnum vein mosaic. Aphids. Grape mealybug. Nema.

GOLDENRAIN-TREE: Canker. Leaf spot. Root rot. Wilt. Scales.

GUAVA: Leaf spots. Blight. Root rot. Scales. Other insects. Nema.

GUMBO-LIMBO: Sooty mold. Brown soft scale.

HAWTHORNS: Leaf blight. Fire blight. Rusts. Leaf spots. Powery mildew. Scab. Aphids. Apple leaf blotch miner. Skeletonizer. Borers. Lace bugs. Planthopper. Scales. Western tent caterpillar. Two-spotted mite.

HOP-HORNBEAM: Diseases. Insects.

HOP-TREE: Leaf spots. Rust. Root rot. Treehopper. Scale.

HORNBEAM: Leaf spots. Cankers. Twig blight. Maple phenacoccus. Sour-gum scale.

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MANGO: Anthracnose. Powdery mildew. Other fungus diseases. Scales. Other insects.

MOUNTAIN-ASH: Canker. Leaf rusts. Other diseases. Aphids. Japanese leafhopper. Sawfly. Pear leaf blister mite. Roundheaded borer. Scales.

ORCHID-TREE: Leaf spot. Cuban May beetle.

PAGODA-TREE: Canker. Damping-off. Twig blight. Other fungus diseases. Scales. Other pests.

PAPER-MULBERRY: Canker. Root rot. Other diseases. White peach scale.

PEACH, FLOWERING: Leaf curl. Green peach aphid. Black peach aphid. Peach tree borer. Lesser peach borer. White peach scale.

PEAR, ORNAMENTAL: Canker.

PERSIMMON: Wilt. Insects.

QUINCE, FLOWERING: Crown gall. Fire blight. Brown rot. Rust. Leaf spots. Other diseases. Cotton aphid.

REDBUD: Canker. Leaf spots. Other diseases. Caterpillars. Two-marked treehopper. Scales. Other insects.

RUSSIAN-OLIVE: Cankers. Leaf spots. Rust. Wilt. Other diseases. Oleaster-Thistle aphid. Scales.

SASSAFRAS: Canker. Leaf spots. Other diseases. Japanese beetle. Promethea moth. Weevil. Scales.

SERVICEBERRY: Fire blight. Fruit rots. Leaf blight. Mildews. Rust. Witches' Broom. Borers. Leaf miner.

SILK-TREE: Wilt. Other fungi. Webworm. Lesser snow scale. Other insects. Nemas.

SILVERBELL: Leaf spot. Wood decay.

SMOKE-TREE: Wilt. Rust. Leaf spots. Oblique-banded leaf roller. San Jose scale.

SORREL-TREE: Twig blight. Leaf spots.

STRAWBERRY-TREE: Leaf spots. Crown gall. California tent caterpillar. Scales.

TREE-OF-HEAVEN: Wilt. Shoestring root rot. Leaf spot. Twig blight. Other diseases. Cynthia moth. Ailanthus webworm. Other insects.

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BEECH: Leaf mottle. Bleeding canker. Beech bark disease. Cankers. Leaf spots. Powdery mildew. Beech blight aphid. Woolly beech aphid. Beech scale. Caterpillars. Brown wood borer. Two-lined chestnut borer. Scales.

CATALPA: Leaf spot. Powdery mildew. Wood decay. Other diseases. Comstock mealybug. Midge. Sphinx.

CHESTNUT: Blight. Twig canker. Other disease. Weevils.

ELM: Wetwood. Dutch elm disease. Cankers. Leaf curl. Leaf spots. Powdery mildews. Cephalosporium wilt. Verticillium wilt. Wood decay. Phloem necrosis. Mosaic. Scorch. Woolly apple aphid. Leaf curl aphid. Case bearer. Lace bug. Leaf beetle. Leaf miner. Smaller European elm bark beetle. Cockscomb gall. Dogwood twig borer. Spring cankerworm. Fall cankerworm. Borer. Spanworm. Leopard moth borer. Gypsy moth. Mourning-cloak butterfly. White-marked tussock moth. Scales. Mites.

GINKGO: Wood decay. Insects. Nema.

HACKBERRY: Canoderma rot. Leaf spots. Powdery mildew. Witches' broom. Nipple-gall maker. Mourning-cloak butterfly. Scales.

HICKORY: Canker. Crown gall. Leaf spots. Powdery mildews. Witches' broom. Gall aphid. Bark beetle. Caterpillars. June bugs. Pecan cigar casebearer. Painted hickory borer. Twig girdler. Scales. Mite.

**HORSECHESTNUT:** Anthracnose. Canker. Leaf blotch. Leaf spot. Powdery mildew. Wound rot. Other diseases. Comstock mealybug. Japanese beetle. Walnut scale. White-marked tussock moth.

**KATSURA-TREE:** Canker

**LARCH:** European larch canker. Other cankers. Leaf cast. Needle rusts. Wood decay. Case-bearer. Sawfly. Woolly larch aphid. Other insects.

**LINDEN:** Canker. Leaf blight. Leaf blotch. Leaf spots. Powdery mildews. Other diseases. Aphid. Japanese beetle. Elm calligrapha. Caterpillars. Basswood leaf miner. Elm sawfly. Looper. Mite. European linden bark borer. Borer. Scales. Walnut lace bug.

**LOCUST, BLACK:** Canker. Damping-off. Leaf spots. Powdery mildews. Wood decay. Witches' broom. Borer. Leaf miner. Twig borer. Scales. Dodder.

**LOCUST, HONEY:** Leaf spot. Cankers. Powdery mildew. Rust. Wood decay. Honey locust borer. Midge pod gall. Webworm. Spider mite.

**MAPLE:** Anthracnose. Leaf spot. Basal canker. Bleeding canker. Bacterial leaf spot. Leaf blister. Bull's-eye spot. Tar spot. Other fungus leaf spots. Nectria canker. Ganoderma rot. Phomopsis blight. Powdery mildews. Sapstreak. Trunk decay. Wilt. Maple decline. Boxelder bug. Forest tent caterpillar. Greenstriped mapleworm. Japanese leafhopper. Leafhopper. Leaf stalk borer. Petiole borer. Leaf cutter. Norway maple aphid. Ocellate leaf gall. Bladder-gall mite. Other mites. Maple phenacoccus. Cottony maple scale. Other scales. Flatheaded borer. Leopard moth borer. Metallic borer. Pigeon tremex. Sugar maple borer. Twig pruner. Squirrels. Nemas.

**MULBERRY:** Bacterial blight. Leaf spots. Popcorn disease. False mildew. Cankers. Powdery mildews. Citrus flatid phanthopper. Cerambycid borer. Scales. Other pests.

**OAK:** Anthracnose. Basal canker. Canker. Leaf blister. Leaf spots. Powdery mildew. Rust. Twig blights. Shoestring root rot. Wilt. Wood decay. Galls. Golden oak scale. Lecanium scales. Oak gall scale. Obscure scale. Purple scale. Yellow-necked caterpillar. Pin oak sawfly. Saddleback caterpillar. Oak skeletonizer. Asiatic oak weevil. Oak leaf tier. Two-lined chestnut borer. Flat-headed borer. Leaf miners. Lace bug. Mite.

**OSAGE-ORANGE:** Leaf spots. Other diseases. Scales.

**PECAN:** Brown leaf spot. Crown gall. Scab. Other diseases. Borers.

**PLANETREE, LONDON:** Cankerstain. Botryosphaeria canker. Powdery mildew. Rosy canker. Dog canker. American plum borer. Lace bug.

**POINCIANA:** Diseases. Lesser snow scale.

**POPLAR:** Chondroplea canker. Cytospora canker. Hypoxylon canker. Septoria canker. Fusarium canker. Branch gall. Leaf rust. Leaf blister. Leaf spots. Die-back. Inkspot. Powdery mildew. Aphids. Bronze birch borer. Borer. Imported willow leaf beetle. Red-humped caterpillar. Tentmaker. Scales.

**SWEETGUM:** Bleeding necrosis. Leaf spots. Other diseases. Webworm. Caterpillars. Cottony-cushion scale. Sweetgum scale. Walnut scale.

**SYCAMORE:** Blight. Aphids. Plant bug. Tussock moth. Scales.

**TULIPTREE:** Cankers. Leaf spots. Powdery mildews. Root and stem rot. Sapstreak. Wilt. Leaf yellowing. Aphid. Scale. Spot gall.

**TUPELO:** Canker. Leaf spots. Rust. Leaf miner. Other pests.

**WALNUT:** Canker. Bacterial blight. Bark canker. Brown leaf spot. Yellow leaf blotch. Die-back. Trunk decay. Brooming disease. Other diseases. Aphid. Caterpillars. Lace bug. Scales. Mites.

**WILLOW:** Leaf blight. Bacterial twig blight. Black canker. Cytospora canker. Other cankers. Gray scab. Leaf spots. Powdery mildew. Rust. Tar spot. Aphids. Eastern tent caterpillar. Basket willow gall. Mottled willow borer. Imported willow leaf beetle. Pine cone gall. Poplar borer. Flea weevil. Lace bug. Shoot sawfly. Scurfy scale.

**YELLOW-WOOD:** Powdery mildew. Canker. Wilt. Root decay.

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- ARBOR-VITAE: Leaf blight. Tip blight. Juniper blight. Browning and shedding of leaves. Aphid. Bagworm. Cedar tree borer. Leaf miner. Mealybug. Scales.
- AUSTRALIAN-PINE: Root rots. Borer. Other insects.
- BALD CYPRESS: Twig blight. Wood decay. Other fungus diseases. Cypress moth.
- BANYAN: Insects.
- BOXWOOD: Canker. Blight. Leaf spots. Root rot. Winter injury and sun scald. Leaf miner. Psyllid. Webworm. Giant hornet. Mealybugs. Scales. Mite. Nemas.
- CAJEPUT: Scales.
- CAMPHOR-TREE: Scales. Mites. Thrips.
- CEDAR: Tip blight. Root rot. Black scale. Deodar weevil.
- CEDAR, INCENSE: Diseases. Insects. Other pests.
- CEDAR, WHITE: Blight. Witches' broom. Spindle burl gall. Root rot. Insects.
- CRYPTOMERIA: Leaf blight. Leaf spot.
- CYPRESS: Canker. Cytospora canker. Other diseases. Cypress aphid. Cypress mealybug. Caterpillars. Bark scale. Other scales.
- DOUGLAS-FIR: Cankers. Leaf cast. Other diseases. Aphids. Scales. Other insects.
- FIR: Needle and twig blight. Leaf cast. Cankers. Shoestring root rot. Rusts. Sooty mold. Balsam twig aphid. Bark beetle. Caterpillars. Spruce spider mite. Scale. Balsam woolly aphid. Dwarf mistletoe.
- GUM-TREE: Leaf spots. Crown gall. Other fungus diseases. Oedema. Insects.
- HEMLOCK: Blister rust. Cankers. Leaf blight. Needle rust. Sapwood rot. Sunscorch. Drought injury. Borer. Fiorinia scale. Looper. Scale. Grape scale. Leaf miner. Spider mites.
- HOLLY: Bacterial blight. Canker. Leaf rot. Leaf spots. Powdery mildews. Spot anthracnose. Tar spot. Twig die-back. Other diseases. Spine spot. Leaf scorch. Beetles. Berry midge. Bud moth. Leaf miner. Scale. Pit-making scale. Other scales. Japanese weevil. Whitefly. Other pests.
- JUNIPER: Cedar rusts. Twig blight. Root rot. Wood decay. Rocky Mountain juniper aphid. Red cedar bark beetle. Bagworm. Midge. Scale. Webworm. Two-spotted mite. Spider mite.
- NORFOLK ISLAND PINE: Blight. Crown gall. Mealybugs. Scales.
- PALMS: Bacterial wilt. False smut. Leaf scab. Leaf blights. Leaf spot. Stem and root rots. Bud rot and wilt. Black scorch and heart rot. Aphid. Leaf skeletonizer. Mealybugs. Scales. Thrips.
- PEPPER-TREE: Heart rot. Root rot. Insects.
- PINES: Cankers. Cenangium twig blight. Die-back. Late damping off and root rot. Leaf casts. Little leaf. Needle blight. Comandra blister rust. Needle rust. Scrub pine needle rust. Stem blister rust. White pine blister rust. Wood decay. White pine blight. Stunt. Air pollutants. Pine bark aphid. White pine aphid. Leaf chermid. Webworm. Bark beetles. European pine shoot moth. Nantucket pine moth. Sawflies. Pine false webworm. Root collar weevil. Needle scale. Needle miner. Tortoise scale. Spittlebugs. White pine shoot borer. White pine tube moth. Pales weevil. Red pine scale. White pine weevil. Zimmerman pine moth.
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- SPRUCE: Cytospora canker. Needle casts. Rusts. Wood decay. Gall aphid. Cooley spruce gall aphid. Bud scale. Budworm. Spruce epizeuxis. Needle miner. Needle scale. Sawflies. Spider mite. White pine weevil.
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# I

## *General Maintenance Practices*



