

# TABLE OF CONTENTS

	Page
PREFACE .....	1
INTRODUCTION TO FOREST PROTECTION .....	2
<b>CHAPTER 1 – Forest Entomology</b>	
Introduction .....	8
Sap-Sucking Insects	
Scales .....	16
Aphids .....	18
Gall-forming Insects .....	20
Hemlock Woolly Adelgid .....	22
Balsam Woolly Adelgid .....	24
Defoliating Insects	
Pine Webworm .....	26
Pine Sawfly .....	28
Eastern Tent Caterpillar .....	30
Forest Tent Caterpillar .....	32
Fall Webworm .....	34
Orangestriped Oakworm .....	36
Pine Colaspis Beetle .....	38
Bagworm .....	40
Cankerworm .....	42
Locust Leafminer .....	44
European Gypsy Moth .....	46
Japanese Beetle .....	48
Bark Beetles	
Southern Pine Beetle .....	50
Ips Engraver Beetles .....	52
Black Turpentine Beetle .....	54
Elm Bark Beetle .....	56
Hickory Bark Beetle .....	58
Wood Borers	
Pine Sawyer Beetles .....	60
Ambrosia Beetles .....	62
Asian Longhorned Beetle .....	64
Emerald Ash Borer .....	66
Sirex Woodwasp .....	68

Bud, Twig, and Seedling Pests

Pales Weevil..... 70  
Nantucket Pine Tip Moth..... 72  
Twig Pruners and Girdlers ..... 74

**CHAPTER 2 – Forest Pathology**

Introduction ..... 78

Foliage Diseases

Anthracnose ..... 86  
Brown Spot Needle Blight ..... 88  
Pine Needle Cast ..... 90  
Dogwood Anthracnose..... 92

Stem and Branch Diseases

Fusiform Rust..... 94  
Hypoxylon Canker ..... 96  
Pitch Canker ..... 98  
Wetwood / Slimeflux ..... 100  
White Pine Blister Rust..... 102  
Beech Bark Disease ..... 104  
Sudden Oak Death ..... 106  
Thousand Cankers Disease ..... 108

Vascular Diseases and Declines

Fireblight..... 110  
Bacterial Leaf Scorch..... 112  
Oak Decline..... 114  
Oak Wilt..... 116  
Dutch Elm Disease..... 118  
Laurel Wilt ..... 120

Root Diseases

Heterobasidion Root Disease / Annosus Root Rot..... 122  
Armillaria Root Rot ..... 124  
Littleleaf Disease..... 126  
Phytophthora Root Rot..... 128  
Procera Root Disease ..... 130

**CHAPTER 3 – Disorders and Abiotic Stress Agents**

Wind..... 134  
Snow / Ice..... 134  
Rain ..... 135  
Lightning..... 135

Hail.....	136
Storms .....	136
Flooding .....	137
Drought .....	137
Salt Damage .....	138
Frost / Freeze Damage .....	138
Heat .....	139
Air Pollution.....	139
Fire .....	140
Mechanical Damage.....	140
Root Injury .....	141
Herbicide Damage.....	141
Nutrient Imbalance.....	142
Frost Crack.....	142
Sun Scald.....	143
Soil Compaction.....	143
Soil Grade Changes.....	144
Improper Pruning .....	144
Deep Planting.....	145
Improper Mulching .....	145
Included Bark.....	146
Girdling Roots.....	146
Genetic Disorders.....	147

## **Appendices**

Appendix A: Diagnosing Disorders of Trees.....	149
Appendix B: Pest Management.....	153
Appendix C: Non-Native Invasive Species.....	155
Appendix D: Diagnostic and Laboratory Services.....	157
Appendix E: Sample Collection Guidelines.....	159
Appendix F: Photographing Tree Disorders .....	163
Appendix G: Diagnostic Tools of the Trade .....	165
Appendix H: Additional Resources and Selected References .....	160
Appendix I: Image Citations .....	169
Appendix J: Glossary .....	179
Appendix K: Forest Health Branch Contact Information .....	185