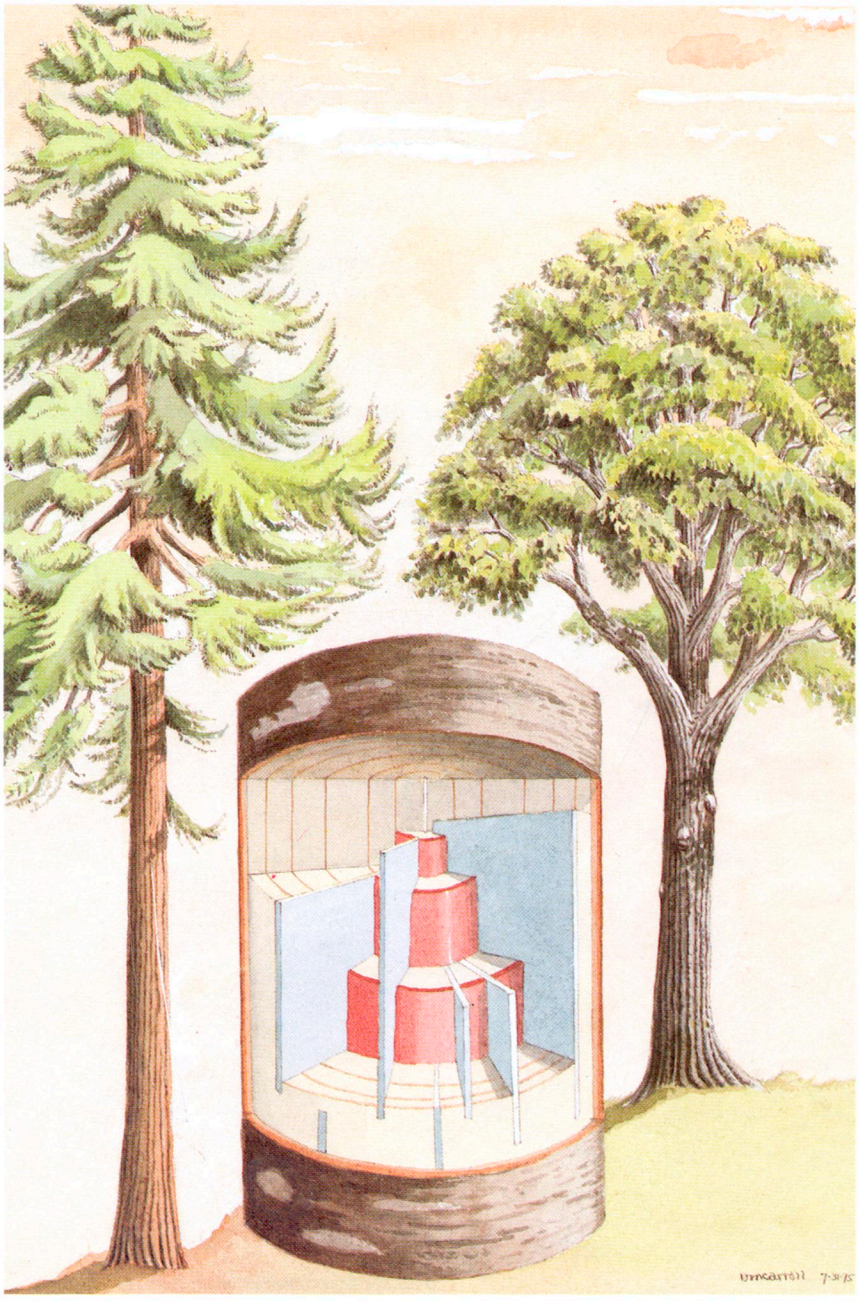
COMPARTMENTALIZATION OF DECAY IN TREES



Forest Service
U.S. Department of Agriculture

Agriculture Information
Bulletin No. 405
July 1977

COMPARTMENTALIZATION OF DECAY IN TREES

Alex L. Shigo
Plant Pathologist, U.S. Department of Agriculture,
Forest Service, Northeastern Forest Experiment Station,
Durham, New Hampshire
and
Harold G. Marx
Research Applications Staff Assistant, U.S. Department of Agriculture,
Forest Service, Washington, D.C.

Forest Service
U.S. Department of Agriculture

Agriculture Information
Bulletin No. 405
July 1977

INTRODUCTION

The science of tree pathology emerged from studies on decay almost a century ago. Many of the concepts developed then have changed little over the years. But, in the last few decades some additional information on the decay process in trees has been developed. This new information has added to the basic story of decay without subtracting anything important from it. The new expanded concept of decay is simply more complete. And this new, more complete concept gives us a better opportunity to regulate and control decay.

Dr. George H. Hepting made the first sound observations on compartmentalization of decay in trees in 1935. His ideas acted as a trigger for the work that followed. The work presented here is an expansion of his ideas.

The information in this publication is based on 16 years of research by Dr. Shigo that involved complete dissections of approximately 10,000 trees—mostly deciduous hardwoods, at least 1,000 conifers, and 17 tropical species. Details of these studies have been published elsewhere.

The purpose of this publication is to show how most columns of discolored and decayed wood associated with trunk wounds in trees are compartmentalized. A great number of confusing terms are given to a wide variety of defects caused by discolorations and decays in trees. This book describes a system that makes it possible for forest managers to understand how most of these defects develop. To understand the system, the report must be studied very carefully. The system is called

CODIT
Compartmentalization **O**f **D**ecay **I**n **T**rees

When the system is learned, it will act as the code for understanding a wide variety of defects on most tree species.

The CODIT system is based on two major points. First, a tree is a highly compartmented plant. Second, after a tree is wounded, the resulting defects are compartmentalized.

To apply the CODIT system it is necessary to understand that the new expanded decay concept developed in the last few decades includes: 1) *Successions* of microorganisms associated with discoloration and decay, and 2) *Compartmentalization* of discolored and decayed wood associated with trunk wounds.

To begin with, decay of wood is a natural process caused by microorganisms, mainly fungi, that enter trees through wounds. Tree wounds are usually inflicted by fire, weather, insects, birds, small or large animals, or man and his activities. These wounds start the processes that can lead to decay, and decay is a major cause of damage to trees. While wood decay is most often caused by decay-causing fungi, these fungi are often intimately associated with bacteria and nondecay fungi in the process. Decay is the breakdown or decomposition of dead organic matter. It is also essential to new life.

To understand how trees react to wounding and the associated defects by compartmentalizing the defects, it is necessary to reevaluate our concept of how a tree is constructed. A tree is considered here as a highly compartmented plant. In a sense, a tree is made up of many trees; each growth ring is a "tree." Each "tree" is divided into many compartments. A compartment can be thought of as a "room," with side walls made up of rays and front and back walls made up of cells that are the last to form in each growth ring. The top and bottom of the compartment is formed after wounding when the elements that transport liquids plug up. The compartment is the least common denominator of the tree. All the types of cells found in the woody stem of a tree will be found in each compartment.

When microorganisms invade tree stems through wounds, they do so in successions. Bacteria, nondecay fungi, and decay fungi are often intimately associated in this invasion process. When microorganisms invade, they first surmount the chemical protective barriers set up by the tree and then move into the tree from compartment to compartment.

The weakest walls of a compartment are the tops and bottoms, and the inner walls. The side walls are fairly strong. When all these walls fall to the invading microorganisms, there is another wall that begins to form. The wall formed by the cambium after wounding is the barrier zone. This wall confines the invasion to the wood present at the time of wounding. The new "trees" or rings that continue to form are then protected from invasion unless new wounds are inflicted. When new wounds are inflicted at later times, multiple columns of defect develop.

An understanding of CODIT will help to clarify many misconceptions about decay.