CAVITY FILL BY SPONTANEOUS TISSUE REPLACEMENT

by John M. Haller

It is widely believed that a tree whose interior has been destroyed by decay, insects, fire, or any other agent can never rebuild that damaged region. Once a hollow tree always a hollow tree. Generally, of course, this is true, since there is no meristematic tissue on the inner surface of the remaining shell to initiate new growth.

In certain cases, however, the whole interior of a hollow tree can be refilled, not by artificial assistance, but by the activity of the tree itself. A complete new trunk may develop within the hollow, enlarging to the stage where it partially or totally occupies that space. The lost tissues are replaced (not regenerated but replaced) by a method difficult to believe did not the photographs present incontrovertible proof. Many tropical trees can effect such replacement, but few temperate-zone species can do so. Of those few, virtually all are to be found in our milder climates.

The process involves the production of adventitious roots, and since these cannot grow from the inside of a non-functional shell, it follows that the shell must communicate with the exterior at some point along its length. Why with the exterior? Because the meristematic tissue capable of producing callus is found only (or principally) between the xylem and the phloem, hence close to the outer surface -- an outer surface which must be broken through so that new growth may begin from its edges. Any open wound, even though small (with a minimum diameter of, say, four or five inches so that enough time is allowed for the action to take place) will suffice, provided that no stub is present to impede inward growth.

What happens is this: As new callus begins to form around the edges of the wound and to roll inward, adventitious roots sometimes sprout from these new tissues. If moisture is present and the woody interior has decayed to the proper consistency, the appearance of such roots is, in many species, almost inevitable as the rapidly developing callus responds to what has, in effect, become a rooting medium. Gardeners who routinely practice air-layering will find nothing surprising in this. Theorists will see in it one more example of cellular totipotency.

As these adventitious roots develop, growing downward through the tree's rotting interior, they thicken proportionally, much like the aerial roots of the Indian banyan but with the advantage that they are functioning as they grow, being nourished from the simulated soil, while those of the banyan, waving about ten or twenty feet in the air, cannot begin to function until they contact the ground.

Once having reached the soil, the roots now grow much faster, in diameter as well as in length, rapidly ramifying to provide both anchorage and a nutrient-gathering network. If the trunk is cut through at this stage, one may easily distinguish the original shell, the partially or totally destroyed interior, and the adventitious root—now become a living post—that is swiftly enlarging inside the shell. After five or ten years, depending on species and growing conditions, the "post" may fill the hollow interior completely, so that we have a trunk within a trunk. By a circuitous, but no less effective, method the tree has managed to rebuild its destroyed center.

Presumably, there will now occur some degree of accommodation between the growth rates of the inside tree and the decay of the outside tree; otherwise either inhibition of the one or rupture of the other will take place, something not impossible -- cases are known in herbaceous plants where displaced xylem tissues have burst open the stem.

If it be alleged that a root, whatever its origin, cannot function as a stem, attention must be

Fig. 1. An adventitious root developing from callus tissue at the top of this long cavity in a hackberry grew straight downward through the tree's rotting interior, made its way to the ground, and there took root to serve as a living post. (Austin, Texas)

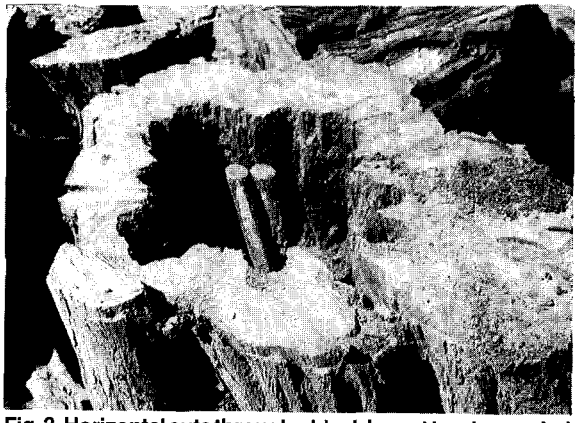

Fig. 3. Horizontal cuts through a black locust trunk revealed a hollow interior with two new trunks forming inside—trunks that had begun life as adventitious roots growing from callus tissue at the top of a long, longitudinal wound. (Modesto, California)

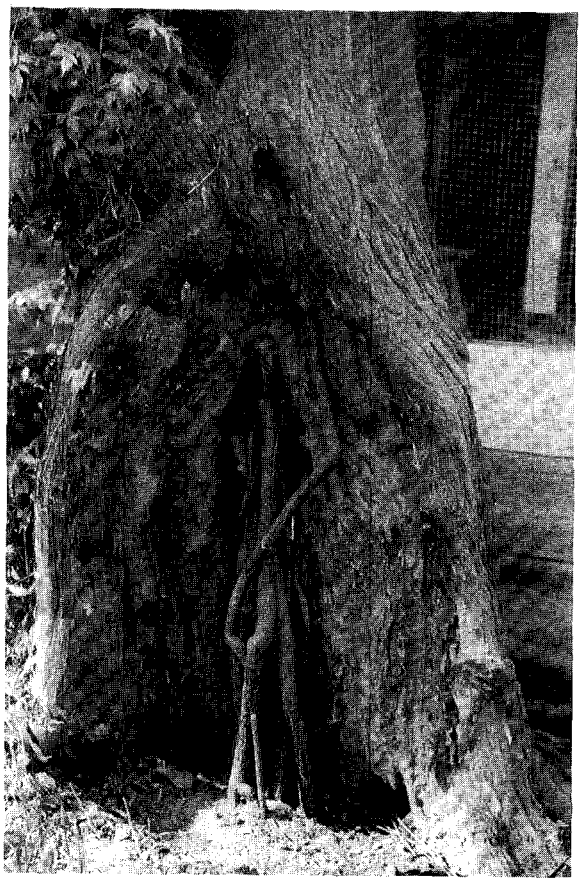

Fig. 2. This basally damaged Chinaberry managed to produce numerous adventitious roots from the callus tissue forming around the rim of the cavity. These roots made it to the ground just in time to become new supports for the tree which was in imminent danger of toppling. (Austin, Texas)

Fig. 4. The same thing closer to ground level, one of the new stems having been cast aside for greater photographic clarity.

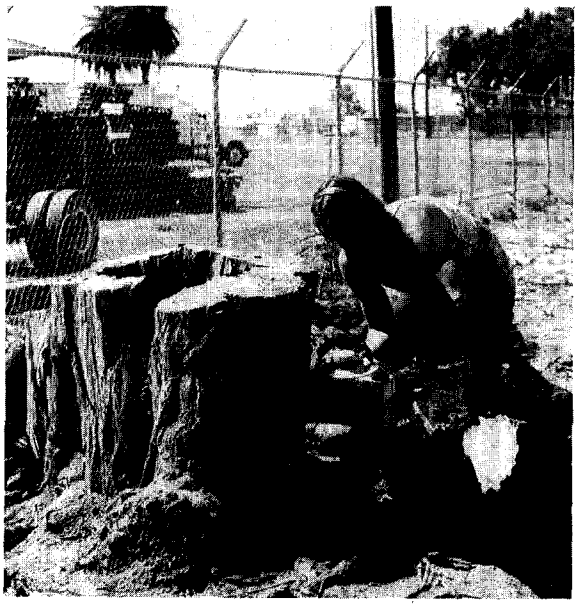

Fig. 5. The same tree being cut near ground level.

called to the banyans (and the Clusias) whose multiple aerial roots do come to function as stems, and very successfully, the original trunk often disappearing entirely. Although the interior structure of young root and young stem are quite different, these differences disappear with the beginning of secondary growth. Macroscopically, older root and stem are hardly distinguishable, both consisting primarily of secondary xylem.

It is interesting to note that when cavities are excavated and filled with concrete, or some other rigid material, this adventitious-root-forming process is completely blocked. When the cavity is shallow and the heartwood beneath sound, the blocking does no harm, for no root would be able to grow through sound heartwood nor would it receive any stimulus to do so. But if the whole center of the trunk is decayed all the way to ground level or nearly so, then rigid fillings are contraindicated. In such cases it is better to leave the tree to its own resources or to fill the cavity with dirt. The dirt fill greatly hastens adventitious root development. Unorthodox though this treatment may be, it has saved many a tree; I have practiced it for years.

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