*From La Hacienda, 1911.*

# CHAPTER III.

## TREES AS AN AID TO DRAINAGE.

ALL trees, in fact all kinds of vegetation, transpire. Although a large part of the body of all plants is water (96 per cent in plants like the banana), a still larger quantity is absorbed by the roots and is again discharged by the leaves into the air. This passage of water into the air from the leaf surface of the plant is called transpiration. Water absorbed by the roots contains the nutrient substances of the soil. There is thus a current of water from soil to air through vegetation which is known, botanically, as the transpiration current. This keeps the plant turgid. When evaporation from the leaves is in excess of the supply from the roots, or in other words, when there is no transpiration current, due to an insufficiency of water, the tender parts of the plant wilt. The cells of the tender rootlets of plants not only absorb this watery solution but have a selective power in choosing from the many mineral substances contained in the moisture of the soil, the kinds and quantities needed for the use of the plant. If even one necessary element is absent the plant dies of starvation. These substances are left in the plant for the manufacture of wood and fruit, while the water which has served as the vehicle of transmission evaporates from the leaf surface of the tree. The actual source of the power of this great transpiration force is still unknown. It is a mighty pump that will lift enormous quantities of water from the roots through the wood to the topmost branches of a tree two hundred and fifty feet in height. In fact, every tree is a natural pump with many valves. The power that does the pumping is simply another one of the great problems in plant life which remain to be solved. The leafage is a broad surface spread out to the sun and air. In addition there are numerous stomata (air-pores) which increase the porousness and promote evaporation of moisture from the surface. These air-pores or stomata open and close to suit the needs of the plant. The leaves and green twigs are then the special organs of transpiration.

The water evaporated in the five months from June to November from an oak standing perfectly free and apart and having about 700,000 leaves has been estimated at 111,225 kilograms. This is equivalent to about a quarter of a million pounds of water.

A clover plant has been found to give off in one day twice its weight of water. A crop of hay on one acre producing two tons has been found to use during its growing season more than six hundred tons or wagon loads of water.

Storer in a chapter in his work on agriculture on "Trees as Pumping Engines" quotes that a single oak in Germany in about five months transpired 264,000 pounds of water, or about eight and one-third times the amount that fell in rain on the surface it occupied. He mentions another oak tree that transpired 4,400 pounds of water in a single summer's day.

Some trees transpire more than others, and, of course, in a climate of continuous summer, transpiration throughout the year is enormous. Rapidity of growth is determined by the amount of moisture available. The amount transpired depends upon the supply of water, the rate of growth and the condition of the atmosphere. Given then a wet soil, a fast growing tree, such as a cedrela or eucalytpus or any one of a hundred or more fast growing tropical trees, with a dry, windy atmosphere, and you will have a pump working quietly and constantly that would rival a windmill.

In a parliamentary paper relating to Natal is the following statement: "Clumps of eucalyptus planted in undrained swamp lands at elevations up to 4,000 feet have been known to completely dry up the space within reach of their roots."

I have heard it said that in India eucalyptus trees were planted along an irrigation ditch. These trees robbed the ditch of so much water that they were cut down. The region around San Paulo delle Tre Fontane, it is claimed, was drained and rid of pestilential fevers by the planting of eucalyptus. Along the Mediterranean shore I have found the belief prevalent that eucalyptus plantations keep off fever. Müller speaks of the cajeput tree (*Melaleuca leucodendron*) as the "anti-malarial tree." Many attributed this effect to emanations of oil from the leaves. It is a "poor lie that is devoid of all truth" and it is a poor popular belief that is not based on some shadow of fact or reason.

I think the modern development of medical science proving the causes and manner of transmission of tropical fevers explains it all.

In order to contract malaria or yellow fever one must be bitten by an infected mosquito. The notion that these fevers are carried by miasmatic emanations from swamp lands no longer holds.

To keep off fevers either one of two things is necessary—remove all mosquitoes that are infected or remove or segregate all people that can infect the mosquito.

The mosquito does not travel far. He must have water to breed in. Undrained land furnishes the breeding place. In the Roman Campagna the water was held in pockets and the land was difficult to drain by ditches. Trees were planted. They drained the land, the mosquito was left without a breeding place and without him, or rather her, since the female does the mischief, the fever was not transmitted.

The eucalyptus has been singled out as the great genus for this purpose, but there are other trees of quite as much value, which I shall mention later.

*Eucalyptus rostrata*, the red gum, is a favorite because it grows on moist ground with a clay subsoil. It will grow on land subject to fresh water inundations for a considerable time. In Mauritius it resisted hurricanes better than other species. It yields a heavy wood, which is highly esteemed in Australia.

*Eucalyptus resinifera*, the red mahogany gum, has proved best for the tropics. It is not, however, such a rapid grower. It yields a good timber, but has an unfortunate common name. It should not be called mahogany, because it does not belong in the same class with this time-tried prince of timbers. It should not be called gum because the term gum to many minds carries with it little to recommend it.

In Cuba I found a eucalypt growing with magical rapidity. It was the fastest growing eucalypt I have ever seen in the tropics. An expert of the Department of Agriculture, Washington, D. C., diagnosed it to be *Eucalyptus crebra,* the narrow leaved iron-bark tree of New South Wales and Queensland. I am not sure that he is right, but if he is this species is the one to plant in Western Cuba. In our excitement over the eucalyptus, some of the many species of which are good for certain special districts, such as Southern California and Mexico, we have overlooked other Australian and American trees which are quite their equals, if not in many instances by far their superiors.

We have many species of the order *Myrtaceae,* to which the eucalyptus belongs, so similar to eucalyptus that the novice could not tell the difference. For instance, the rose apple or pomerosa and many other species of the genus *Eugenia* and allied genera, which have large seeds, grow very rapidly, and yield fruit as well as wood.

Any quick-growing tree such as the cedrela or cigar-box cedar will pump just as much, if not more, water than the eucalyptus. The Australian pine is a fine tree for swamp lands. It is storm fast, grows very quickly, in fact faster than any eucalyptus in Florida, and yields a fine, hard wood.

*Melaleuca leucodendron,* the cajeput tree of India, which yields the cajeput oil of commerce, is, according to Baron V. Mueller, a great tree for swamp lands. He thus speaks of it: "It can with great advantage be utilized for such areas for subduing malarial vapors in salt swamps where no eucalyptus will live." I have it growing successfully on the bay shore here in Florida. We have all noticed how the roots of trees will run to an old well and then form in great hair masses down its sides to the water below; we have all noticed how the roots of quick growing trees such as the poplars and willows will go long distances to a tile drain and fill it completely with hundreds of rootlets; and we have all noticed how the roots of some trees will run out and under a pavement so persistently that they crack and ruin it. The rootlets are merely doing their part—hunting for moisture, so that the tree can hold up its head, and hunting for mineral food which is dilutely dissolved in the water which it drinks. When the earth fails to yield sufficient moisture and in consequence sufficient plant-food held in solution the tree begins to die at the top first—a condition called stagheadedness, which is the beginning of the end. In the selection of soils, look up and not down. The height of the timber is usually a good measure of the soil's depth and fertility. On an old homestead in this region there was a well cut from the solid rock. By the side of this well a wild rubber grew. The well was long ago abandoned and is now almost filled by its hose-like roots.

In conclusion let me say that the greatest function of the forest, aside from yielding materials useful to man, is soil betterment. It holds the soil in place against the erosive action of wind and water, but what is more important, the roots penetrate to the deeper layers of the soil, absorb the mineral substances and then deposit them again on the surface in the form of detritus, which soon becomes humus. Thus the surface soil is being constantly fed, thus the mineral ingredients of the soil are conserved and thus the wornout fields and ruinate lands of the tropics may be rejuvenated and rendered virgin. This deposit on the surface gradually raises the level and thus helps also in the process of drainage.

ON THE BEACH AT CAPE FLORIDA. (PHOTO BY HOMER SAINT-GAUDENS.)

COCO-PALM GROVE OR "COCAL" ON ONE OF THE KEYS.
(PHOTO BY FLORIDA PHOTOGRAPHIC CONCERN.)