A Landfill Botanic Garden

Armand Sarinana

THE ESTABLISHMENT of South Coast Botanic Garden over a sanitary landfill was one of the first such attempts in the Western Hemisphere. The garden was conceived as an outdoor botanic laboratory for the study of horticulture under landfill conditions in a diatomaceous earth medium. Therefore, problems in plant culture and soil engineering were expected. Solving them was the challenge.

The uniqueness of this challenge served to form a working partnership between the Sanitation District and the Department of Arboreta and Botanic Gardens, a partnership which continues to this day.

In the second half of the eighteenth century, Portuguese whalers made twice-yearly visits to this coastal area to capture the migrating gray whales. The nauseating odor of boiling whale blubber that arose from their iron kettles at Portuguese Bend and floated out over the Palos Verdes hills could have been an omen of the future. Certainly the odor disturbed the local Indian civilization as well as the new white settlers in the area.

Two centuries later the Sanitation District, trying to persuade local residents to accept a sanitary landfill, were faced with similar odorous gases, not to mention the sight of decaying garbage and the resultant flies.

The decomposition of refuse is always accompanied by the production of gases, mostly methane and carbon dioxide. Lower concentrations of the more noticeable odorous gases, or as they are specifically called, mercaptans, are also included as byproducts of this decomposition. This chemical process is accompanied by heat generation and increased pressures. The Arboreta Department's concern is primarily with the heat and pressures and the resulting soil subsidence and high soil temperatures.

The first problem anticipated was the possible pollution of the neighborhood with odorous gases. Previous laboratory studies had shown the efficiency of soil as a filtering agent, and field testing proved the odors generated within a fill would be effectively controlled by maintaining a soil cover on the surface. The lateral migration or movement of decomposition gases within and adjacent to the fill was controlled by the establishment of horizontal, gravel-filled collection basins with vertical upright exhausts. A constant program of inspection, maintenance, and monitoring is followed to assure continued control of odors and other landfill decomposition gases. The southern and eastern boundaries of the garden, which are adjacent to residential areas, are protected with this type of system.

Last July, the Sanitation District and the NGR Nu Fuel Company of Newport Beach concluded a joint study which had as its objective the feasibility of collecting, purifying, and selling methane gas created in a landfill. The 172-acre sanitary landfill across Crenshaw Boulevard from

South Coast Botanic Garden was their test site. The major problems centered around collecting and purifying the gas. The results of their study were positive and today the area, known officially as Landfill #1, has become very possibly the first facility in the world in which refuse gas is taken through a system that can pump it into a pipeline for direct sale to a utility company. The anticipated daily production is one million cubic feet of pure methane, an amount equal to the daily requirement for 4,000 homes. The two 100-foot wells in the garden were not established for commercial methane production but rather for the study of trash decomposition in the presence of moisture.

As previously mentioned, the Arboreta Department's main concern is the study and solution of plant growth in abnormal soil conditions. Areas of extreme soil temperatures, 120° to 160°, are localized in the garden; more general areas of lower temperatures are common throughout the garden with the average range 70° to 90°. The average home garden soil temperature in the vicinity of this facility averages between 55° to 70°. The same type of venting system used by the Sanitation District for odorous gases is used to vent these abnormal temperature areas where plant growth is initially impossible. Once soil temperatures are reduced, shallow-rooted plant material, such as gazanias or alyssum, is established. As temperatures continue to drop, deeper rooted perennials are introduced, such as carisa, junipers or cassias. The ultimate goal is to plant the deeper rooted trees and shrubs.

Characteristically, most established trees and large shrubs have lateral root systems limited to the three-foot top-soil cover. Therefore, the periods of greatest danger to these specimens are during the March winds when the soil is saturated from the winter rains and tree support is vital. Due to the higher temperatures in the lower trash decomposition zones with the maximum top soil cover of three feet, the development of deep root systems is impossible. These higher soil temperatures destroy or burn the new developing rootlets which must have cooler, tolerant temperatures.

In the localized zones of greatest gas, heat, and pressure activity, fissures serve as escape vents. Several main fissures transverse the garden and since soil temperatures are the highest at these escape vents all plant growth is impossible. These areas are therefore designated as study points of trash decomposition for the visitor. Differences in solid and fill land can also cause fissures, especially where great weight is involved. An example is the fissure that developed adjacent to the 1.75-acre artificial lake. The imbalance of the land in this particular area, coupled with a severe earthquake that occurred in February of 1971, caused the fissure, which in turn caused the asphalt-jute waterproofing membrane on the bottom of the lake to rupture. The ensuing geological study by the County Engineers and Sanitation District resulted in the recommendation that the lake perimeter be reduced, thereby bringing in the lake margins over non-trash filled areas and away from the fissure zone.

The more common problems encountered are due to settling, or subsidence, a problem of the completed landfill. Subsidence is caused by the variation in the density of debris deposited and its difference in decomposition rate. Interesting variations in terrain have resulted from this subsidence. An example is the spoon-shaped small lawn at the garden entrance which has become a favorite spot for photographers. The original terrain was almost level, with only the most necessary slope for drainage. As subsi-

These pictures show a large fissure at South Coast Botanic Garden and typical filling and venting. Top photo shows the fissure that developed from the pressure of escaping gas. Note that there is no plant life in the immediate vicinity. Second photo shows the fissure filled in and vented by plastic, perforated pipe. Third photo is simply a close-up view with a long-handled shovel thrust into the hole to indicate the depth of the fissure.

This photo shows the sinking of the land around the foundation of the current administration office. Because it was set on pilings, the office floor remained stable.

dence increased with added moisture, the center of the lawn sank approximately 24 inches. All lawn areas originally graded to a level terrain have developed graceful, moderate-sized depressions.

Because of the subsidence factor, all permanent building construction is forbidden unless built on pilings driven to the bedrock area. South Coast's current building and shop area were constructed on 40-foot pilings. This construction was generally effective insofar as the structures are concerned, but as can be seen in the picture, the land bordering the structures shows the results of more or less continuous subsidence. The new office-auditorium complex presently under construction will be located on the only solid one-acre area in the garden site.

The more common yet equally serious problem resulting from subsidence is the breakage of the sprinkler systems throughout the garden. The breakage is circumvented by the use of PVC, or polyvinyl plastic pipe, which has greater flexibility and is easy to repair. An effort to make this system more flexible and durable is under constant study.

The third problem due to subsidence at South Coast is drainage. Terraced areas must be corrected periodically to maintain the proper drainage necessary for successful horticulture. The accumulation of water accelerates settling, no doubt due to greater trash decomposition.

These are the problems that pose the horticultural challenge. Actually, many plants have adapted very well to this unusual environment. Except for areas having very high soil temperatures, all introduced plant material has survived the above-average soil temperatures, the subsidence, and the generally shallow root systems that result from the condition. Overall, plant losses are less than one percent, a figure considered normal for the ordinary garden.

This is another in a series of articles by Armand Sarinana, superintendent of South Coast Botanic Garden, tracing the origin and development of that garden.