

Landscaping for Realism: Simulating the Natural Habitats of Zoo Animals

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In Atlanta, Georgia, horticulturists have created the illusion of a West African rain forest and an East African savanna with hardy, woody plants.

What does a horticulturist or landscape architect strive to attain when choosing plants for a naturalistic animal exhibit in any major zoo? Should visitors come upon bananas and tropical figs complementing an exhibit featuring giraffes or zebras that naturally roam the hot, arid Serengeti? Let's hope not. Likewise, they should not be confronted by trees that

resemble the acacias of arid Kenya and Tanzania in a lowland gorilla exhibit.

In order to simulate a particular geographical area as closely as possible, zoo horticulturists must have a thorough knowledge of the region's overall geology, climate, economy, and social customs—all critically important for installing an appropriate habitat for zoo



Lowland gorilla in the African rain forest exhibit at Zoo Atlanta.



The lush feeling of the Ford Tropical Rain Forest at Zoo Atlanta.

animals. To create a lowland gorilla habitat in Zoo Atlanta, our goal was to gather as much information on the region as possible in order to simulate its home convincingly.

Simulating Tropical Rain Forests

What botanical characteristics tend to dominate the lush rain forests of Cameroon, West Africa, the home of the lowland gorilla? If we think back to our childhood and recall old movie footage of Tarzan, numerous lianas or tropical vines probably come to mind, a fairly accurate representation of the flora of the region. Brief but frequent rains and high humidity also characterize tropical areas in Cameroon as well as similar areas through-

out the world, and the rain forest canopy has more levels or strata than we are familiar with in the deciduous woodlands of eastern North America.

The tremendous diversity of animal life strikes anyone who has seen or read about a tropical rain forest. An almost unimaginable array of mammals, amphibians, reptiles, birds, fish, and especially insects lives in the tropics—a great number of which scientists have yet to describe. Although the variety of plant life is equally diverse, many plants have certain features in common, such as large leaves with a relatively smooth, waxy upper surface and long “drip tips,” two features that help shed excessive rainfall in the humid

tropics. In contrast, species native to the Serengeti and other arid regions tend to have small leaves that help them conserve as much precious moisture as possible through reduced transpiration.

The ideal method of landscaping a naturalistic exhibit of animals from tropical regions is to use exclusively those plant species that are native to tropical forests. To be truly accurate, only flora indigenous to Cameroon, West Africa, should be used to landscape a lowland gorilla enclosure, and only those plants that grow in the rain forests of Borneo and Sumatra should be selected for an orangutan exhibit.

Although such choices would be optimum, this goal is obviously not realistic. Since very few American zoos are located in climates without frost, such an endeavor would make little sense in an outdoor exhibit. Even in an indoor exhibit, the costs of obtaining native plants both for the initial landscaping and for replacements over the long term—even if it were possible to procure them—would be prohibitively expensive.

However, even when we substituted non-native material in our lowland gorilla complex at Zoo Atlanta, well over \$40,000 worth of non-hardy tropical plants were used outdoors, including up to 20-foot-tall schefflers, 16-foot-



The foliage of Magnolia macrophylla, the bigleaf magnolia, at the Arnold Arboretum. Photo by Rácz and Debreczy.

tall areca palms, and countless numbers of philodendrons, anthuriums, and bananas. These plants are overwintered in large polyhouses and simply add a tropical flair to the exhibit during the warmer months. They must be viewed as "icing on the cake," however, since the real horticultural backbone of nearly any zoo exhibit is made up of cold-hardy species and cultivars that *simulate* the indigenous flora of the animal's native habitat.

Temperate Trees with a Tropical Look

The large, glossy evergreen leaves of the southern magnolia (*Magnolia grandiflora*) resemble the foliage of a number of tropical species, especially figs, quite effectively. A number of other magnolias are frequently used by zoo horticulturists to simulate the world's tropical habitats. The bigleaf magno-

lia (*M. macrophylla*) and the umbrella magnolia (*M. tripetala*) are both superb simulators with their extremely large leaves. Those of the bigleaf magnolia measure two to three feet in length; those of the umbrella reach one to two feet. An added bonus is the huge flowers, produced in early summer; those of the bigleaf magnolia can grow to over twelve inches in width; those of the umbrella reach from seven to ten inches.

The biggest deterrent to using either of these two species to create a tropical-looking landscape is not their appearance but their poor availability within the nursery trade. Because their coarsely textured foliage makes them difficult to incorporate successfully into either a residential or commercial landscape design, few nurseries grow either the umbrella or bigleaf magnolias. And those that are avail-



The attractive compound foliage of Rhus typhina, the staghorn sumac. From the Archives of the Arnold Arboretum.



Aralia elata in full bloom at the Arnold Arboretum. Photo by Rác and Debreczy.

able in nurseries are usually only an inch or so in diameter and at best six to eight feet in height.

Two other magnolias valuable for simulating a rain forest environment are the sweetbay (*M. virginiana*) and the cucumber tree (*M. acuminata*), with leaves that can reach ten inches in length and bearing a reasonably long "drip tip." The sweetbay is readily available; its glossy leaves and fragrant flowers are highly attractive but unfortunately do not grow as large as those of most other magnolias. The cucumber magnolia is much harder to locate although, with persistence, large specimens can be found in the fields of old wholesale nurseries. My experience with the cucumber magnolia corroborates the general opinion that it is difficult to transplant.

Two additional members of *Magnoliaceae* often used in a simulated rain forest exhibit are the native American tulip tree or tulip poplar (*Liriodendron tulipifera*) and the Japanese anise tree (*Illicium anisatum*). The flowers of the tulip poplar are particularly

appealing in that they have a delectable fragrance of vanilla and green and orange coloring. Unfortunately, they are not produced in quantity until the tree reaches the age of fifteen years or more, and a height of twenty to thirty feet.

Among the best of the cold-hardy plants for use in simulating the tropical rain forest are the empress tree or royal paulownia (*Paulownia tomentosa*) and the northern catalpa (*Catalpa speciosa*). The paulownia is particularly fast-growing and, like the catalpa, boasts very large heart-shaped leaves and tropical-looking flowers. Neither of these species is much sought after for planting in the home landscape or as street trees, so both are rather difficult to locate in large sizes within the nursery trade. Likewise, the ailanthus (*Ailanthus altissima*) with its large pinnately compound leaves remains a good choice for the zoo horticulturist striving to introduce a tropical flair to the landscape.

The long pinnately compound leaves of the smooth sumac (*Rhus glabra*) and staghorn

sumac (*R. typhina*) make these species possible candidates for use in rain forest habitats. Both grow exceedingly fast and, except for the cut-leaf varieties, are not frequent components of the home landscape. The lanternaphyllum viburnum (*Viburnum x rhytidophylloides*), hardy rubber tree (*Eucomia ulmoides*), devil's walking stick (either *Aralia spinosa* or *Aralia elata*), and cultivars of the common rose mallow (*Hibiscus moscheutos*) are other hardy plants that can effectively simulate the atmosphere of tropical rain forests.

The various species of temperate bamboos, particularly within the genus *Phyllostachys*, can be extremely important in habitat exhibits. In general, they are available from wholesale nurseries in sizes and quantities sufficient to meet the demands of landscaping large exhibit areas, and their cold-hardiness is greater than many horticulturists realize.

While the leaves of the white mulberry (*Morus alba*) are the food of silkworms, the fruitless (male) cultivars are valuable to the zoo horticulturist not only for their vigorous growth and spreading form but also because their foliage provides an excellent browse for many zoo animals from colobus monkeys to giraffes.

Willow (*Salix* sp.) is another multi-purpose plant for the zoo horticulturist. Although the leaves are not particularly large, their long narrow shape somewhat simulates the foliage of the bamboos characteristic of tropical areas. Branches of small diameter can simply be cut in early spring and stuck into moist soil where they quickly take root. These willow saplings soon form impressive thickets that can be easily and cheaply used to screen unsightly vistas or to hide the backs of small buildings. As the willows continue to mature and become too tree-like, they can be thinned out to keep the colony dense and shrubby. Like white mulberry, the leaves of willow are an excellent source of browse for many zoo animals and, with their fast growth, they can be frequently harvested for this purpose.

Creative Methods for Simulating a Rain Forest

As mentioned, vines or lianas are very important components of the world's rain forests. We found one of the best vines to use to simulate Cameroon, West Africa, is the trumpet vine (*Campsis radicans*) with its long tubular, two-inch-wide flowers and rampant growth. Its blooms can range in color from scarlet to orange or even yellow, depending on the cultivar; its Zone 4 cold hardiness allows it to be planted in most zoos throughout the country. The trumpet vine's large pinnately compound leaves, along with its wide availability, make it a first-rate choice to simulate the tropical habitats of many diverse animals—from a shy tapir to an agile and inquisitive siamang.

Although a wide variety of vines, ranging from the sweet autumn clematis (*Clematis paniculata*) to the Chilean jasmine (*Mandevilla laxa*), can be used by zoos located in more southern climates, some of the best vines are just not available in nurseries. As a substitute, the simple stringing of dead grapevines throughout the trees can give an amazingly realistic effect to a rain forest exhibit. Also the strategic placement of deadfalls and brushpiles along public walkways can dramatically add a touch of authenticity to a rain forest exhibit.

At Zoo Atlanta, a dead twenty-two-inch-caliper southern magnolia—with a wide multi-branched crown—was hoisted up by crane, and a portion of its lower trunk simply "planted" in concrete near one of the exhibit's main animal viewing areas. The tree had died a number of weeks before, but we used it to help convey an image of the struggle of life and death in the forest. More important, the use of deadfalls and brushpiles—when combined with interpretive graphics—depicts the destructive effects of slash-and-burn agriculture within the world's tropical rain forests and can provide an educational message regarding the wise use of our world's natural resources for visitors of all ages.



The flowers and foliage of Albizia julibrissin. From the Archives of the Arnold Arboretum.

Simulating the East African Plains

In addition to the tropical rain forests, another environment that affords the zoo horticulturist a challenge is that of the plains of Kenya and Tanzania in East Africa. The plants used to simulate the authentic habitat of giraffes, lions, zebras, elephants, and fleet-footed Thomson's gazelles look much different from those chosen to complement a lowland gorilla or a white-handed gibbon exhibit.

Unlike tropical plants with large leaves and "drip tips," the trees and shrubs that a zoo horticulturist would choose to depict the plains of Kenya and Tanzania would almost all have thorns or spines and small leaves to simulate the native flora's need to conserve water. Species and cultivars of selected ornamental grasses would also be appropriate, as are associated landscape features, such as artificial termite mounds.

Simulating East African acacias is most often accomplished in zoos by planting broad-crowned, irregularly shaped honey locusts (*Gleditsia triacanthos* var. *inermis*) and removing the lower branches to make them appear to have been browsed. Like those of the honey locust, the small leaflets of the mimosa (*Albizia julibrissin*) make it an excellent simulator of the acacias of the Serengeti. Although seldom recommended for the home landscape for a number of reasons, its broad-spreading crown provides unique opportunities to zoo horticulturists.

In the southeastern United States, the yaupon holly (*Ilex vomitoria*) is a common and often overused plant in the general landscape. Although its small leaves are valuable in simulating an arid environment, the form of specimens sold in nurseries is seldom very natural in appearance. We were fortunate



Large naturalistic yaupon holly (Ilex vomitoria), intentionally planted on an angle, in the Masai Mara East African Savanna Exhibit.

enough to locate some very large and overgrown yaupons growing in the back corner of a large wholesale nursery, and they are now one of the premier focal points of Zoo Atlanta's new East African plains exhibit.

The two- to three-inch thorns of the cockspur hawthorn (*Crataegus crus-galli*) also make it a valued addition to any exhibit housing lions, zebras, giraffes, and similar animal species. While its thorns are very realistic, they are also potentially dangerous, particularly to small children. The use of this hawthorn in a zoological landscape is, therefore,

restricted to areas that can be easily seen and appreciated but are totally inaccessible to both the animals and the visiting public.

The following list of plants will help zoo horticulturists simulate the arid plains of Kenya and Tanzania: Adam's needle (*Yucca filamentosa*); small soap weed (*Yucca glauca*); Russian olive (*Elaeagnus angustifolia*); Japanese barberry (*Berberis thunbergii*); Siberian pea shrub (*Caragana arborescens*); Warminster broom (*Cytisus x praecox*); pampas grass (*Cortaderia selloana*); ravenna grass (*Erianthus ravennae*); Chinese pennise-

tum (*Pennisetum alopecuroides*); maiden grass (*Miscanthus sinensis* 'Gracillimus'); eulalia grass (*M. sinensis*); and hardy orange (*Poncirus trifoliata*).

Toxicity and Other Constraints

Whether it be the simulation of a rain forest in tropical West Africa, the arid plains of Kenya and Tanzania, or some other region of the world, zoo horticulturists are constrained in many ways in their efforts to create the "natural" habitat of a specific animal. For example, oleander (*Nerium oleander*), commonly seen in gardens throughout the deep South, is not used in a zoological setting because of its toxicity. Likewise, while some plants may be difficult to locate in the nursery trade, others are impossible to obtain except through professional contacts at arboreta or botanical gardens. One example that comes readily to mind is the Chinese toon tree (*Cedrela sinensis*). Few public gardens can even claim it as part of their collection, although its large pinnately compound leaves, strongly resembling those of the ailanthus, evoke a tropical feeling. While widely available, certain varieties and cultivars with variegated foliage or with crimson-colored leaves, such as zebra grass (*Miscanthus sinensis* 'Zebrinus') or the ever-popular red-leaved Japanese barberry (*Berberis thunbergii* var. *atropurpurea*), are of little use for creating a natural-looking habitat.

Animal-related damage to plants can be quite extensive if precautions are not taken. Elephants and rhinos can be particularly destructive as a result of their immense weight and strength. Both animals must always be kept well away from the trunks and lower branches of trees within their exhibits. Boulders and other large-sized barriers, such as logs, can also be strategically placed around

the drip lines of trees to guard against soil compaction.

Plants must also be protected against the sheer strength of a lowland gorilla. Fiberglass tree casts can be used to protect the bark of mature shade trees within gorilla enclosures. Final texturing and coloring give the casts a realistic appearance when fitted around the tree's trunk.

Significant damage to plants can be caused by a wide range of other animals. The bark of any tree must always be protected against the sharp claws of lions or leopards. Likewise, the playfulness of tiger cubs can be particularly rough on any landscaping within their exhibit if care is not taken. Finally, in areas where ducks and geese are allowed to range freely over lawn areas, the effects of grazing and soil compaction can be much more significant than most visitors would ever imagine.

In some cases, human behavior can cause problems, as in the case of the Chinese chestnut (*Castanea mollissima*), which cannot be located near our gorilla exhibit because of its nuts. The nuts can be thrown by children, and its spiny fruit husks can present additional liabilities along pedestrian walkways. Suffice it to say that some plants that superficially appear useful in complementing an animal exhibit cannot even be considered by zoo horticulturists.

Despite its constraints, zoo horticulture has come a long way in the past decade or two in an effort to display animals in a convincing simulation of their native environments. Look closely at the types of plants used around the exhibits on your next visit to a major zoo. You may be pleasantly surprised by what you recognize.

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