

Coe, Jon C. 1983, "A Greensward for Gorillas", 1983 AAZPA Conference Proceedings, American Zoo and Aquarium Association, Wheeling, WV, pp. 117-121.

2006 Update: While exhibit design has advanced in the 23 years since I wrote this paper, most of its content remains valid today. The one area that has changed is awareness of the dangers of encouraging invasive species such as those discussed under "Weeds and Other Useful Plants." I feel zoos should be able to use and manage potentially dangerous and invasive plants just as they use and manage potentially dangerous and invasive animals. However the zoo horticulturists I've spoke to disagree and strongly support government and industry restrictions on use of potentially invasive plants.

A Greensward for Gorillas

Adventures in Zoo Horticulture

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"The plant resources of the earth are largely within the purview of the horticulturist, involving conceptions of plant geography, climate, adaptations."

L. H. Bailey

Prologue:

Kiki awakens from his nap on the grassy slope and yawns immensely. Sitting now, he reaches out a gigantic arm and delicately plucks a clover flower. His supple lips play with it while he surveys his family. Nina with her infant Kamila on her back is browsing further down the slope, searching for large succulent leaves. Kamila reaches over Nina's shoulder begging for morsels. A second female is resting against a log beside a clump of large-leaved herbs with stalks of blue flowers. She plucks a large velvety leaf, inspects it casually and lets it drop. Pete, the second silverback in the group, is about a hundred paces away approaching a small stream. He wets his hand and sips some of the cool water trickling from it before bending down to drink more fully, always keeping one eye on Kiki.

Kiki abruptly jumps to a four-point stance, and then runs upright down the hill, pelting his massive chest with open hands. Nina looks up and Pete looks submissively away. Approaching a toppled tree, Kiki ascends it into a larger spreading tree, his 460 pound body moving effortlessly to a favorite perch about 25 feet above the ground. Here he remains almost motionless, surveying again this territory, where he and his family have lived for the last six years.

Would Kiki remember his old home with its concrete walls, floors and ledges and its steel pipes and merry-go-round? He keeps his silence and leans back against the tree trunk as the others go about their gorilla business below.

The profession of zoo horticulture is alive and growing.

Today, a casual review of *Zoological Parks and Aquariums in the Americas* shows that 24 AAZPA member institutions list personnel under the heading of Horticulturist (19), Landscape Supervisor (2) or even Curator of Horticulture (3). I also know of three other major zoos that have staff horticulturists who, for some reason, are not listed in their staff summaries. Zoos having horticulturists range in size from the Living Desert Reserve in Palm Desert, California, with an annual visitation of 60,000, to the San Diego Zoo, with over three million annual visitors. The third national symposium on zoo horticulture will be held in San Diego following this conference.

While this dedicated group works toward the recognition and responsible role it deserves, it is questioning some of its basic tenants.

Definition and Premise:

Zoo horticulture can be defined as the application of horticultural knowledge - an understanding of plants, their needs, associations and characteristics - to the exhibition of wild animals and the beautification of zoo grounds. I would further define the goal of zoo horticulture as the creation of living landscapes immersing zoo visitors in the characteristic animal habitat and demonstrating wildlife as exciting, interactive and indispensable elements of the landscapes. If large segments of the population are to appreciate the importance of conserving wildlife and preserving the wild landscapes these animals inhabit, zoos must provide memorable demonstrations of the interdependence of animals and plants, of wildlife and habitat, or leopard and thornbush.

Traditional Zoo Horticulture and the Challenge of Change

Most zoo horticulturists focus on the beautification of zoo grounds. But beauty must be judged by its appropriateness. Traditionally this has meant beautiful floral displays, neatly clipped hedges and lawn with healthy shade trees. But is it sufficient today? Colorful bedding plants are as relevant as topiary beastiaries in displaying the real character of wilderness and wildlife. Exhibit foreground plantings of clipped Natal plum and weeded beds of Transval daisy tell us nothing useful about the zebras beyond, or about zebra habitat. Clearly there are some fundamental barriers to overcome before zoo horticulturists can make significant contributions to the realistic presentation of zoo animals.

1. The conceptual and organizational division represented by the exhibit barrier must be surmounted. Zoo horticulturists must be encouraged to work with animal experts, educators and landscape architects in the design and maintenance of the landscape on both sides of the moat.
2. The ideal of the manicured man-dominated landscape must be relegated to its true habitat - the entry plazas and public gathering places of the zoo.
3. Both zoo horticulturists and the directors who supervise them must support these concepts before they can be realized.

Landscape Simulation

The idea of presenting "naturalistic" animal exhibits is as old as Carl Hagenbeck. But a distinction must now be made between naturalistic abstraction, with its romantic disregard for reality, and realistic landscape simulation which attempts to represent ecological and geographic characteristics of animal habitats. Successful development of such exhibits has only been achieved in the last decade and a half. I believe the best early examples are the World of Birds at the Bronx Zoo, Predator Ecology at Brookfield and the Small Cat Complex at the Arizona Sonora Desert Museum. These exhibits were opened during the 1960s. The first systematic design of realistic exhibits in which the public is immersed in the simulated landscape occurred with the Gorilla, African Savanna and the other exhibits at Woodland Park Zoological Gardens in Seattle, at the Minnesota Zoological Gardens and at the San Diego Wild Animal Park. More recent major projects of this type include exhibits at Pt. Defiance Park/Zoo Aquarium in Tacoma, Washington, at the Audubon Park and Zoological Gardens in New Orleans, and the Tropic World at the Brookfield Zoo. Developments at the North Carolina Zoological Park in Asheboro also deserve favorable notice.

Planning and Research

If landscape simulation is so attractive, why then isn't it more widely used, and why does one see so many examples of trampled out, eroded, unattractive exhibits? The reason is clearly found in a lack of research, planning, design and follow-through. The following conversation might be typical:

ZOO DIRECTOR (Z.D.): "This African veldt exhibit looks terrible! The trees died, the ground is bare and dusty, and every time it rains all the soil washes into the moat leaving the slope eroded. Grass will never grow here."

INFORMED HORTICULTURIST (I.H.): "Did you seed it?"

Z.D.: "Yes, every spring, but the seed wash away or is trampled."

I.H.: "Did you try sod?"

Z.D.: "Yes, but it turned to mud, then dried out and died."

I.D.: "Is there under-drainage?"

Z.D.: "No."

I.H.: "Was the soil especially prepared for this purpose?"

Z.D.: "No."

I.H.: "Was the sod especially grown for this purpose?"

Z.D.: "No."

I.H.: "Were the animals kept off the new sod?"

Z.D.: "No."

I.H.: "Were the trees protected from the animals?"

Z.D.: "Yes, their trunks were protected."

- I.H.: "But were their roots protected from compaction and erosion?"
- Z.D.: "We didn't think of that."
- I.H.: "And why was such a steep slope built into the exhibit?"
- Z.D.: "I don't know, the architect called for it."
- I.H.: "Were a landscape architect and a horticulturist on the initial design team?"
- Z.D.: "I guess not. Another thing, some of the public complained when we didn't mow the grass in the foreground of the exhibit."
- I.H.: "Have you put up interpretive signs explaining your intention to simulate the natural African Veldt?"
- Z.D.: "No. Would that help?"

Failures like this are all too common, and often generate further conversation at other zoos:

ENTHUSIASTIC ZOO SUPPORTER: "Why don't we make a real African exhibit, one that is just like being there?"

ZOO DIRECTOR: "That's been tried. It just doesn't work. Everything turns to mud and dust."

Typical Research Questions

Using the popular African veldt or savanna exhibit as a model, here are some typical questions to help guide research and design:

A. Habitat Research:

1. Which types of savanna or geographic areas are we interested in?
2. What do each of these areas look like?
3. What are their characteristic features?
4. How is the landscape modified by wild animals and/or local people's activities?
5. How do soil, climate, fire and grazing affect the appearance of the landscape? (Assemble a file on soil color, rock or boulder characteristics, etc.)
6. How does the landscape change throughout the year?
7. In what parts of the landscape are animals best seen?
8. What photographic images best capture both the physical essence and the mood of the landscape? (Assemble a file.)
9. What plants (trees, shrubs, grasses, and forbs) actually grow there and in what situations?
10. What animals (mammals, birds, reptiles, and invertebrates) are found there and in what situations? Which ones leave a visible trace that can be replicated? (Examples: termite mounds, warthog or ground squirrel burrows, vulture droppings on rocks, etc.)

11. How can this information be used to develop interpretive story lines that are integrated with the exhibit design?

B. Exhibit Design:

1. What hardy plants most closely resemble the plants to be replicated?
2. Are any of the plants poisonous or potentially dangerous?
3. Are plants available? Where? In what sizes and quantities? Is any lead time required to grow them?
4. What large existing trees can be used or moved from other parts of the site?
5. What are their soil, drainage and moisture requirements?
6. How can the area be irrigated without the animals damaging or being damaged by the equipment?
7. How can plants be most unobtrusively protected from animals?
8. How can the soil be engineered to withstand animal use? (Hint: Look up specifications for good quality football and soccer fields in your area. Animal hooves and grazing have an impact on turf similar to football cleats and mowing.)
9. What sort of escape areas are needed by ground birds and smaller antelope, and how can realistic landscape features be replicated to provide them?
10. How can necessary barriers and other functional necessities be masked or hidden realistically?
11. How can artificial rockwork and other "hard" features be softened and integrated into the landscape?
12. How can soil, fertilizer, plants, drainage and irrigation be integrated into planting pockets in gunite areas?
13. How are these and other planting areas made accessible for maintenance without interfering with animals or animal keepers?
14. How can this information be integrated with similar data about the animals' physical and behavioral needs, keepers' requirements, education and interpretive objectives and visitor viewing concepts?
15. How can this information effectively be communicated to other team members, to contractors, and to those who will maintain the exhibit?
16. How much will this exhibit cost to landscape and maintain?

These types of questions can beneficially be asked when designing many other types of exhibits, both outdoors and indoors. For indoor exhibits the following additional questions should be asked:

1. What types, intensities and durations of light are required and how can these best be supplied?
2. What atmospheric temperatures and humidity levels are best for both the plants and animals being exhibited?

3. What soil temperature range do the plants and animals require?
4. How are plant pests controlled and what effects will these measures have on the animals exhibited? (Hint: What acceptable plant species are most resistant to serious conservatory and greenhouse pests and plant diseases)?

Exhibit Construction

If the project has been properly planned and researched and if the construction budget is adequate to the zoo's expectations, there should be no major surprises during construction. However, there is no substitute for experience at this point. Inexperienced designers may underestimate the cost of construction. Inexperienced contractors, noting the uniqueness and complexity of the project and the unusual procedures called for will usually overbid the job. This so-called "fear factor" should be considered when preparing the construction estimate.

Realistic simulation calls for unusual horticultural practices. For example, many large trees and shrubs may be planted at steep angles to encourage them to grow out over moats or pools or to form multi-stemmed clumps. Trees may even be planted horizontally from above a bank or cliff, as if they were toppled and recovered. Such unusual practices require firm and sure supervision and innovative means of guying. Also, in nature dead wood and dieback remain unpruned. You may choose to leave dead or weak trees and shrubs in place to simulate the stress of drought, browsing, fire and insects, having the contractor replace, but not remove, such plants.

Despite careful planning, the results are often sparse until plants mature several years hence. Two useful practices are: 1) to plant short lived herbs (and even uncommon vegetables) to temporarily fill in between permanent plants, and 2) to require 10% more of specified species and sizes than are required on the plans. These discretionary plants may be field-placed to fill in weak areas in the planting.

Weeds and Other Useful Plants

Natural landscapes, almost by definition, consist of species unaltered by man. Horticultural hybrids and popular cloned varieties, including variegated and unnaturally colored specimen plants represent the opposite end of the plant spectrum from that desired to re-create natural landscapes.

Older, less popular forms that are often considered "weedy" and undesirable in the nursery trade may make the best replicators of the desired natural species. For example, thorny honey locust (*Gleditsia triacanthos*) is more like the thorny acacias of East Africa than the more popular thornless varieties. Other excellent replicator species which are in horticultural disrepute include Siberian elm (*Ulmus pumila*) for replicating monsoon forests, and Osage-orange (*Maclure pomitera*), Tartian honeysuckle (*Lonicera tartarica*), and cockspur thorn (*Crataegus crusgalli*) for simulating thornbush species. Garden varieties such as comfrey (*Symphytem officinale*) and horseradish (*Armoracia rusticana*) can be used to give a tropical appearance to gorilla exhibits. Both are virtually impossible to eradicate once established.

Many infrequently used plants are also very useful. Such typical botanic garden specimens as butterbur (*Petasites gigantens*), Gunnera (*Gunnera chilensis*), large-leaved magnolia (*Magnolia macrophylla*), and giant grasses and cane's such as Miscanthus species and *Arundo donax* can be used to create landscapes of great drama and beauty. Many of these

plants are hardy quite far north. Additionally, specimen plants such as banana, papyrus and lotus can be kept in concealed containers and stored in greenhouses during the winter.

Some of the most useful plants for enduring the severe attention of exotic hoofed stock include true weeds such as nettle (*urtica*), tree-of-heaven (*Ailantus*), elderberry (*Sambucus*), goosefoot (*chenopodium*) and mallow (*Malva*). These plants will often arrive unbidden if protected areas are provided by placing large logs in the exhibit. Other plants frequently ignored by hoofstock include goldenrod (*Solidago*), pigweed (*amaranthus*) and nightshade (*solanum*). This introduces the subject of poisonous plants.

Poisonous Plants

Kingsbury, in his useful book *Poisonous Plants of the United States and Canada*, lists hundreds of potentially harmful species and discusses their toxic properties. All plants to be placed in animal areas or that may find their way into the exhibit area should be checked for possible toxicity. However, the mere fact that a plant is listed in Kingsbury does not mean it must be rejected. For example, Bermuda grass (*Cynodon dactylon*) has caused photosensitivity in cattle in the southeastern United States. Nevertheless, it is one of the most widespread and heavily grazed species in East Africa where it is known as star grass. *Solanum* and *Datura*, two notorious species, are extremely common among herbs of the Serengeti Plain where they alone are not overgrazed during the dry season. Plant toxicity is usually developed as a strategy to discourage over abuse by animals and may, within proper limits, be useful to keep animal exhibits green and vegetated. The point is that toxicity must be known and considered in discussion with the zoo veterinarian and other responsible officials. If it is agreed that the risks are not great, then the species can be used. However, valuable animals are not to be put at risk without proper consideration.

Animal Introduction and Exhibit Break-In

Zoos that are really serious about developing and maintaining realistic exhibits will provide a plant establishment period for one full growing season after planting before animals are introduced into the exhibit. Most zoo directors fear that such a delay would be intolerable to the public they greatly underestimate popular intelligence. At the Seattle Zoo, attractive graphics explained to the public why animals were not in the exhibits the first year and what was intended. The most commonly heard comments included "...won't this be wonderful for the animals," and "...it is so much better than those old cages, it feels so real!" This delay period is essential for very destructive animals like Great Apes, quite important for hoofed animals and desirable, though not essential, for carnivores that are largely inactive and tend to follow established paths.

When animals are introduced, every effort should be made to protect plantings from their initial curiosity. Such protection may include temporary fencing and the addition of large amounts of browse and other suitable food to entice animals away from permanent plants.

Temporary fencing may also be needed for several years to keep the public away from turf, shrub and tree plantings.

Follow-Up

Follow-up is commonly the weakest part of zoo exhibit development. This is because the original design, the construction and the maintenance are often carried out by three separate parties, none really understanding the intentions or needs of the others. It is essential that

someone in a decision-making capacity be actively involved throughout all phases. Also, when traditional grounds maintenance practices threaten to compromise the realism of the exhibit, there are two indispensable tools to call upon: 1) an Exhibit Maintenance Manual should be assembled by the original designers to communicate their long-term intentions to maintenance personnel years in the future, and 2) the original photos, drawings and slides used to convey the desired "image" of the project should be kept in tact to help guide long-term maintenance.

The highest plant mortality will occur during the first year that an exhibit is open. The wise zoo official will anticipate this and set aside a special fund to replace plants or modify the exhibit as required. Exhibits of this type, though proven successful in many zoos, will always be somewhat experimental, and hindsight will inevitably point out possible improvements.

Good documentation throughout the project and during the follow-up period will lead to clear improvements in future projects, not to mention substance for worthwhile research.

Conclusion: Adventures in Zoo Horticulture

Kiki and his troop live at the Woodland Park Zoo in Seattle in a landscape created by people with horticultural knowledge and a realistic vision of gorilla habitat based upon thorough research. They worked closely with animal behaviorists and great ape keepers. They talked to people who know wild gorillas, like Dr. George Schaller and Dr. Dian Fossey. Importantly, they had the fullest support of the zoo director and veterinarian.

They were experimental. Some things succeeded wonderfully, some failed. The lush grasses and herbs thrive, safe from the assault of mowers. The fast draining soil resists compaction and plant roots stay healthy. Automatic irrigation supplies required moisture at night (gorillas don't like to be showered) and sprinkler heads are located well beyond the reach of curious animals. Nettles and thistles, common plants in wild gorillas' diets, were planted in the exhibit but are avoided, as are spiny barberries. The lush herb with blue flowers is comfrey, planted as forage for the animals, but largely ignored. They prefer to search among the tall grass clumps for bits of lettuce, carrot and fruit scattered about by keepers. They do prize clover blossoms. The exhibit area, though large, requires very little time to maintain. Among the failures are a maple killed by filling excessively over its roots during construction and another whose bark was badly stripped by the gorillas when its sugary sap ran in the spring. The trunks of exhibit trees are now protected by electrified wires that are invisible from public viewing areas. The pathway the public traverses in viewing the gorillas is also lushly planted, using all of the same species and many more, such as *Gleditsia*, *Albizia*, *Catalpa*, *Gunnera* and several species of bamboo.

Zoo horticulture is an adventure, a safari in search of wild landscapes with meaning and the means to re-create them. Anyone who has been on safari knows that success depends upon vision, research, planning and execution. There will be setbacks and compromises but there will be progress. The work is difficult, frustrating, poorly paid and underappreciated, but the rewards are great. Seeing Kiki calmly surveying his territory from high in the tree and hearing zoo visitors of every age and race exclaim with hushed voices and drawn breath is very rewarding indeed.