Columbus Zoological Gardens

A Play Environment for Learning

AN ARCHITECTURAL THESIS
ATHENE N. CARRAS
DEDICATED TO

Mom & Dad

CRITICS

Alfredo Missair
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Sliced

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Thesis Statement
"Space has no room, time not a moment for man. He is excluded. 

In order to include him- help his homecoming- he must be gathered into their meaning ( man is the subject as well as the object of architecture ).

Whatever space and time mean, place and occasion mean more.

For space in the image of man is place, and time in the image of man is occasion.

Today, space and what it should coincide with in order to become "space" - man at home with himself - are lost. Both search for the same place, but cannot find it.

Provide that place."

This is a quote by Aldo van Eyck which states my thesis more eloquently than I ever could. For so long, man in architecture has been lost. His needs have been ignored for the sake of high art. Buildings were designed with looks or economics in mind instead of the user and the event. The environment in which one exists should promote and sustain
the activity for which it is designed. It should become the backdrop for an array of diverse and spontaneous events, not the event itself.

In designing for children, this belief is often ignored. Children are special and cannot be designed for in the same manner as adults. They learn by playing and experiencing, and a project should be designed with this duality of function in mind. Space needs to become place and give the child an opportunity to grow.

Along with the issue of children's design, I wanted my thesis project to deal with the dilemma of the man made and the natural. I wanted to deal with the logistics of landscape design and be able to make site decisions based on fact not just intuition. With these issues in mind, I chose as my project a small community zoo and conservatory in Columbus, Indiana.
The Site
Total Acreage 38

Water 4

Parking 4

Land 30
In choosing a site, I had three basic criteria. First, it needed to be centrally located in relation to the schools and the general public. For it to be a successful learning tool, it could not be on the outskirts of town. It also needed open space adjacent to it for future expansion, and I wanted some kind of natural feature on which I could capitalize. With this in mind, I went to Columbus.

My choice was a site adjacent to and in Mill Race Park. It is an eight minute walk from the heart of the downtown, has plenty of room for expansion (a whole park), is bordered by the Flat Rock River, and has a large pond with a covered bridge. I could also capitalize upon the undeveloped land across the Flat Rock River.

The first step was to review the condition of the existing landscape. The eastern half of the site was rubble from an old demolished building. Technically considered a gravel pit, it had few trees, and its only strong point was its view across the pond to the wooded bank.
I took this area and recontoured the landscape, raising the
topography an additional ten feet creating a berm that not
only acted as a visual and physical barrier to the street,
but also created a slight hill for the children to roll down
or, in the winter, slide. The retaining wall on this east
side becomes a large billboard for the zoo while keeping the
children safe from the traffic and keeping vandals out.

The western half of the site I left basically untouched.
Some minor recontouring was done to create a natural
boundary for the zoo and make it a cohesive whole within the
park. Other than that, I removed the existing roadway. This
side of the site is densely forested along the banks, and,
due to the fact that it was a part of the park, it is in
very good shape.

I placed my parking across the river for several reasons. The
river acts as a natural barrier between parking and the zoo.
This eliminates the problem of hiding the parking from the
view of the zoo. It's a densely wooded area and becomes less of a barren asphalt strip, with clusters of trees every fourteen cars and strips of trees between the rows. Another advantage is that entry from across the river becomes an event in itself. The bridge allows you glimpses of the river and its banks, and to the zoo itself, through a trellis work covered with vines. Glimpses of nature through a man made structure serve to reinforce the concept of structure with nature as opposed to against it.

Three ancillary entrances are located around the site. A vehicular service entry on Lindsey Street is located in the southernmost corner of the site. A pedestrian access for those visitors coming from Mill Race Park would intersect the main entrance along the bank giving a different perspective of the river and its banks; and my main pedestrian entrance on Lindsey Street. The vine-covered trellis acts as a screen allowing views into the zoo while serving as a barrier to keep people out after hours.
Relating more to the workers from the downtown, this entry focuses on the conservatory drawing these workers in for lunch or after work.

Pathways through the site are provided to each of the "attractions", but I want to encourage the children to make their own paths. This encouragement to stray from the path and walk on the grass is enhanced by the edge condition of the pathway. Brick pavers would occur at the buildings, but elsewhere on the site finely crushed and graded stone would be used. It is durable, accessible to the handicapped, and not as harsh or imposing as asphalt.

Along with the planned activities, a wide variety of incidental activity can occur. Animals natural to the site would be free to roam, and by offering a variety of open and wooded areas, the incidental play activities of the children are encouraged. The site becomes a play environment for learning.
The Animals
DOMESTIC

Chickens
Cows
Donkeys
Goats
Horses
Sheep

BIRDS

Ducks
Geese
Pheasant
Quail

WILD REMOVED

Bison
Black Bears
Bobcats
Coyotes
Grey Fox
Grey Wolves
Mountain Lion
Red Fox

WILD INTERACTIVE

Beavers
Grey Wolves
Raccoons
White Tail Deer
What could my zoo offer that would make it unique?

Surprisingly enough, there are a number of zoos in and around Indiana. Within a one hundred mile radius of Columbus alone there is the Louisville Zoo, the Cincinnatti Zoo, and the Indianapolis Zoo. All of them world class zoos; all of them offering a wide variety of exotic animals. How could my zoo compete?

The solution was to have a zoo that features animals that are or were at one time indigenous to the state of Indiana. This concept opened up a lot of possibilities. Educationally, a child would learn something about the natural history of this area: why some animals left, why others stayed, and what occurred ecologically to cause them to emigrate? Also the child could come to understand the way in which nature adapts to the new environment in the fact that many of these animals are reappearing in the cities and suburbs, e.g. red fox, bobcat, mountain lion.
As far as habitat requirements are concerned, all of these animals can lead a relatively normal existence. No man-made structures of gunite and wire need to be built because the environment suits them naturally. A hollow log can become the den of the grey and red fox, and the beaver can dam in a natural condition.

In the general groupings of the animal habitats, I categorized them as such: wild removed, wild interactive, and domestic animals. The wild interactive and domestic animals are those that the children could enter the habitats and have physical contact with. I've placed the grey wolves into this category because I hope that, in the future, small control groups could be taken into the habitat. Although grey wolves are thought to be dangerous, there has never been an instance of a wolf attacking a human unprovoked.

This program would be dependent on being able to break down peoples misconceptions and apprehensions towards these “wild” animals.
I've also tried to provide each species with a natural water source. I feel very strongly about this need. A complaint of habitat design is not that the animals are cramped for space, but that they are bored. By providing this water feature, it gives the animals a variety of experiences, and in most cases, something that is essential to their well-being. The black bears can fish for food, the raccoons can wash, and the beavers swim and dam. This provides a habitat that is designed for the animal, but also enhances the experience of the child watching. They get to view the animal doing what comes naturally.

The habitat response for the child would include low rails and walls that a child could look through or over without having to be picked up by an adult, the removal of bars and spikes or other threatening devices, and access to the wall by the animal. By sloping the ground and using a retaining wall, safety can be maintained without the use of dry moats.
or oddly shaped wall configurations. It is straightforward, simple, and effective.

Animal viewing is done in a variety of ways: on all four sides, from the pathway above, on an elevated platform through the habitat, from across the pond, and within the habitat with the animal. The beaver exhibit uses the covered bridge as a vantage point. A platform would be built onto the bridge which would put you closer to the water level and the beaver activity.

The closer the child can get, safely, the better. That is why I tried to incorporate this face to face interaction whenever possible. With the domestic farm animals, a youth farm would be established. More than just a petting zoo, the children take on some of the burden of taking care of the animals. They would clean and feed the livestock, and most important, be responsible for these animals. A world of knowledge gained by taking care of something.

As the pond is reserved for animal use on the western half,
so it is reserved for human use on the eastern side. Children and adults both can feed the ducks and geese, paddle their feet in the water, fish, and, in the wintertime, ice skate. By providing these kinds of play activities, a child will come more often and will be forced in some way to engage the zoo, gaining something each and every time.

Animals can be nature's greatest teacher. Through observation and an understanding of how they coexist in their environment, people might be able to learn how to better live with their natural environment.
The Buildings
<table>
<thead>
<tr>
<th>PROGRAM</th>
<th>SQUARE FOOTAGES</th>
</tr>
</thead>
<tbody>
<tr>
<td>Administrative Offices</td>
<td>1250</td>
</tr>
<tr>
<td>Conservatory</td>
<td>10,000</td>
</tr>
<tr>
<td>Concession</td>
<td>3 at 361</td>
</tr>
<tr>
<td>Maintenance/Storage</td>
<td>1250</td>
</tr>
<tr>
<td>Veterinary Clinic</td>
<td>2500</td>
</tr>
<tr>
<td>Zoo Keeper’s Shed</td>
<td>6 at 432</td>
</tr>
<tr>
<td>Educational Center</td>
<td></td>
</tr>
<tr>
<td>Exhibit Space</td>
<td>2300</td>
</tr>
<tr>
<td>Insect Exhibit</td>
<td>1310</td>
</tr>
<tr>
<td>Reptile Exhibit</td>
<td>1650</td>
</tr>
<tr>
<td>Amphitheater</td>
<td>1075</td>
</tr>
<tr>
<td>Restrooms</td>
<td>280</td>
</tr>
<tr>
<td>Lounge</td>
<td>270</td>
</tr>
</tbody>
</table>
The building vocabulary I want to establish is one that is also indigenous to Indiana. Existing on my site is a covered wooden bridge. A simple gabled structure, it worked well with the site and enhanced the personal feeling I wished to create. This gable form also related well with children.

In a class "Design for Children", we conducted an experiment with children using cubes and variations of that cube. The children were asked to create a play environment with these pieces arranging them any way they chose. In every instance, the children built a gabled structure and related their play environment to their home. With this psychological indication and site support, this form was the most appropriate. For my zoo keeper's sheds, I used the typical gabled structure. Located along the pathways, the large windows, and informal form of the building would encourage children to ask questions of the zoo keeper. Plus the fact that I provide one zoo keeper for every two species gives the keeper more time to get involved with the children. The
other structures e.g. concessions, administration building, clinic, and maintenance, would also use variations of this basic theme.

The conservatory breaks with this vocabulary. It is removed from the other structures, and due to its exotic nature, it becomes a more exotic structure. Closest to the street, it is also the main visual marker from the outside. It is the wild, fanciful creature on the site.

The conservatory is a mixed use structure. Housed within are a conservatory, aviary, and aquarium. Each has its separate space, but none are secluded from the other. Plants are growing throughout, water that you can put your hands in flows in all three spaces, and the birds are free to fly. The aquarium will feature tanks that are backlit through glazed apertures, and tanks that you can stick your hands into. The conservatory provides a special area reserved for the children's own personal plant. This gives the child a reason to come often, just to monitor their plant. For adults
and children alike, an outdoor garden would be included for relaxing and lunchtime eating. The main advantage of this structure is the variety and quality of activity contained in one place.

For the educational center, I once again broke from the gabled structure. In looking at the rural landscape of Indiana, I was struck by the familiarity, but also the sculptural beauty of the silos, standing in clusters on an isolated piece of land with the series of cables connecting them.

The visual importance of my educational center is apparent. It is the first building you see from the main entry and should also pique the child's curiosity. By the time the child arrives at the building, he should be filled with anticipation. The visual dominance of the silos lent itself conceptually to this building, but also the fact that it is a familiar form to most if not all children.
The four silos have different functions. The main silo is the attention grabber. Totally transparent, it is a riot of color, light, and activity. Exhibits would rotate monthly, and at times could feature the children's own works. The two middle silos are exhibit spaces in which the child could sit and work on a computer or other educational games. With one wall of glass block, the room gets plenty of natural light without the distractions from outside. The final silo is a stair tower. Totally enclosed, it is lit from above and features a slide to the lower level. This slide reinforces the "play environment for learning" idea, as does the glass block floor pattern. Designed to allow some natural light into the lower level, it creates a yellow brick road for the children to follow.

The tension cables radiating from the main silo cover the amphitheater. These cables support the silo concept, but also define the amphitheater as a space unto itself. They create a colonnade for entry into the space, but are also
the structure off of which a cloth canopy would be hung in the summer and taken in during the winter to allow for maximum solar gain.

This educational center is in essence the center of the zoo. By nature of its location and function, it is a versatile and dynamic structure around which the rest of the zoo’s activities rotate.
Photographs
Site
Pedestrian Entrance
Educational Center
Educational Games
Cincinatti Zoo
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<th>CINCINNATI ZOOLOGICAL GARDENS</th>
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<td><strong>NEGATIVE</strong></td>
</tr>
<tr>
<td>Animal Interaction in Children’s Zoo</td>
<td>Circulation Confusing; Orientation Difficult</td>
</tr>
<tr>
<td>Educational Games in Children’s Zoo</td>
<td>High Density; No breathing room</td>
</tr>
<tr>
<td>Exhibits - Interior &amp; Exterior</td>
<td>Signage Obliterated by Foliage</td>
</tr>
<tr>
<td>Fence allow for easy viewing</td>
<td>Duck Pond cut off by fences</td>
</tr>
<tr>
<td>Baby Animal Exhibits</td>
<td>Strollers not allowed in Buildings</td>
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<table>
<thead>
<tr>
<th>LOUISVILLE ZOOLOGICAL GARDENS</th>
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<tr>
<td><strong>POSITIVE</strong></td>
<td><strong>NEGATIVE</strong></td>
</tr>
<tr>
<td>Signage - Visible &amp; Informative</td>
<td>Walls of Fences Obstruct view by Children</td>
</tr>
<tr>
<td>Low Density - Open Natural Space</td>
<td>Too many stairs</td>
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<tr>
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<tr>
<td>Educational Games</td>
<td>Glass on Windows</td>
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<tr>
<td>Duck Pond accessible by the Children</td>
<td>Ignores some natural needs of animals</td>
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<td></td>
<td>Little interaction with Animals</td>
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Observations of Zoos
<table>
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<tr>
<th>USERS</th>
<th>BUDS &amp; SQ. FT.'S</th>
<th>CHARACTERISTICS &amp; PROXIMITIES</th>
</tr>
</thead>
<tbody>
<tr>
<td>Children/Adults</td>
<td>Restrooms; Eating Areas; Concessions; Shelter; Open Rest Areas</td>
<td>Bright, clean, attractive, festive; should not inhibit child's natural tendency to be loud &amp; boisterous; flexibility for different seasons - maximum shade in summer, maximum exposure in winter; close proximity to each other; maximum play potential.</td>
</tr>
<tr>
<td></td>
<td>Educational Center/Amphitheater; Conservatory</td>
<td>Structures used as a learning tool; variety of experiences; Conservatory - smaller scale for child's planting area but larger for Aviary. These 2 buildings are anchors; service facilities rear.</td>
</tr>
<tr>
<td>Keepers &amp; Employees</td>
<td>Food Storage; equipment storage; lounge/cleanup facilities; garage; chimie office/Conference Area</td>
<td>Airy, roomy, bright, comfortable; a place they can work &amp; rest in comfortability; versatility; Informal; non-hierarchical</td>
</tr>
<tr>
<td>Administrators</td>
<td>Offices; Conference area</td>
<td>Quiet, conducive to work but should be approachable to encourage visitors questions</td>
</tr>
</tbody>
</table>

First Quarter Observations
WILDLIFE

The beaver, a robust, high-rumped, short-eared character, has an average size of 34 to 43 inches and weights between 30 to 60 pounds at maturity. His fully webbed hind feet and his large tail help him swim extremely fast and he is able to stay underwater for periods lasting from 10 to 15 minutes.

At the age of two, the beaver will start mating. Continuing this annually for life, it breeds between January and February. After a short gestation period an average litter of four will appear between March and May. The young will weigh as much as one pound at birth, their eyes are open, and they are able to walk. From this point the young start learning the tasks and chores that keep the beaver lively all night and most of the day. As the young start maturing toward one year of age they are nearly ready to live on their own. Even when the body is full grown, the teeth do not stop growing. As a matter of fact, they will grow the rest of his life, necessitating constant gnawing on bark, twigs, various grasses, and the wood of certain deciduous trees, including poplars, cottonwoods, and willows—all of which happen to be the beaver's main diet.

Active at all hours, the beaver never ventures far from the wood-predominant water-laden home for fear of attack by one of his predators: bear, wolf, fishers, lynx, and wolverine. When he senses danger coming, he slaps his large tail on the water to warn others and swims to safety.

The young, after reaching maturity, migrate downstream. Finding a suitable poplar grove, the beaver will start constructing a dam made out of logs, branches, mud, and stones. This will provide a pool behind the dam. Once the dam is finished, he will start construction of his home. Gathering sticks and brush, he forms them into a rough circular pattern extending a few inches above water. Stones, boughs, and slender poles chinked with mud form walls and roof. The now cone-shaped structure extends from the water 3 to 4 feet, but can only be entered from the passages underneath.

In the coming fall the moose will find this newly created pond and inhabit the area for the ensuing winter. As the fall progresses the trees will start shedding their leaves and eventually the litter and sediment will collect on the edges of the pond forming a rich silt as it decays. The following spring this muck will yield pond weeds and lillies, forming an ideal trout pond. After exhausting the poplar population in this area, the beaver will once again move downstream to start over, thus leaving behind a richly endowed area of new plants and habitat.

The beaver is a very interesting animal, as well as educational. For him to thrive in a confined area he will need a waterway with a minimal flood plain, consisting of deciduous trees, namely poplar. This will take care of his diet naturally. The beaver is nonaggressive yet could adapt to confinement within a minimal area. Some appealing aspects of the beaver are his dam-building abilities, large tail, and fur, which is a valuable trade item. Other aspects are his chopping ability, swimming ability, and an occasional mudway for his infamous belly slide.

WILDLIFE

Black Bear (Ursus americanus)

The black bear is the most widely distributed bear in North America. They are found in much of eastern and western parts of the continent, except where he has been driven out by hunting or destruction of a suitable habitat.

There are certain major characteristics which set it apart from other bears. It is smaller in size with a "straight Roman profile." This profile is taken from the fact that his nose resembles one of a Roman. Other characteristics are no shoulder humps and short rounded claws. Black bears are not always that color in nature. They can be various shades of brown, blue, and white. The face is always brownish with a blaze of white on the chest. These bears grow to about 5 feet tall and weigh from 200-500 pounds. Also, their life span lasts from 12-15 years. Even though they have enormous weight, they are still very strong animals. They are capable of running in bursts of up to 25 mph and are expert tree climbers as well as strong swimmers. These animals also have an acute sense of smell while their eyesight is only fair.
Bears are by nature solitary animals. However, one time of year in which they interact is in the mating season. They usually mate in June or early July and the pregnancy lasts for 7 1/2 months. At 2 months after birth, cubs weigh 5 pounds and are taken from the den to start their long strict training with their mothers. The females nurse the cubs throughout the summer and continually watch over and direct them to keep them out of trouble. At the end of the summer, the cubs may turn them away to be on their own or she may keep them until the following spring depending upon if they have matured.

Food sources for bears come in a variety of forms. They enjoy a variety of grasses, berries, fruits, seeds, nuts, bark and roots. Bears also like animal and insect prey. Nuts, bees’ honey, fish, deer, frogs, rodents, eggs, and even dead bears are part of their carnivorous diet. Black bears are not great hunters however. They tend to go more for garbage dumps, camp sites, and cabins for their appetite needs. Then more than one bear congregates around a common food supply, there is constant quarreling and snapping which can lead to bitter fighting. Bears are particularly dangerous when attracted to “carcass” or dead animal carcass.

Contrary to popular belief, black bears do not truly hibernate. In northern parts of their range, they do den up in the worst of winter conditions. They build beds of grass, twigs, bark, and leaves in hollow trees, caves, or shallow depressions in wooded areas.

Bears usually den alone although cubs may be allowed to stay with their mothers. During warmer conditions, bears come out and wander in their geographic area, usually for food of some kind. During the summer, bears have no permanent home. They usually sleep in trees, on the ground, or wherever they get tired.

Behavior in mating season can become violent. Females will attack any bear that comes close to her cubs. This is because even the males that father the young will attack and kill them. They behave this way because they do not recognize who their cubs are. Not until the cubs have left her side will a female show any interest in a prospective mate. Females can also be hostile to her own cubs. Once the young are turned away, females will lash out at them if they return.

So one is quite sure why they do this other than their sense for solitude is stronger than any other feelings.

Intruding on a bear’s territory can be a serious offense. Bears mark their territories by clawing or biting trees. Other bears recognize this sign and usually stay away, but the exact purpose is not known.

When forced into battle, a bear will travel on all fours and bite like a dog. They also strike out with their heavily clawed front paws which are so powerful that it can take off a man’s head.

Black bears are considered creatures of habit. They tend to stay within their marked territories on well established trails. Their home range varies in size from a 10 mile radius of the female to a 15 mile
radius for males. They prefer heavily wooded areas where they establish their range. If it is located near civilization, bears tend to be nocturnal, but if it is in an undisturbed area, they can be out day or night.

Since black bears are an endangered species, their effect on the environment is relatively minimal. Their most important function is within the food chain. They help control certain populations like fish, insects, deer, and rodents. Also, since they love trash containers, they tend to make a mess wherever they look for food.

Designing a space for the black bear is not an easy task. Since their home range can extend 10-15 miles, putting a limit on space is quite a constraint. The best adaptations that can be made would be having a wooded area as large as can be allowed for one bear. This would provide the food it likes along with the solitude it needs. A stream or lake is also desired for recreation and as a food source.

Being able to watch bears roam and eat are their most lovable traits. At times, they remind us of a child getting into peanut butter. Watching them climb trees, care for their young, and hibernate are things which people may never have observed before. However, the unpredictable behavior bears have can be dangerous. Watching them in their natural habitat requires strong protection in case a disturbed bear attacks.

Since black bears are the most common of all bears in North America, people should know more about how and where they live. By educating people, it will create a greater understanding of the bears potential extinction. This will also help to provide better protection and habitats in which bear populations can grow.

WILDLIFE

Whitetailed Deer (Odocoileus virginianus)

The whitetail deer are one of North America's most common species. Their range covers an area from Canada to extreme South Central America. Although they do have other cousin species in North America, like the mule deer and the dwarfed Key deer, we shall concentrate on the temperate species.

The whitetail has a more graceful appearance with its long slender neck, narrow face, and beautiful eyes. The deer stand 3-3 1/2 feet tall (shoulder height) and are 55-75 inches long. Although deer over 250 pounds are unusual, they can weigh anywhere from 50-350 pounds. The antlers of the whitetail are low and compact. They shed between December and February and regrow in April or May.

Whitetail are also "unguligrade", or they walk on their toes. Even though they have small dainty feet, they can hit speeds of 35 mph and can maintain 25 mph for several miles without stopping. These deer have also been known to take jumps of 29 feet and can reach a height of 8 feet as they gracefully take a series of 20 foot bounds effortlessly. They are also excellent swimmers with high speed and endurance in water.
Whitetail mating season is a key period for watching their unusual behavioral characteristics. The season lasts from September to February and reaches its height in November. After the fawns are born, the mothers are their only food source; otherwise they are hidden by lying still in a clump of bushes or high grass for hours. Predators can come within a few feet and notice nothing by scent or sound. By 4 months, fawns must get their own food. If they survive all of nature's challenges, their lifespan should last from 10-15 years.

The colors of these animals are always reddish brown on top and white underneath. They also have some seasonal change in color. In summer they tend to be more reddish brown and in winter turn some shades of blue gray. One other distinguishing mark are their whitish patched rumps which they use as a flag to warn other deer of danger.

Whitetailed deer's nutritional needs are basically vegetational. They eat fresh leaves, branches, blackberries, water lilies, mushrooms, mistletoe, algae, and ferns. They tend to feed at dawn and dusk when the darkness gives them protection. During the day, they hide out in the sunny woodland glades and sheltered meadows for the security it provides.

Although not asocial, since they are seen close together, deer are not really herd animals. Males and females are together during the mating season and does are with their young after birth, but other than that they are basically solitary animals. Their home range extends to 1 mile in radius around the general area in which they were born. They migrate little over the course of their lifetime.

Considering that nature tries to keep itself in balance, it has provided the deer as a key prey animal for large predators. For this reason, the deer must be swift and alert. Their senses of hearing, sight, and smell are quite acute. Large animals like bobcats, wolves, dogs, and bears are constantly stalking them so they develop certain signals to warn others. For instance, their tails are used as flags of impending danger. When a deer snaps it upright, the other deer notice the color change in the landscape and react to it.

The whitetailed deer are not always so timid and afraid. During the mating season they can become quite violent. This time of year is called their "rut". It is a psychologically straining time for the bucks when competition for does or territorial intrusion results in aggression. These clashes result in vicious use of antlers or the kick of powerful hooves which are sharp and dangerous.

Though nature tries to keep the deer in check, man is doing his best to prevent it. Since the sport of deer hunting was created, man has gone after the biggest and strongest. Therefore, many bucks are killed off year after year and it is endangering the species. Because of killing the strong bucks, the weaker ones
are allowed to mate and produce a weaker strain. To compound this situation old and sickly animals, which were destined to be eaten in any natural situation, are not killed because predator populations are low. The result is too many weak deer overgrazing too small an area and eventually causing starvation. As one naturalist said, "The best thing that could happen to the deer would be a resurgence of the wolf and a moratorium on man's hunting for a decade or two." Hopefully, measures will be taken to correct this worsening situation before it becomes devastating.

Nevertheless, deer in a confined environment are quite easy to care for. They require a large open area with trees and brush for cover. Grasses and leaves would be their diet. Some basic needs are brush for protection, trees for cover, and plenty of natural vegetation. Deer should not be crowded but have a density of 2 per acre, especially during mating season. Also, a sort of water feature would provide bathing and exercise.

Probably the best enjoyed characteristic of deer is their gentle personality. Another appealing thing is their graceful movement when running. An educational feature may include the birth and care of a fawn by its mother. One of the more interesting behaviors to observe are the fights between bucks. This occurs in their mating season, so the correct time of year is necessary.

Even though the whitetailed deer may have the largest species population, its importance cannot be overlooked. Teaching people that deer are not just loveable creatures but an intricate part of many predator's food chains is educational for many people. Information on current hunting practices may also prove informative to people who are not aware of the weakening strain of deer. Hopefully, through designing a suitable environment, knowledge can be gained and applied to the natural environment for the protection and survival of existing deer.

WILDLIFE

The red fox is a dog-like animal with an elongated pointed muzzle and erect forward pointing ears. Their overall appearance is that of daintiness. The fox weighs between 8-10 pounds with a body length of 30 inches. The bushy white tipped tail measures another 14 inches. The female is slightly smaller than the male. As its name implies, the red fox's coat is a reddish orange on most of its body, and a white chest and tip on his tail. The fox's face has the appearance of intelligence and alertness.

In January the male begins to search for his mate. He stays with his mate for most of the year. They breed in February, and the female fox has her pups after a gestation period of 36 days. She gives birth to her pups in a den that she has prepared. Litters average 6-8 pups. The pups are fully furred when born, but blind for the first nine days. The pups grow quickly and in about 3 weeks, they crawl out of the den to play.

The red fox is a quick little animal with a top speed of 30 m.p.h. He also has good endurance. Although the red fox has these capabilities though, he prefers to use his cunningness. For centuries songs, stories, and folklore have told of the fox's intelligence and cunningness. The red fox is famous for the tricks he uses to fool a pack of hounds on his trail. He often will double back on his trail, cross a stream, run atop a fence or wall, and many other tricks to confuse his pursuers.
The red fox has an excellent sense of hearing. The fox uses this sense as a warning device for danger, in his pursuit of food, and as a means for communicating to other foxes many miles away. Smell is also a vital sense to the fox. This sense also serves as a warning device for the fox as well as a tracking system. The fox's eyesight is good. The pupils of the eyes become elliptical when they contract, instead of round as with other wild dogs. The red fox uses all his senses combined to constantly analyze and interpret his environment.

The red fox eats a variety of things. Pheasants, quail, grouse, ducks, rabbits, poultry, frogs, snakes, mice, rats, fruits, berries, grain, and grasses are the staples of the fox's diet. His diet changes seasonally according to the available food source. Because of his appetite for chickens, the fox has been hunted and destroyed by farmers.

The red fox belongs to an established society. The most aggressive and adept fox becomes the dominate fox for the area. The other foxes are ranked below him. The dominant fox is established through fighting and physical challenge. This social situation fluctuates by the season and changes often. The fox establishes his own territory by marking it with his scent. The size of the fox's territory varies. The fox will defend his territory from the threat of another animal.

The male fox and the vixen keep close contact together for most of the year. This along with contact with the pups make up their interaction with other animals on a close, intimate level. While the pups are with them, both parents will bring food for them. They play together extensively. The vixen teaches the young pups how to fend for themselves by taking them with her on short hunts trips outside of the den. After the pups are about 6-7 months old, the family splits up and they are on their own.

The adult red fox prefers to sleep outside in the snow in cold winter instead of denning up. By sleeping out in the open, the fox eliminates the chance of being attacked without warning. The fox uses his long bushy tail to cover his nose and feet while sleeping for warmth. During the mating period, the vixen will establish her den. The fox seldom digs its own den, but instead the fox will enlarge a woodchuck burrow or some similar hole. The den is typically located along the edge of a field, on the top of a knoll, or out in the middle of a large, bare area. The fox likes to have a good view of the countryside. A red fox's den has a mildly skunk-like odor. The red fox has adapted to several environments. He is comfortable in open woodlands, treeless areas, the brushy borders of swamps, and suburban communities. The fox is completely aware of his environment. He knows when any element is misplaced or when a new one has been introduced.

The red fox has adapted to several environments. He is comfortable in open woodlands, treeless areas, the brushy borders of swamps, and suburban communities. The fox is adapted to living in areas where man has been introduced. They seem to live together in a mutual state. As man clears land for agriculture and housing, the rodent population increases and so provides more food for the fox. The fox is completely aware of his environment. He knows when any element is misplaced or when a new one has been introduced. He is a careful animal and is sure of his surroundings before he ventures forth.

The fox needs an environment which allows him his territory and natural environment. The fox is an active animal and must have room to run and exercise as naturally as possible. The fox is a private animal who doesn't care for the presence of others. His environment needs to be as private as possible. The fox lives in a variety of habitats, he moves through several different ones in his daily routines.

Since a large amount of the fox's diet is made up of small rodents, these can be provided for the fox in his environment as live. This not only links him with his natural environment, but provides for his exercise and play. Larger animals will have to be provided already killed. Direct interaction with the fox would only confuse him and interrupt his natural environment. Human contact will need to be only visual. The most appealing part of the fox's life is the litter of pups. This would be an enjoyable activity for people to watch. This could be made a focal point if handled with care. All aspects of the fox's life would be educational and enjoyable.
WILDLIFE

The raccoon is a rugged little animal with a compact body. He has a shaggy coat with long, coarse guard hairs and a luxurious soft underfur. The color of his coat ranges from grayish to brownish buff tones. The two things which distinguish the raccoon are his black face mask and his bushy black ringed tail. The raccoon weighs about 12-16 pounds. He is 9-12 inches at the shoulder. His overall length is 30-33 inches, 8-12 inches of this length is his bushy tail. The raccoon is very curious and this reflects on his appearance. His "hands" are almost human like and are constantly handling something.

The female raccoon breeds at the age of 10-12 months old. The male is a little older when he mates. Breeding occurs in February and March. The gestation period is 63 days. Litter size ranges from 2-7 babies. At birth the babies weigh about 2½ ounces. The female has her babies in an already established den. The mother takes complete care of the young. If the male comes near, he is driven away.

The raccoon generally moves at a slow, shuffling walk. Top speed for a raccoon is 15 m.p.h. This speed cannot be maintained for any length of time. Raccoons are courageous fighters though with powerful muscles. Their compact size, short neck and dense fur also gives them protection when fighting. Also the raccoon is an excellent tree climber and he uses this as a way to escape trouble.

The raccoon's sense of touch is the most highly developed of the five senses. The raccoon touches, feels, and handles everything he comes in contact with. This sense is heightened when the raccoon's fingers are wet. This is one reason why the raccoon "fingers" its food in the water. The raccoon is able to locate food by touch alone. Although the raccoon has small ears, the varicos and its hearing is good. This is used to alert the raccoon of danger coming. The eyesight of the raccoon is good also. He has good vision at night. The raccoon doesn't hunt or stalk its prey, so its sense of smell doesn't need to be highly developed.

The raccoon eats a number of different things. Young birds, small mammals, carrion, poultry, fish, frogs, shellfish (especially crayfish), all types of fruit, nuts, berries, vegetables, and grains. Most of the raccoon's food is caught near water and the raccoon will wash the food whenever possible.

The raccoon in the northern areas sleep part of the winter in its den. The raccoon likes hollow trees best, often they are found in caves, mines, woodchuck burrows, drain tiles, rock ledges, and even in barns and under buildings. Even though the raccoon does den up in the winter, its metabolism doesn't decrease as it does in the animal who truly hibernates. They are easily awakened from sleep.

The raccoon's greatest asset is its adaptability. It will eat almost anything that is available. Even with the advance of man, the raccoon continues to adapt and thrive. The raccoon likes partially cleared land with stands of maple, beech, and oak. He is always found near streams and lakes and is common in most swampy or woody areas. Raccoons have small territorial ranges. These are usually only about a mile in diameter.

The raccoon is a curious little animal. He is into everything. He especially likes shiny objects. The raccoon's intelligence and natural curiosity along with it's dexterity rates the raccoon high on the mammal I.Q. scale. They are engaging creatures who are fun to watch. Although mainly nocturnal, the raccoon will be out during the day if his sleep has been disturbed. Many people make pets of the raccoon. They are friendly, but frequently become aggressive and hostile when they are older.

The raccoon is an animal that has a close family tie when they are together. The mother spends much time with her young. They play together in the den and outside in the trees and on the ground when they are old enough. Mother raccoons have been known to adopt orphaned baby raccoons as their own. Although most of the raccoon families split up in the winter, many stay together and den up for the winter.

The raccoon's environmental needs are fairly adaptable. Water is important. The raccoon needs a specific territory. A hollowed out tree would be perfect for the raccoon's den. They are adept climbers, so care must be taken that the animal can't climb out of his environment. The raccoon is not overly concerned with man, so he wouldn't be a threat to the raccoon. Direct contact between man and animal could even be established. The raccoon's food needs could consist mainly of natural inhabitants of water (fish, frogs, crayfish etc.) Other necessary food such as small animals could be introduced to him as already dead after hours.
Bibliography


