

DESIGNING ZOO HABITATS TOUR

Objectives:

Participants will be able to:

- List five needs of animals in captivity
- List at least five basic considerations of exhibit design based on the needs of the animals, the caretakers, and the visitors
- Describe at least three different examples of successful design elements for visitors, animals, and keepers
- Describe at least three different examples of unsuccessful design elements for visitors, animals, and keepers

Key Terms

Adaptation- Physical characteristics or behaviors that allow an animal to adjust to and survive in their environment.

Aquatic- Relating to or inhabiting freshwater environments.

Architect- a person who designs buildings or zoo habitats and advises in their construction.

Barrier- something intended to block passage such as a wall, fence, mesh, wire cables, moats, plantings, etc.

Engineer- a person who applies science and math to solve problems, in this case, creating suitable, safe zoo habitats.

Enrichment- something novel that is added to an animal in human care's environment that encourages increased physical and cognitive activity levels while promoting natural behaviors.

Furniture- Term that refers to the branches, platforms, ropes, or other components of a zoo habitat. Can be moved by animal care staff as needed.

Habitat- The area/region where a plant or animal naturally occurs. Must contain the needs of living things (food, water, shelter, space) in appropriate proximity.

Life-support Systems- in terms of aquatic zoo habitats, life support systems include water filtration, pumps, heaters/chillers and other components necessary to maintain an ideal environment for the animals.

Horticulturalist- a person whose work involves growing and maintaining plants, especially ornamental plants

Natural Behaviors- Actions or reactions to internal or external stimuli that would be observed in nature. The natural way an animal would behave in the wild.

Structure- the elements that make up the framework of a zoo habitat. For example, support poles, walls, etc.

Toxic- in terms of plants and landscaping, anything that is poisonous to a particular species if ingested is considered toxic.

Zoo Habitat- An artificial habitat that provides an animal in human care with all the needs of living things (food, water, shelter, space). Sometimes also referred to as an exhibit.

Introduction: Welcome your group and go over expected behaviors while at the zoo. Begin your program by asking your audience why they would consider keeping animals in captivity. In other words, why zoos? The answer: Potter Park Zoo exists for conservation, education, recreation, and scientific studies. Zoos work together to save endangered species through work in zoos and around the world. Resident animals serve as ambassadors for their wild relatives to help zoo visitors build connections that will foster stewardship for the world's wildlife.

IF we are keeping animals in zoos, what kinds of questions need to be answered before designing a zoo habitat for them? Among them are -

Which animal or animals do you want to exhibit? Why?

- “Cool” factor?
- Opportunity to help the species?
- Good fit for our climate?
- Other?

What are the basic needs of the animals in zoos?

What are the needs of all living things?

Food, Water, Shelter, Space

- Food for animals in zoos
 - What kinds of food do they eat?
 - Are they provided with a variety of appropriate food?
 - Is the food nutritionally as good or better than what they would get in the wild?
- Water
 - How is fresh water for drinking supplied?
 - Do they need water for swimming, wading, playing?
- Shelter
 - What provisions are made for their comfort?
 - Is there access to heating and cooling depending on the time of year?
 - Is there shade?
- Space to exercise and move about
 - How much space do they need?
 - Can they have privacy from visitors if they want it?
 - How will they exercise?
 - ✓ How high can they jump?
 - ✓ How fast do they run?
 - ✓ Do they tunnel underground?
 - ✓ Do they climb?
 - ✓ Do they leap?
 - ✓ Do they swim?
- Behavioral enrichment that challenges them, occupies their day, and provides opportunities to be active mentally and physically and exhibit natural behaviors
- Access to companions, if they are group dwelling in nature
- Access to privacy for breeding and birth. May need a place to be separated from mother and babies. Is space available for more animals?

What are the needs of the zookeepers?

- How do the keepers access the habitats?
- Can they easily get in and out?
- Can they safely go in with the animals?
- Do they need extra pens and doors to shift the animals in order to clean and maintain the exhibit?

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What are the needs of the medical staff?

- How do the veterinarian and other health care professionals access the animals?
- Is there protected contact? (For example, a squeeze cage)

What are the needs of zoo visitors?

- Can they see the animals easily?
- Is there a place to sit to watch animal activity?
- Is there a cover for shade or rain?
- Visitors need restroom facilities and a place for refreshments.
- Many zoos are providing spaces near exhibits for fund raising functions.

What are the engineering requirements to make all of this happen?

- HVAC systems?
- Coolers/chillers?
- Hydraulic doors?
- Water/air filtration?
- Structural supports?
- Special lighting?
- How do we design and build it so it meets the animals' needs?

Habitats to highlight and their features:

NOTE: You will not have time to visit every habitat. Make sure to select a variety to illustrate different features.

Otters and Arctic Foxes: These exhibits were opened in 2006. A lot of research went into the design. Staff visited several zoos to see what other people were doing, and what they would have done differently. The new habitats are vast improvements over the previous enclosures for the animals, which were in the small moats. One of our otters at the time was more interested in the grass of the new exhibit rather than the pool because he had never experienced it before.

In both of the habitats the perimeter fence goes down and over a few feet so if they dig in the habitat, the animals will encounter mesh and will not be able to dig out. There is also hot wire to remind the animals not to get too close to the fence. Otters in particular can be little escape artists. Their heads are flattened, so the shape as well as the size of the mesh had to be considered. One of our previous otters found a way to get out within minutes of being put into the habitat for the first time.

Otters: The water is not heated or cooled in the otter habitat. In the winter, bubblers next to the glass in the pool help prevent the pool from freezing over. In the building there is a complex filtration system to keep the water clean. Even then, the pool is emptied periodically for cleaning and repairs. We do not use chemicals to treat the water. The sand patch was added for the otters to roll in to clean their fur. The habitat also lends itself to small private events and has been rented out in the past, an example of an exhibit serving multiple functions.

Arctic foxes: They have a shade tarp over part of their habitat in the hot weather, and

access to indoors in extreme weather. Their fence also goes below ground to prevent digging out.

Bald Eagle: Build in 2008. Special fencing material was ordered that would give good viewing and be safe for the eagles. Move back. Can you even see the mesh? There is a top on the enclosure when because even non-flighted birds might be able to “ladder” themselves up and out. Also, we want to keep raccoons out. Notice the shelter and heat source. This is necessary since the birds are outside year round. In the warm months the small pond is filled with water and sometimes there are live fish in the pond for enrichment. Notice the large support poles that hold up the mesh. Why are they so big? Is the mesh that heavy? No, the mesh itself isn’t that heavy, but since we do get snow and the snow can pile up on the mesh, the engineers who built it had to calculate how big the post would need to be to support a heavy snow load.

Wolf Woods: The perimeter fence is a double fence. The interior fence also is buried about three feet below the surface to prevent the wolves from tunneling out. Holding pens allow the keepers to shift animals off exhibit, so they can clean. The cabin provides an educational opportunity by showcasing two prey animals and a wolf. Glass viewing takes away the bars but adds wolf footprints. There has been quite a bit of discussion over the last few years about the size of the space. Wolves live in packs, do we really have enough space for a proper size pack of 5-7 individuals?

Raven Flight Cage: This is one of our newest habitats. It was made big enough that our male raven could have a female companion. The ravens are fully flighted. Our male can be aggressive so a holding area for shifting was added. The habitat was held up for almost a year because the type of screening was not squirrel proof. The designers had consulted the other zoos that had assured them that their squirrels did not damage the screening. Exhibits like this one – that do not need special climate controls or even running water – can be built relatively quickly and inexpensively by zoo staff – are a good economic choice. Notice that there are plenty of branches for the animals to explore (enrichment), and some shrubs where they can get a little privacy from the public if they choose. They have choice and control over how they use their space.

Farmyard: Completely redone from the ground up in 1992. Initially, the gauge of the fence used around the contact area was too small and the goats had it all bent and bulging at the end of the first year just by standing on it. Because of the summer heat, the umbrella was added. The wooden climbing structure – with stair steps and a platform - in the goat exhibit is behavioral enrichment. For visitors, we have a shade pergola and benches. Windows to the vet clinic allow visitors to observe medical procedures.

Red Panda Habitat: Originally designed and built by women architects as a spider monkey exhibit, it was newly redesigned in 2015 for the red pandas. The red panda used to be housed across from the snow leopard. In the past we have tried unsuccessfully to breed red pandas. It is thought that they might not have bred due to the proximity of the snow leopard, which looks a lot like the clouded leopard, a predator of the red panda. The new habitat is more spacious, with more climbing opportunities, and two indoor stalls to cool off in the summer, one a protected maternity den with multiple nest boxes for babies. We have been rewarded for our efforts with the birth of multiple cubs, the first two were born in 2016. Careful consideration was made for the roof structure (notice the big support poles), platforms for the red pandas, landscaping plants inside and outside of the exhibit, and drainage.

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Feline & Primate Building and Exterior: Renovated in 1988-89, the old concrete and barred cages were replaced with more naturalistic outdoor habitats and larger, indoor exhibits. One reason that concrete was used so much in older zoo exhibits is that it is easily disinfected. Providing animals naturalistic habitats is much better for the animals' welfare but the more naturalistic the habitat, the harder it is to keep it clean.

Look at the primate enclosures. What equipment has been provided for their behavioral enrichment? (ropes, branches, platforms, puzzle feeders, boxes, etc)

As you pass the cat side, ask your audience to compare and contrast the top of the fences. The lions and the tigers have in-rigger fencing (a "kick" at the top to keep them from climbing out); and the snow leopard cage is completely covered. Which cat do you think is the best climber/jumper (snow leopard)? Tigers are excellent swimmers and enjoy the water, so there is a water feature in the tiger habitat for the warmer months. The big rock in the outdoor habitat of the lions can be heated when it is cold outside – not to be hot but warm enough to melt the snow and ice. What other considerations for the animals' comfort do you notice?

Inside the building there are a series of hydraulic doors between different holding areas. These types of doors use hydraulic pressure to help keep them closed so animals are not able to force the doors open when they shouldn't. This is an important safety feature for the animal care staff that work around these dangerous animals.

Even when animals have successfully lived at the zoo for many years, new animals can surprise the staff with new behaviors. Many times volunteers are asked to do "behavior watches" when new animals are introduced to the habitat or the habitat is changed for our existing animals. The great almost-escapes of young lions:

- Young male lion started to climb the trees at the side of habitat. He might have been able to climb up and over. The area now has electric fencing around the trees.
- The female lion was on the big rock when a peacock flew up on the edge of the glass front of the habitat. Despite the moat in front of her, she jumped over to a small ledge and managed to hang on and try to pull herself to reach the bird. The ledge now has a sloping surface. The height of the front wall had been increased and the top has an angle. No more leaping lions allowed.

Rhino Habitat: Originally built for elephants, this habitat has undergone some major renovations, most recently in 2011. The indoor space was greatly increased, allowing zookeepers to better manage the area and to shift the animals inside in winter. A squeeze cage with a built-in scale also allows keepers and medical staff to get a better look at the animals and conduct target training to give shots, draw blood, etc. There are also hydraulic doors that serve a similar purpose to the ones in the feline/primate building.

The outdoor area has also been expanded and includes an off-exhibit outdoor area that is flat and safer for the rhinos when it is slippery outside. The umbrellas and log posts in the yard are buried six feet down to prevent the rhinos from knocking them down if they charge them. Rhinos in the wild wallow in shallow pools of water. Our rhinos like to create their own wallows from puddles when it rains. The large "rocks" in the middle of the yards are actually man made and serve as feeding platforms.

Small Moats: Built during the WPA (Works Project Administration) of the Depression, these
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exhibits were “state-of-the-art” nearly 80 years ago. These were the first exhibits without bars. The concrete keeps diggers from escaping and can be disinfected; the deep moats can be filled with water to make a barrier or can be left dry and the height used to keep non-climbers and non-leapers in. The problem is size. These can only be used for smaller animals, hence the name of this area. Point out the different barriers used to keep animals in - electric wire, steep and smooth walls, and rocks that hang into the habitat from above creating the optical illusion of having a “roof” over your head when you approach the wall to jump out.

Note the small doors for the animals entering the outdoor exhibits. Zookeepers need a ladder to get down into the exhibits, and the animals must be non-aggressive. There is inside space for animals to be out of the weather, but the ceiling is very low and keepers have to crouch in order to work in that space.

These habitats are quickly becoming obsolete, and will no longer be used by the end of 2023.

Bird & Reptile House: Built during the same era as the small moats, this building was designed for “jewel case” exhibits (small glass front exhibits that showcase a bird but do not have much space). Today, we mostly have reptiles, small mammals, and few insect species. There are many challenges with managing animals in these spaces: heat source is five feet overhead, controlling heat is a problem (this is why the building is kept so warm, even in the summer), air circulation is poor, humidity is hard to control, and all lighting is artificial. The species picked for this building are fairly hardy (they can survive variations in their environment). Some species do have humidifiers to increase the humidity in their space (emerald tree boa, blue tree monitor, geckos). End cages feature multi-species habitats and give plenty of spaces for exercise and breeding to those living there. See if you can find potential places for animals to be out of view of the public if they choose to. In the last few years, nocturnal habitats have been added with special lighting for animals such as the bats and emperor scorpion. Many of the habitats were made larger by knocking down walls between adjacent exhibits to allow animals to have more space.

Penguin Habitat: The pool is six-feet deep, and the water is chilled to 55 degrees in the summer. Note the fan in the rock used to simulate ocean breezes. Misters overhead in the rocks are used to cool the habitat. The nest boxes extend into a room behind the habitat where there is heating and air conditioning. The bubbler keeps the water moving to prevent algae build up on the surface, keep mosquitoes from laying eggs and to prevent ice from forming. Mistake made by architects at the time of construction - They did not listen to the keepers when they were told that these penguins jump six feet out of the water. Rocks close to the edge of the pool had to be extended farther out over the water because the penguins, on opening day, jumped out of the habitat and proceeded to waddle down to the employee parking lot. Problems: Water exhibits are high maintenance areas; pool has to be stripped of algae every two weeks in the summer and every three-to-four weeks in the winter; pool must be resealed every few years to combat leakage; the chiller and filtering system need constant care; and the door leading into the habitat was built for a penguin not a person, so keepers must crouch and crawl through a three-foot door to access the space. Ask audience what they would do differently?

Elk Habitat: It was completed in 2016 originally in a move away from the old hoofstock model of barn-and fence construction to a naturalistic look – mimicking a natural habitat with

unobstructed viewing. It was originally designed for moose, but is now used for elk, another cervid species also found in Michigan. It includes lots of room to roam; a large, deep pond for swimming and cooling off; a waterfall system; and vegetation similar to what would be found in their natural environment. Water aeration keeps open water near the boardwalk during cold weather. Engineering challenges included dredging the pond to make it deeper (and relocating the displaced fish when the pond was drained), working with the city and government offices about our plans since the Red Cedar River is essentially connected to the pond when the water is high, and getting permission to build the barn in an area that would be affected by a “100 year” flood. The barn provides larger holding stalls and training walls that allow keepers more access to the animals for voluntary husbandry and medical procedures, and a cool spot in the summer, with shade and fans blowing over ice.

It is very important that native white-tailed deer be kept from the elk, because deer can spread disease (chronic wasting disease). Note the double perimeter fence at the back of the habitat to help keep deer out.

Measures implemented to protect the public include a “kid-catcher” barrier for the boardwalk, placed at an angle so that if a child did fall into it, the child would bounce back into the catcher and not into the pond. Also, vertical fence posts have pointed tops to discourage setting children on and peek-through areas in the fencing provide opportunities for children to view the pond area without being put into potentially dangerous positions.

Eagle Owls: The eagle owl habitat shares many features of the bald eagle exhibit. There are large support poles, the same type of special mesh, heat lamps, and a water source. There is also a box to provide shelter, and possibly a nesting location in the future.

Kangaroo Habitat: The current kangaroo habitat was created in 2021. It is in the space formerly occupied by the Bactrian camels. The fence was modified to prevent better viewing by using a special mesh that is very strong but is easy to see through. When the habitat was first remodeled for the kangaroos, a lot of plants were put in. However, the kangaroos promptly ate them. In the summer, a canopy is put up over part of the yard to provide shade. The barn, which is somewhat difficult to see from the viewing area, provides shelter and warmth during colder weather. Notice that there are two separate yards. They can be closed off if some animals need to be separated, but the gate can also be left open to give them more options.

Binturong Habitat: Binturongs are excellent climbers, so this habitat gives them plenty of things to climb up. Because they are such good climbers, we had to take some precautions so they wouldn’t climb out of their habitat. Notice the big trees in the center of the space. Binturongs could easily climb all the way to the top if they wanted to. Just above the other climbing structures, there is a smooth metal band around the tree, but it has been painted so as to blend in. There is also hot wire around the top of the fence, so if they actually tried to climb the fence, they would be reminded to stay in.

Conclusion: Use your objectives to review your program. Ask participants questions whose answers were covered on the tour. By doing so, you will be able to evaluate whether or not the objectives were achieved. Wish them a good day. Bring the group back to their classroom, the front of the zoo, or other location based on the needs of the group.