A Resource Guide
Facility Requirements for
Orang-utans

Executive summary

This document arises from a workshop that took place at Taronga Zoo on 23 November 2004. The workshop was prompted by the fact that several ARAZPA zoos are currently in the process of either developing new facilities for Orang-utans, or are upgrading existing facilities. It seemed appropriate to pool resources and to learn from each other's experiences.

Twenty-three participants represented all ARAZPA Zoos involved with the ASMP Orang-utan Program. Presentations were made by Amanda Embury (Melbourne Zoo) on future regional Orang-utan population, Leif Cocks (Perth Zoo) on Orang-utan behavior and captive requirements, Jon Coe (Jon Coe Design) on the evolution of Orang-utan facilities, Maria Finnigan (Auckland Zoo) on assessment and development of the Orang-utan Management Program at Auckland Zoo and Dodi Siever (Melbourne Zoo) on the training and conditioning program for Great Apes at Melbourne Zoo. Lou Grossfeldt (Taronga Zoo) led a tour of the Orang-utan facility at Taronga Zoo.

After an entertaining day with discussion on many aspects of requirements for captive Orang-utans, agreement was reached that Orang-utan facilities must be flexible and provide the Orang-utans with choice. There are various appropriate solutions to developing facilities, such as open or enclosed, or naturalistic or artificial. As a rule of thumb, consider how a wild Orang-utan uses its habitat, how it uses trees to move through the jungle, where it rests, how and where it feeds, and how it interacts with other Orang-utans. As with all facilities, it must provide for species appropriate behaviors. If the facility is an exhibit for visitors, then consideration must be given to storylines, and the design of the facility must complement interpretive objectives. Furthermore, exhibit maintenance is a critical component, especially the implications of working and heights and the need for risk assessments to be completed.

Rather than presenting 'minutes of the workshop', a resource guide has been compiled. This will be modified and expanded as appropriate. The guide does not provide all the answers – nor does it describe the requirements of an Orang-utan facility. The intent is to capture a range of elements that should be considered when developing facilities, and to share our knowledge and experiences.

Thanks to everyone who participated in the workshop, especially those who gave presentations.

We're all committed to the challenge – to develop the world's best Orang-utan facilities.

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Section 1: Introduction and overview

Participants:
- Adelaide Zoo: Kevin Evans
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- Melbourne Zoo: Damian Lewis, Scott Killeen, Dodi Siever, Fleur Butcher, Jan Steele, Amanda Embury
- Perth Zoo: Leif Cocks
- Taronga Zoo: Chris Hibbard, Judith Gillespie, Lou Grossfeldt, Lisa Abra, Mandy, McLellan, Ben Britton and Rob Joyce
- Hassell: Sharon McKay,
- Jon Coe Design: Jon Coe

An introduction to the workshop
This workshop has largely been prompted by the fact that several zoos within the region are in the process of either renovating or developing new facilities for Orang-utans. A workshop to share the expertise and experiences of all those in the region was seen as the best way of providing for exchange of information. In developing facilities for Orang-utans we need to consider Orang-utan behavioral requirements, and management and operation of the facilities. By developing facilities that satisfy the behavioral requirements for Orang-utans sets the platform for developing successful exhibits that meet visitor requirements.

Orang-utans have been held in ARAZPA zoos since the 1880s. Orang-utans are the only great ape indigenous to Asia, and differ markedly from Chimpanzees and Gorillas. All too often, 'Ape Facilities' are developed to meet the differing needs of Gorillas, Chimpanzees and Orang-utans.

Currently the ASMP population includes Sumatran Orang-utans, Bornean Orang-utans (held only at Auckland Zoo) and several hybrid Orang-utans. Four zoos currently hold Orang-utans, and additional two zoos have expressed interest in acquiring Orang-utans.

A Captive Management Plan has been developed for Orang-utans. A challenge is the dispersal of any Orang-utans born within the region, with difficulties experienced in placement of surplus animals. Any recommendations for breeding must consider long term options for individuals produced, i.e. to provide for the entirety of their life.

Many existing Orang-utan facilities at ARAZPA zoos date from the 1970s or earlier. It seems that zoo facilities typically are expected to have longevity of at least twenty years. Thus we need to ensure that any facilities developed today will provide for Orang-utans both now and in the future.

The objective of this workshop is to endeavor to identify those requirements that will contribute to the design and development of facilities that successfully provide for Orang-utans.

Section 2: Orang-utan behavior and background information

2.1 Identifying husbandry requirements

- Leif Cocks tabled a document outlining the varying requirements of different Orang-utans, including different species/subspecies of Orang-utans. The requirements of wild Orang-utans should be considered when developing management programs and exhibit facilities for captive Orang-utans (document included, see page 6)
- Environmental conditions suiting one type of Orang-utan may not be appropriate for others – e.g. requirements of an adult male differ to those of an adult female or juveniles and infants.
- Orang-utans are naturally conservative with regard to energy budget, they seek to conserve energy – this should be remembered when developing furnishings for facilities.
- Orang-utans show significant variations in approach to activities, for example, nest building behavior.

2.2 Social groupings

- Orang-utan of different sexes and different ages use different parts of the forest in differing ways.
- Sub-adult males form the most social age-class.
- Adult males form the least social age-class.
- Adult females will travel for periods with other related females but do have any physical contact
- Juveniles interact and play with one another.
- Orang-utans show varied cultures and social systems.
- It is inappropriate to house single Orang-utans at zoos.
- When developing facilities, the relationships and relatedness of individuals should be considered. Orang-utans familiar with one another since being juveniles are more likely to exist in social groupings.
- Adult male Orang-utans should be given the option of being housed on their own, females having access to the males at the choice of the females.
- Adult female Orang-utans should be given the option of being housed on their own (or with offspring) away from other adult females.
- Problems may be encountered if two adult male Orang-utans are kept in close proximity (although some zoos house adult males in the same exhibit).
- Facilities must provide for flexibility in groupings, allowing Orang-utans to be housed separately or together.

2.3 Providing choice – flexibility/variation in design

- Enable Orang-utans to control / manage their own environment. Components of the facility should change over time and evolve. The design of the exhibit must provide for flexibility. There must be scope to add to the exhibit and renovate it.
- Providing choice for Orang-utans contributes to reduced levels of stress, especially when there is choice associated with social groupings.
- The need to develop facilities that provide a range of conditions both indoors and outdoors (e.g. differing levels of light, sun or shade) and options for Orang-utans to adjust/control environment (e.g. turn on a water shower or turn on a light) was noted. Typically ‘ape houses’ have been designed based on principles used in design of animal houses in research facilities, i.e. having constant temperatures and constant light levels throughout the facility. It would be more like “nature” to provide gradients of light/dark, warm/cold, dry/humid, breezy/calm, etc.
- Light levels, temperature, water showers and availability of food are all variables that Orang-utans may have some level of choice over.

- Examples were provided of Orang-utans using switches to make choices, e.g. with light levels. One potential form of switch is the remote controlled infrared beam, such as is

used to open doors at hotels, airports, etc.

- Climbing structures must provide flexibility; their design should enable regular change in configuration/placement.
- Space (adequate room to move, to distance oneself from other Orang-utans or zoo visitors), microclimate (varied temperature, light levels, sunlight, shade), access (to indoors/outdoors, arboreal structures, shelter), social opportunity, delight (what will delight an Orang-utan or visitor?), respect (for requirements of Orang-utans and for the apes themselves, present Orang-utans in a respectful manner), choice and self determination should all be considered when designing facilities for Orang-utans with 24 hour access, especially for apes which must be kept off-exhibit.

2.4 Management routine

- We must move away from confining Orang-utans to night dens for 16 hours per day.
- Although Orang-utans activity period is about 14 hrs per day, access to outdoor enclosures should be provided 24 hours per day.
- Orang-utans will sleep in outdoor enclosure rather than den (at Melbourne, Orang-utans may sleep outdoors between November and May). The Orang-utans are brought in to dens for exhibit maintenance, etc.
- If it is not feasible to allow access to main enclosure overnight, consider smaller outdoor enclosures

Orang-utan natural history discussion paper

Leif Cocks, Perth Zoo

If we are designing enclosures for an 'Orang-utan', it may be a too general of an approach?

Taxonomic differences

There are at least four distinct types of Orang-utans; each has distinguishable set of physical and behavioral characteristics. In captivity there are also hybrids, both between the two species and also between the Bornean subspecies.

Bornean Orang-utan (*Pongo pygmaeus*)	Borneo
Pongo pygmaeus pygmaeus	North West Kalimantan and Sarawak
Pongo pygmaeus wurmbii	South West Kalimantan
Pongo pygmaeus morio	Sabah to Sungai Mahakam
Sumatran Orang-utan (*Pongo abelii*)	North Sumatra

The differences between the groups are not just superficial and the differences can have conservation implications. For example, before the three Bornean subspecies were recognized, both *Pongo pygmaeus wurmbii* and *Pongo pygmaeus morio* were released in a forest reserve in East Kalimantan. All the *P. p. morio* have survived and all of the *P. p. wurmbii* have died. In this case the defining difference may be due to the *P. p. morio* having stronger jaw muscles and 80% of its diet being leaves and bark, while the *P. p. wurmbii* has smaller jaw muscles and eats 60% fruit. This is an example that demonstrates that there are differences between the Orang-utan types and that the difference can matter.

Differences between sexes

As well as the size differences between species; there is also a large sexual dimorphism within Orang-utans. Males average weight is 93 kg + and average height is 1,500mm. In females the average weight is 48 kg and the average height is 1,160mm. Due to the large variation in size they use different parts of the rainforest and exploit different food sources.

Adult Males (14-16+ years) try to establish home ranges or territories that overlap the territories of a number of females, or alternatively become nomadic over a large area. Except for brief courtship with females, the adult male is totally solitary. While adult Female (10-12+ years**)** will establish a home range. They will occasionally travel with neighboring females for short periods, but will mostly ignore them. At this stage the females are usually accompanied by up to two offspring (an infant plus an adolescent daughter).

In both Sumatra and Borneo there is now a huge bias towards male Orang-utans. This has been caused by the deforestation. When the forest is cleared the females will usually not move from their territory and are killed, while the males will leave the area and create hypo-densities of male Orang-utans in the remaining forest. These differences in the flexibility of leaving a territory may also have implications for their captive husbandry.

Difference between life stages

Infant stage (birth to 3 years)

The infant clings continuously to the mother for the first five to six months. Small amounts of solid food provided by the mother starts to be ingested from six to twelve months of age. The infant sleeps in the nest with its mother, suckles and is carried by its mother throughout infancy. The infant starts to move about close to its mother at about 18 to 24 months. In time the infant takes short exploratory trips in sight of the mother at about 2½ years of age.

Infant/Juvenile transition stage (3 to 5 years)

The infant starts to forage for food from three years of age but still continue to suckle until five to six years of age. Towards the end of this stage the infant may be making its own night nests next to its mothers'.

Juvenile stage (5 to 7-8 years)
The juvenile will make its own night nest close to its mother. As well as playing alone, the juvenile seeks contact with its peers. The female juvenile stays close to its mother or makes daily contact with her until after the next infant is born. In contrast males gradually move away and explore new territory.

Adolescent stage (7 to 8 year)
Females stay close to their mother, observing the next born infant. They then start to set up a home range near the home range of their mother. Adolescent females seek contact with other adolescent females and closely related adult females as well as being sexually active with adolescent males. Males are now independent and travel long distances into new territories. Adolescent males seek contact with adolescent males and females, but avoid contact with adults, especially adult males.

Subadult males (8 to 14-16 years)
Behavioral changes include: following and 'raping' adult females, temporary consortships with subadult females, increase in dominance behavior and involvement in challenges with other subadult males, while still avoiding adult males. The subadult males gradually become less social and more solitary.

Subadult females (8 to 10-12 years)
During this time the females increasingly reduce their association with related females and subadult males and begin to follow adult males, showing periodic receptivity towards these males, which usually ignore them. In captivity, females usually give birth at this stage but in the wild females do not usually become pregnant in the first two years after menarche until they are at least 12 to 15 years of age.

There are large variations between sociability according to age. For example most markedly the most social Orang-utans tend to be adolescent males, while adult males are the most solitary.

Are Orang-utans solitary or social?

Hopefully this question in now nonsensical, as the answer could vary widely depending on which Orang-utan you are talking about. The more important question for captive management is, do they have a social system?

Wild Orang-utans that choose to have contact (at least visually) with each other are not choosing their partners randomly. Females that move for some time with other females, and allow mutual exploitation of resources, are almost always close relatives (mothers, daughters, sisters and aunts). As females set up territories next to their mothers, it is their female relatives that they will most likely have contact. It is also these relationships which allow the transfer and learning of maternal behaviors and the transmission of other cultural behaviors from generation to generation. On the other hand males leave their natal territories and mostly associate with non-related animals.

Summary

Orang-utan enclosures need to accommodate a wide range of Orang-utans that will vary considerably over time. In addition Orang-utans display wide individual differences. As with all species, 'best practice' would be to hold Orang-utans in a natural social system. This has implications for the design of all aspects of Orang-utan exhibits, including in-built flexibility in the number of territories that can be maintained within the exhibit, variable access to other Orang-utans and the design of climbing structures.

Section 3: Facility design

3.1 Evolution of facility design for Orang-utans

Jon Coe made a presentation outlining the evolution of facility design for Orang-utans. This included varied approaches to developing Orang-utan exhibits.

- When developing facilities for Orang-utans, consideration must be made of the requirements of wild Orang-utans. The design must also provide for enrichment opportunities.
- Zoos should copy nature instead of copying other zoos. Nature is the best model for study and inspiration, whether planning a "naturalistic" or "artificial" type of display.
- Some zoos have opted to develop naturalistic exhibits that use the principle of habitat immersion for visitors. Although appearing naturalistic these exhibits do not always promote naturalistic behaviors/activities for Orang-utans.
- An alternative approach might be to develop a functional exhibit for the Orang-utans and use 'borrowed landscapes' to create a natural backdrop or surroundings to the exhibit.
- Some facilities show a post-modern design, the Kyoto University Primate Research Institute has artificial climbing structures that are 15m-18m high for chimpanzees. These promote naturalistic behaviors, but bear no resemblance to natural structures.
- San Diego Zoo developed a naturalistic exhibit during the 1980s. No shade was provided at heights, so the adult Orang-utans spent most of their time on the ground.
- Orang-utans seem to favor vertical climbing, but zoos often provide long horizontal ropes.
- Enclosed exhibits are a way of maintaining / providing for Orang-utans. The first lightweight meshed exhibit was developed at Colorado Springs. These structures are very expensive.
- At Lost Angeles Zoo the Orang-utans move through net structures above visitors, creating the illusion that the Orang-utans are moving over the visitors.
- To promote arboreal behavior, the O-Line was developed at National Zoo (Washington DC). This is about 13m above the ground and 250m long. It connects the Great Ape House with the new "Think Tank" facility. Adult males are kept at both places, and females travel back and forth on the O-Line whenever they want. Adult males tend not to use it.
- A similar concept to the O-line has been developed at Perth Zoo with aerial pathways about 8m above ground.
- Consider options for raceways, if space and vegetation permits aerial raceways may be developed that provide 'trails' through the forest, animals can harvest fruit/leaves as they move through the raceways. This approach is used at The Center for Great Apes in Wauchula, Florida. The enclosures being a series of domes connected by aerial raceways.
- Within the enclosure designate some areas that cannot be accessed by adult males, thus providing retreats for females and species such as Siamang.
- Provide protection from rain/bad weather, include shade structures. Provide opportunities for the Orang-utans to create their own shelters (as they do in the wild) – e.g. cardboard boxes, sacks. If 'rain nests' are built under shade structures they typically provide adequate shelter.
- The day room at Auckland Zoo measure 10.4m X 9.5m X 5m high.
- Facilities that have artificial appearance and those having naturalistic appearance provide for different visitor experiences. Perhaps both should be developed to provide opportunities for the broadest possible range of Orang-utan behaviors.
- An alternative to the 'O-line' might be using natural trees connected by cables. Platforms/collars would prevent the Orang-utans climbing to the ground. However natural (dead) trees must be replaced periodically. Replacement budgets must be established, as well as access for cranes and other types of heavy equipment.
- It is important to consider Orang-utan facilities as three-dimensional; make use of vertical height and complexity of space – it is not just the ground area that is required.

3.2 Planting and vegetation

- One strategy for planting of Orang-utan enclosures is to mass plant then identify those plants that survive and those that don't.
- If using trees in the exhibit, remember that Orang-utans have a tendency to break branches and strip bark.
- The Primate Research Institute, Kyoto University in Japan, makes deliberate use of toxic plants in the Chimpanzee exhibit. The chimps leave the toxic plants alone, creating lush planting.
- A list of plant species used in Orang-utan exhibits will be included as an attachment.
- Vegetation combined with hot wires may be used as barriers to separate Orang-utans.
- See "Orang-utan Plant Survival" section for more information – following, see Page 14

3.3 Hot wires

- Electric fencing has proved successful with some Orang-utans, and does not seem to work in other situations. Electric fencing has proved less successful with Orang-utans than with other great apes.
- Hot grass, as used at Disney Animal Kingdom, has worked successfully for various species. This should be considered as an option to traditional hot wire fences. It looks very "natural" and is much more difficult to break or short circuit.

3.4 Meshed-enclosed facilities

- Enclosed exhibits making use of steel mesh (woven of stainless steel aircraft cable) are significantly more expensive to construct than large open walled exhibits. However they are more reasonable for very high, large volume enclosures with smaller ground areas.

Enclosed mesh exhibits provide the following benefits:

- Stainless is expensive but has a low maintenance cost
- An enclosed exhibit reduces likelihood of Orang-utans escaping, e.g. through vegetation falling into exhibit or by using browse sticks as ladders.
- Orang-utans are able to make use of the mesh for climbing, giving them access to the full volume of space.
- The roof provides options for servicing of the exhibit by keepers
- The support structures for the mesh provide options for attachment of climbing structures, such as "sway branches", ropes or vines and other enrichment devices, etc. which can be raised and lowered using electric winches. This eliminates the need for keepers to climb to service the display.

3.5 Barrier size

- Barrier sizes for Orang-utan facilities vary between institutions, 3.5m barriers have proved successful with containment of Orang-utans. More typically barriers of 4m and 4.5m have been used.
- New Zealand standards require a 4.5m barrier for Orang-utan exhibits.
- The largest arm span reported for an Orang-utan is 2.6m, if creating a barrier to exclude Orang-utans from climbing (to reach above or below), 3m should be adequate.

3.6 Barrier types

- Walls may be used in conjunction with overhangs (provided that these cannot be climbed).

3.7 Water barriers / moats

- In Australia there have been 2 or 3 Orang-utan deaths due to drowning in water moats.
- If water barriers are used for an Orang-utan exhibit, the depth must allow Orang-utans to stand. Agreement that depth of water moat must not exceed 500mm.

- Provide options for an Orang-utan to easily get out of a water moat, e.g. safe entry point, ropes, etc.

3.8 Glass

- Glass allows guests and apes to get "nose-to-nose", this can be very important in establishing a bond or affinity, which could translate into conservation action.
- Tempered, laminated glass provides the advantage that if it is broken the Orang-utans remain contained within their enclosure.
- The major problem with glass is that it can be shattered when hit with a sharp point, such as a small sharp stone or concrete fragment. Some Orang-utans are expert at finding things to break windows with.
- Acrylic windows provide the advantage of not breaking when hit with sharp objects. Scratch marks can be removed by polishing. The disadvantage is that it is very expensive and scratch marks (for example, from frequent cleaning) detract from visibility.
- It may be useful to distance Orang-utans from glass windows (e.g. by plantings); this can help to keep viewing windows cleaner.
- Investigate potential for thin layers that can be removed when scratched (has been trialled with Orang-utans and chimps, some will simply rip off the layers.
- Ensure that sharp objects, e.g. rocks are removed from the enclosure. It may prove beneficial to 'reward' Orang-utans for trading rocks or other items that may damage windows.
- One-way glass has been used successfully for the Chimpanzee exhibit at Detroit. If using one-way glass, visitors must be in an area darker than the exhibit.

3.9 Wire / wire mesh

- Auckland has a mix of wire in 50mm X 50mm squares and 150mm X 150mm squares.
- Melbourne is opting for crimped mesh having squares of 75mm in its new facility.
- AZA Husbandry Guidelines provide preferred option of 6.36mm X 50mm X50mm crimped steel mesh. Crimped mesh is more flexible than welded mesh. Welds are brittle and can be broken by repeated impact.

3.10 Orang-utans escapes

- Orang-utans are renowned for their escapes; some accounts of Orang-utan escapes are becoming urban myths.
- A range of factors have contributed to Orang-utan escapes including compromised wire (sometimes weakened by Orang-utans), tools (such as using wires to pick locks) and vegetation.

3.11 Climbing structures

- Perth Zoo makes use of platforms with slats to enable ease of cleaning. There are grips for the Orang-utans to hold when resting. The platforms have hardwood edges and metal slats.
- Telegraph poles at Taronga Zoo are set 2m into a concrete slab.
- The poles at Perth Zoo have a 500mm diameter at the base and then taper towards the top. They are designed to sway.
- Telegraph poles have a greater longevity than dead trees, which can be very difficult to replace.
- When natural trees are used as climbing structures, smaller limbs are removed. Yet these are the size of branch most used by Orang-utans. Perth Zoo used steel climbing structures because the diameter of the poles and rails well suited the needs of the apes and would not require replacement.
- Climbing structures should be designed to withstand the weight of an adult male weighing up to 130kgs (unless the structure has the purpose of excluding males.)
- The Army and/or Navy may be used to provide assistance with placement of climbing structures (and donation of ropes, etc.)

- Diameter of climbing structures must provide for Orang-utan locomotion.
- Using climbing structures to create aerial pathways through the enclosure, remember that for an Orang-utan to regularly use the pathways, they must provide the easiest route for moving from one desired location to another.
- Aerial cables may be used as an aerial pathway.
- A number of US zoos use "sway branches" for primates and the Los Angeles Zoo uses them for Orang-utans. These are artificial steel/epoxy branches attached with flexible universal joints at the base and supported by a cable or artificial vine, providing a range of natural motion.
- Include vertical elements; i.e. sway poles so that Orang-utans may use locomotor skills as seen for wild Orang-utans. Sway poles 50mm diameter and 5m high made of fibreglass rods have been used successfully in several U.S. zoos.
- Include shade structures.
- A solarscope (or computer-modeling program) may be used to design for shade requirements of exhibit (ensure that there are sunny as well as shady rest areas).
- Elevated platforms for rest must be included within enclosures.
- Enclosures must have feeders and water drinkers. Ideally these are elevated.

3.12 Enrichment devices

- Enrichment devices tend to be either expensive and long lasting or of lower cost and require regular replacement. It is much easier to provide novelty and combat habituation using low cost items.
- To bring costs down consider several zoos using the same device so that 'bulk orders' are placed.

3.13 Indoor facilities / dens / off-exhibits

- Remember, identify what is really needed, e.g. don't design a door that is bigger than requirements (increases costs, weight, maintenance issues, etc.)
- Opt to use commercially available items, e.g. winches, etc. Ensure that replacement parts are readily available.
- For buildings/indoor facilities, make use of lots of natural light and ventilation.
- Consider providing opportunities for apes to manipulate micro-climate, lights, etc. (refer to Section 2.3).
- Ideally the apes will spend most of their time outdoors. Nevertheless, indoor facilities should provide a wide range of behavioral opportunities.
- Feeders can be placed on outside of dens.
- Drinkers with metal straws can be placed outside dens (see Perth Zoo drinkers).
- Consider options for urine collection.
- Removable blood sleeves may be incorporated into den areas. Perth Zoo has a diabetic male Orang-utan. The blood sleeve has facilitated his management.
- Provide eye bolts or other built in tie points to attach ropes, cargo nets, etc. in holding areas.
- Overhead transfers allow rotation of apes throughout the facility.
- Traditionally specifications for heating/ventilation have been based on laboratory requirements, thus they call for constant temperatures, light levels, etc.
- The preferred option is to create a gradient of micro-climates: e.g. dark to light, dry to wet, varying temperatures.
- There seems to be a lack of literature available regarding color perception by Orang-utans. In humans, it appears that the intensity of a color may be arousing rather than the actual color, thus intense yellows, intense blues and intense greens will be more arousing. Typically if animals want to rest/retreat they choose to move into less intense, e.g. shaded areas. Animals move to more brightly-lit areas for 'a challenge'.

3.14 Substrate / flooring

- As for all dens/indoor enclosures, floors must provide for drainage, by quick drying and have insulating properties.

- Apenheul makes use of a bio-floor, it is more than 1m deep filled with leaf mulch and topped up every few months. It never needs to be changed. It is wet down daily like a compost pile and works similarly.
- Refer to Chamove for references on advantages of deep litter floors.
- Deep litter may be used for elephants at Denver Zoo upcoming exhibit.
- Oregon Zoo uses a dirt substrate that is replaced every couple of years.

3.15 Raceways, winches and slides (gates)

- Slides – winch, pulley, hydraulic, pneumatic.
- Consider placing a transfer cage and scales in raceways.
- If possible use elevated raceways. Orang-utans tend to be more comfortable when elevated.
- Perth Zoo has opted for a pneumatic system. This has proved successful to date.
- Auckland has a manual system but is trialling hydraulic components.
- A mechanism to stop doors must be included, to prevent injury to Orang-utans.
- A manual over-ride is required for all automated systems.
- Include remote controls for slides.
- About 60%-70% of North American Orang-utan exhibits have manual systems. However as manual systems become more complex to meet staff requests, they approach the price of hydraulic systems. The preference for using automated systems is also increasing.
- Polypropylene doors are lighter in weight than metal and less noisy.
- Nylon guides that make gates slide easily and quietly have been used for doors in the US. This material has been trialled at Auckland.
- Remember keeper safety when deciding on winch mechanism. Manual may be cheaper, but there are many keepers with back/shoulder problems attributed to winch operation.
- Mechanical systems prevent keeper injury and can be easily used by all staff, regardless of their strength.

3.16 Mixed species displays

- Langurs proposed as an option of a species that might prove suitable for mixed species display with Orang-utans.
- Macaques, including Lion-tailed and Crab-eating have been successfully displayed with Orang-utans. This combination is not recommended for ARAZPA zoos due to possible incidence of Herpes B.
- Orang-utans have been successfully displayed with Gibbons including White-handed Gibbons (Jersey) and White-cheeked Gibbons (Allwetter/Leipzig).
- Orang-utans have been successfully displayed with Siamangs (San Diego).
- Orang-utans have been successfully displayed with otters (Allwetter).
- Louisville Zoo makes use of multi-species rotation, i.e. various species (including tigers) using the same four enclosures at different times. Preliminary results of cortico-steroid level testing and long term behavioral observations suggest that the rotation does not provide any stress on any of the species and is, in fact, enriching to them..
- Rotation displays are underpinned by successful operant conditioning.
- The success of a mixed species display is dependent on the compatibility/temperament of individual animals – e.g. may work for some but not for others. Again, operant conditioning can be used to increase compatibility.
- It may be appropriate to create two separate exhibits and provide opportunities to mix species as appropriate.
- When considering a mixed species display, a risk assessment must be undertaken – identify the possible risks and possible benefits to each species. The perception of visitors must also be considered, e.g. if animals are injured, can the risks by justified to visitors.

Orang-utan plant survival

Ian Crombie, Perth Zoo

1 First to be consumed:
Lettuce, Parsley, Cabbage, Broccoli, Rosemary, Bananas

First removed:
Rosemary

First damaged:
Rosemary, Lavender, Ginger

2 Second stage, consumed:
Resultant weeds, Thyme, Cabbage, Broccoli, Ficus (four of the seven have been damaged and eaten—but will grow back), Hibiscus leaves (will grow back), *Coprosma repens*, leaves (will grow back)

Second stage, removed:
Gardenia, weeds

Second stage, damaged:
Corn, Beans, Pumpkin, Nandina.

3 Recent stage, consumed
Some Corn, Beans, tips of Liriope (grasses), weeds, remainder of Ficus, Hibiscus leaves.

Recent removed:
Weeds, beans, peas

Recent damaged:
Lonicera (creeper), Nandina

Untouched species:

- Basil
- Sage
- Peppermint
- Spearmint
- Marigolds
- Lomandra -- grasses to .5m
- Sambacus (Elderberry)
- *Osmanthus fortunei*
- *Cycas revoluta – cycad*
- Chinese Windmill Palm
- *Gardenia florida*
- *Euonymus fortunei*
- *Rhaphiolepis rosea*
- *Buxus sempervirens*
- *Coprosma 'yvonne'*
- *Viburnum tinus*
- *Canna indica*
- *Michelia figo*

Observations:

- Fodder plants in the exhibit:-
- Bananas completely eaten
- Ficus, Hibiscus, Coprosma only partially consumed
- Succulent herbs and vegetables consumed first
- Prickly, spiky grasses, palms and shrubs not selected for consumption
- Marigolds not touched—maybe their pungent smell or maybe their 'yellow' colour?

Summary:

- To date, a rather successful experiment with only a small percentage of plants being eaten.
- Many of the softer foliaged plants have been damaged/trampled.
- It would appear that this random foraging is a successful form of behavioural enrichment.

Recommendation:

- That vegetable and annual seed continue to be planted within the exhibit-ongoing through the seasons.
- That the hardier and less palatable species are planted in conjunction with the edible species. This would reduce the possibility of bare patches, areas devoid of vegetation where the edible plants had been devoured.
- Future exhibit upgrades to include similar plant selection and methods of germination and planting.
- If possible, future exhibit upgrades to be planted out well in advance—optimum period of time for establishment of plant species.

13th May 2002

Plant establishment

Jon Coe, Jon Coe Design

Zoos should not make the mistake of introducing apes into newly planted displays, the result will be disastrous. Great ape displays that truly look like a “jungle” must have at least a full year plant establishment period before the apes are introduced. Consider a double exhibit. One exhibit is clearly “artificial”, but highly enriched. The second display is a highly naturalistic, “immersion” exhibit. Open the “artificial” one first, allowing the second display a year to become established before opening it the second year.

Section 4: Visitor experience and conservtion education

- Of particular interest are conservation outcomes, do visitors get involved with Orang-utan conservation, how do they support this cause, e.g. donations.
- If we want visitors to respect nature, we must present animals respectfully. Visitors have greater respect if animals are placed in a dominant position; avoid sight lines where visitors look down on animals.
- Identify opportunities for affiliative design for example an ape can pull a cord to operate "shower" over visitors.
- 'Howdy' crates provide opportunities for visitors, especially children to interact with animals on a one-to-one basis.
- The National Zoo's (Washington DC) Think Tank combines research and display with respect to Orang-utans. The experience seems to provide mixed messages, with the Orang-utan almost seeming out of place at their computers.
- At Perth Zoo interpretive signage compares the forest home of Orang-utans with the functionality with exhibits, and compares how a wild Orang-utan might spend its day with a day in the life of zoo Orang-utans.
- Before developing the exhibit, identify what message will be communicated to visitors. What is being represented? What is the story that is being told? Develop story-lines consistent with what you can achieve.
- Highlight the intelligence of Orangs – intelligence relates to natural environment
- Consider placement of dens/off-exhibit facilities in relation to visitors, move Orangs towards visitors rather than away from visitors when Orangs are shifted to dens, etc.
- Create a structure that provides shelter for visitors on one side and for Orang-utans on the other – providing a comfortable place for Orang-utans near visitors.
- Identify space requirements for visitor areas, what capacity is required? Will there be a keeper presentation? Any other requirements for space? Do different viewing areas provide for varied experiences?
- Is there a need to provide for behind-the-scenes experiences? Will visitors have access to den areas (e.g. VIP tours)?
- Will tours of off-limits areas be limited to when Orang-utans are in outdoor areas?
- Perth Zoo currently has guided 'rooftop tours.' Eventually the rooftop will be the primary viewing area for the exhibit.
- Various zoos have 'keeper-for-a-day' or similar programs – visitors pay to get involved with keeper activities.
- Consider options for other commercial activities, e.g. a research station/field sanctuary might provide a venue for cocktail functions or other special events.
- Philadelphia Zoo has themed their exhibit to represent a disused timber-mill, the area is now being reclaimed by the forest. This provides context for industrial styled furnishings/fittings and enrichment features used in the exhibit.
- Timber furnishings used as climbing structures could be blended with vegetation used in the background, i.e. structures will tend to merge more with background plantings.
- Interpretive material should empower visitors and encourage them to take action, e.g. support Orang-utan conservation.
- Evaluation and assessment of visitor perceptions should be completed to determine the 'take home' message from Orang-utan exhibits. The cost of evaluation should be included in the project budget.
- The Philadelphia Zoo included budgets for behavioural enrichment and in situ conservation endowments in the overall construction of their PECO Primate Reserve.
- The donation boxes at Adelaide Zoo provide one way of evaluating visitor contributions.
- Melbourne Zoo's Orang-utan exhibit is scheduled for opening in March 2006.

Section 5: Conservation issues – a brief overview

- DEH requires that ARAZPA zoos demonstrate liaison with home-range states and support of in situ conservation programs for CITES I species. Given that Orang-utans are CITES I species, we must provide support to in situ programs.
- The home range of a wild male Orang-utan crosses the home range of 3 or 4 females.
- Male Orang-utans tend to be more transient than female Orang-utans.
- When habitat is destroyed, males are more likely to move to a new area than females. Females are more likely to 'stay put' and consequently starve to death.
- In the wild there are fewer adult males than females, adult males have a higher mortality.
- In remaining rainforest areas, sex ratios have changed to 3 males to every female.
- Male Orang-utans are now displacing female Orang-utans and further contributing to the decline of populations.

Section 6: Green design

- Design facilities to provide for energy efficiencies – e.g. ventilation to provide cooling.
- Consider options for use of renewable energy sources.
- Consider aspect of building to minimise need for heating/cooling.
- For exhibits that have water features, use recirculating systems whilst ensuring that appropriate water quality is maintained.

Section 7: Maintenance / risk assessment / safe working procedures

7.1 Maintenance requirements

- When developing new facilities, ongoing recurrent operating costs must be identified.
- Incorporate winches to move branches/vines/enrichment devices up and down – or to lower them to the ground for servicing (commercially available industrial products).
- When designing facility, incorporate systems to manage the following, e.g. urine collection, detecting diarrhoea, menstruation: substrate/flooring will impact on systems required to achieve this.
- Incorporate process for Strongyloides – be able to detect.
- Ensure that facility provides access for machinery, e.g. bobcat, crane.
- Incorporate dedicated storage for enrichment materials.
- Incorporate dedicated storage for learning/interpretive materials.
- Provide access to mechanical room that doesn't require access to keeper doors, den areas, etc.
- Determine frequency of cleaning, e.g. this may vary according to individual Orangs, e.g. some Orang outdoor nests are cleaned daily, whilst others might be cleaned once a fortnight.

7.2 Risk assessment

- Orang-utan exhibits typically require keepers to 'work at heights'. Risk assessments must be completed, and written safe operating procedures (including number of staff to be present) produced.
- Identify training programs for staff, e.g. working at heights and using harnesses, etc.
- Do climbing structures provide hook-up points for carabineers?
- Develop procedures for rescue of staff and Orang-utans at heights, including use of stretcher.
- When designing barriers, etc., consider risks of Orang-utan escape. Is an institution willing to build an exhibit from which an Orang-utan might be able to escape? (Example, drop from an O-line into another exhibit or public area).
- Identify whether or not keepers will enter enclosures with Orang-utans. If yes, under what conditions? What are the safety requirements, e.g. protective clothing (boots and long pants)? Produce written safe operating procedures.
- To date nobody has been killed by a zoo Orang-utan. If an Orang-utan attacks, it tends to attack limbs, usually biting legs.
- Going in with Orang-utans enables a relationship to be developed between keeper and Orang.

7.3 Evaluation

- Ensure that there is quantitative evaluation of enclosure use by Orangs, e.g. time spent on the ground, time spent on platforms, climbing structures, etc. This will enable effective modifications to facilities to be implemented.
- There should be a "post occupancy" or "commissioning" contingency to pay for needed modifications after facilities have opened and been evaluated. This should be considered a necessary part of project cost.

Section 8: Training and conditioning

- Maria Finnigan spoke about Auckland Zoo, providing a case study of the development of a training program, and outcomes resulting from the review.
- Different situations at different zoos provide for different cultures with respect to management of Orang-utans.
- At Auckland Zoo an independent animal trainer (Sharon Holden) was brought in to review the program, and to advise and identify opportunities to improve the program.
- This consultancy provided the opportunity to address some existing problems, including Orang-utans manipulating keepers. It provided the opportunity to introduce practices that provided for behavioural needs and improved management of Orang-utans.
- An outcome was consistency in program delivery, strengthening relationship between keeper and Orang.
- Orang-utans were conditioned for stationing, presentation of body parts.
- The sessions were enjoyable for both keepers and orang-utans.
- The program provided Orang-utans with opportunity to become familiar with vets.
- Training sessions were scheduled 3 or 4 times a day.
- Following each training session a debriefing occurred.
- The training of the Orang-utans reflects the program goals of the zoo; furthermore, there is a purpose for each of the behaviors being trained.
- This includes trade of items with keepers e.g. when visitors throw things into the enclosure.
- The management system at Auckland required that Orang-utans might be moved up to 6 times a day.
- Conditioning has always been a component of captive animal management, e.g. moving animals from outdoor enclosures to den areas.
- The initial consultancy lasted for four weeks, with a further two week follow-up.
- Dodi Siever provided an overview of the training approach at Melbourne Zoo, including training for hand injection.
- A united and consistent approach is required to develop program.
- Identify objectives, including zoo wide, departmental, individual species and individual animals.
- Plan the programs to support the agreed objectives.
- Implement programs.
- Document every session.
- Evaluate progress, review and adjust programs as required.
- The Sumatran Orang-utans were managed so that the male and female were 'comfortable' with separation once that the female was confirmed pregnant.
- The pregnant female was conditioned for maternal procedure, receiving training to provide keeper access to the infant, e.g. feeding of infant.
- The female has proved to be an exemplary mother – although it cannot be said how much of this success is due to the training program.
- Currently great apes at Melbourne Zoo are trained for some 26 behaviours.
- The training procedure has enabled some 7-8 hand injections, removing the need for darting. This has lowered stress within the group. This includes hand-injection of the female with her young infant. A procedure that went smoothly, the infant showing no distress during the procedure.
- To provide for training – elevate the Orangs.
- The mesh size is too small, and mesh panels 'too busy', i.e. full of clutter, for training

- Determine the ideal mesh size to support training
- Have one big panel, not lots of barriers.
- To facilitate training, consider removable mesh panels, over fixed mesh with larger apertures.
- The husbandry training equips both apes and staff to accomplish other enriching activities, such as multi-exhibit rotation. (Jon Coe)
- Training programs should be implemented prior to a shift into a new facility.
- Training can be used to reduce negative behaviours including Orang-utans spitting, food throwing, aggression, too much time on the ground, holding slides, and begging from public.

Section 9: Orang-utan shipments / transfers

- Following transfer to a new enclosure within the same zoo, it can take about two months for a female to settle into new surroundings.
- Females are not keen on moving, males are a lot more comfortable (this reflects the situation seen for wild Orang-utans).
- Data analysis indicates that there are three periods of high risk in the life of captive female Orang-utans. These are:
  1) If they breed too early (before 10 years of age).
  2) Inter-birth interval (8-9), nursing inhabits cycling, if inter-birth interval is less than 4 years, there is an increased risk of females dying.
  3) Transportation – 60% die within 30 days of transportation (females).
- Males can be moved away from their mothers at an age comparable to dispersal of wild Orang-utans.
- There have been some successes of introducing unknown animals. Ideally social groups should be formed with animals that have known each other since being juveniles.

Section 10: References

Agreed Actions:

- Compile a list of appropriate references for Orang-utan behavior and facility design.
- Develop a forum to provide comment on proposed facility designs. Zoos should be encouraged to share proposals and seek feedback.
- Further add to these resources with information about wire mesh, laminated windows, winch systems, etc.
- Encourage visits to look at operations at zoos throughout the region.