



INTO THE FUTURE

The evolution of Dublin Zoo's Asian elephant programme

Most visitors who wander along Dublin Zoo's inspiring Kaziranga Forest Trail will be unaware of the meticulous planning that went into the creation of this Asian elephant habitat, an ambitious project that began over ten years ago with the founding of a new breeding herd in Dublin. This is the story of how the habitat evolved and how our approach to elephant care has changed. Each element of the design and husbandry has been based on our understanding of elephant biology and behaviour, and we continue to learn how best to provide for their natural needs.



BACKGROUND

In 2004, Dublin Zoo housed two elderly, wild-caught females: Judy (born c.1957) and Kirsty (born c.1967). Both had come from Chester Zoo, Judy in 1991 and Kirsty in 1994. They were managed in a 'free contact' situation – keepers working alongside their charges without barriers, a traditional practice that could pose dangers to both elephant and human.

By early 2004, Judy was beginning to show signs of arthritis and we needed to inspect her feet regularly. But she was also increasingly resistant to her keepers' commands to allow this and there were real safety concerns. A decision was made to move towards a system of 'protected contact' management, under the guidance of Alan Roodcroft, an elephant behaviour consultant (former Elephant Manager and Elephant Care Specialist at San Diego Zoo) with vast experience in managing elephants in a wide variety of environments. Alan has played a fundamental role in developing protected contact as an elephant management system, and now spends his time acting as a consultant for zoos worldwide.

Alan visited Dublin Zoo to work with the keepers and elephants several times over the course of the next 18 months. Great strides were made, particularly with Kirsty, but as the programme developed more and more major alterations were needed. The old elephant exhibit was in bad disrepair and required massive financial investment to reflect modern husbandry techniques and allow keepers to work an entirely protected contact system.

Both The European Association of Zoos and Aquaria (EAZA) and the European Endangered Species Programme (EEP) were encouraging zoos to house either a breeding herd or a retirement herd – elephants past breeding age or unable to live in a breeding herd. (EAZA now stipulates that institutions wishing to hold a breeding herd must also have the facilities to house a bull.)

The Zoo had a big decision to make, either to invest and move to a breeding situation or to end the housing of elephants in Dublin.

STARTING AGAIN

When the opportunity arose to accept a small breeding herd from Rotterdam Zoo, Dublin Zoo decided to renovate the entire elephant exhibit, with a new house and a greatly increased outside habitat suitable for keeping a small herd of cows and with facilities to keep a bull. This involved massive financial investment and significant government support.

Judy and Kirsty were moved from to Neunkirchen Zoo in Germany in September 2005 and the old elephant house was demolished soon after.

The elephant project was to be completed in three phases over five years, first building a new house and small outdoor paddock, or 'kraal', to house the new herd when it first arrived. The second phase was the creation of a large outside habitat (nearly two acres) with two pools and rock formations and undulating sand topography. The third phase was the construction of a bull house. The whole project was finally completed in 2012 in time for the arrival of a breeding bull from Chester Zoo, UK.



Upali's introduction to the

Our new herd arrived in Dublin from Rotterdam on 18 October 2006. It consisted of two sisters, Bernhardine (born 1984) and Yasmin (born 1990) together with Anak, Yasmin's first calf (born 2003). This meant that they already had natural and comfortable relationships when they arrived and settled in quickly.

The small herd soon grew. Bernhardine was already pregnant and gave birth to a healthy female calf, Asha, on 7 May 2007. Yasmin gave birth in February 2008 to a male calf, Budi (now residing in Denver Zoo, USA).

In July 2012, 18-year-old bull Upali joined the herd from a multi-generational group at Chester Zoo, which shares our long term philosophy on progressive elephant management. A proven breeder, Upali was chosen for his calm attitude, with the hope that he would help create a calm and confident atmosphere within our own herd and continue our breeding success.

And so it proved. 24 months later, Yasmin gave birth to her second male calf, Kavi, followed a month later by the birth of a male calf, Ashoka, to her daughter, Anak, and of female calf, Samiya, that September to our matriarch, Bernhardine. This herd of eight elephants has been exploring and enjoying their new habitat – the Kaziranga Forest Trail – ever since.

DESIGNING FOR ELEPHANTS

The Kaziranga Forest Trail offers visitors an exciting immersive experience, but the key criteria that drove its design were the elephants' own natural ecology, biology and behaviour while still allowing us to care for them safely. The Zoo team and consultant worked closely with the specialist US firm of landscape architects, Jones & Jones Architects, to ensure that every element served a purpose in enabling the herd to express natural behaviours, and to allow keepers to manage their care to the highest modern husbandry standards. We have been able to observe the impact of the many key design elements and we continue to learn and develop our husbandry techniques.

As visitors wander along the Trail, past a roaring waterfall and a meandering stream, they catch glimpses of our majestic Asian elephant herd through thick bamboo and exotic vegetation. Several open viewing areas offer wider vistas, where they can watch the elephants displaying a wide range of natural behaviours – bathing, feeding, moving, digging, playing, sand-dusting, interacting or simply relaxing together as a herd.



Plan of Kaziranga Forest Trail (Walsh, B. 2015)

The importance of sand

The outside habitat is covered in a deep sand substrate, which has a very important role in the physical health of our elephants. Deep sand provides an excellent surface to enhance exercise and natural behaviours. As the elephants' feet sink into the sand they must use

more energy when moving, particularly up and down slopes. The young elephants must work hard to run and play and the adults dig and throw sand on themselves after swimming or washing. They also like to lie down on the high piles of sand when wet, using energy and exercising more muscle groups to get up again.



The three young calves playing in new sand

Hanging feed nets are a key source of stimulation and are filled regularly with hay, maize, browse and feed balls. They can be automatically lowered and raised out of the elephants' reach by hand-held remote controls.

This encourages movement and searching behaviour, as well as prolonging the amount of time that a single net of food can be used. And, as explained on page 9, reaching up to feed helps strengthen their neck and shoulder muscles.



Elephants must stretch up to feed from the nets

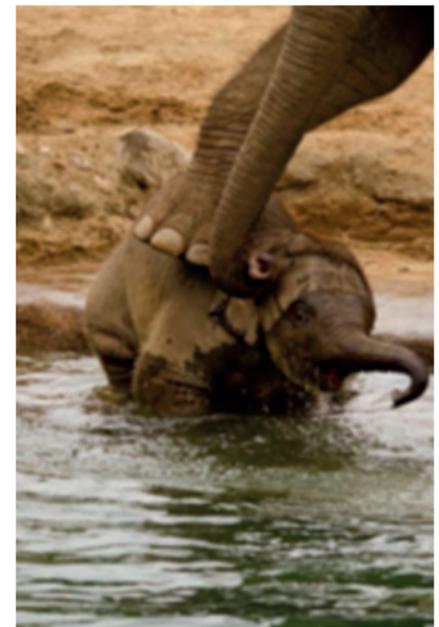
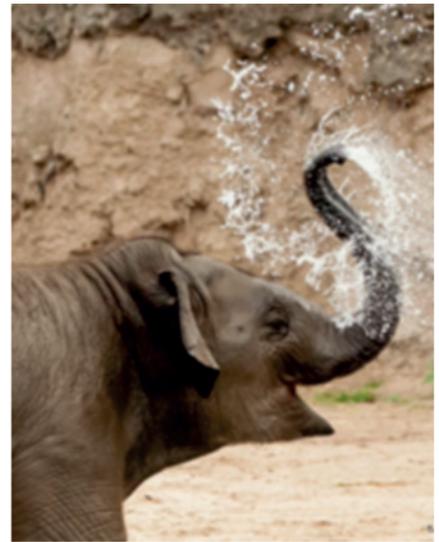
Water

There are two large pools – one in the 'cow area', the other in the 'bull area'. (These areas can be easily divided to separate the bull from the females, using an electronic gating system.)

Both pools are equipped with unique filtration systems so that minimal labour is needed to keep the water clean and fresh for the elephants.

Large shallow steps give the elephants a sure-footed way to enter the water and youngsters can test out the water step by step and gain confidence before going in deeper. When our first young calf was ready to explore the habitat, we wanted to be sure that the group was aware of the danger, so we kept the water level very low. As the elephants became more accustomed to the pools, we increased the water depth.

Now the calves (all approximately a year old at the time of writing) paddle, splash and swim – usually under the watchful eye of 8-year-old Asha, the 'big sister'. They can often be seen swimming together when the mood takes them. The adult females, too, have spent most of the summer enjoying the pools.



Adding species

Our aim has been to take full advantage of the facilities offered by the Kaziranga habitat by adding further species. We currently have a small herd of Asian antelopes, the Indian blackbuck (*Antelope cervicapra*) sharing the outdoor habitat. They have separate night quarters at the back, which only they can access, for supplemental feeding and sanctuary if they should need it. Over time that they have learned to share the space with our elephants and we hope to increase the number of blackbuck in the future. Their presence – along with that of peacocks (and even pigeons) – enriches the life of our young and curious elephants.



Blackbuck and elephants now share the habitat



Constantly changing

It is our goal to make the outside habitat a new experience for the elephants every day, carefully planning out furniture such as new tree stumps, rocks and even changing the contour of the surface by moving the sand into hills and rises for the elephants to climb and negotiate. We want to stimulate all their senses: visual, tactile, taste and smell. Encountering something different on a regular basis will, we hope, encourage searching behaviour as they explore the 'new' terrain.



Yasmin scratching on a rock



The herd exploring some fresh bark (above right) and a variety of browse

INDOOR HABITAT

Historically, elephants have been held on hard surfaces such as concrete and rubber. Ease of cleaning was the main advantage. Sand however, provides a much-needed interactive element, allowing elephants to show natural behaviours such as throwing and dusting at any time of day and all year round.

The positive effect of using two-metre-deep sand flooring in the Elephant House has been notable. The sand is used to create a stimulating, uneven

surface, which helps strengthen leg tendons and muscles. Heaped into large mounds, it provides playing opportunities for the youngsters and sleeping opportunities for the adults.

The sand is moved and turned to keep it fresh and varied on a daily basis. Tree stumps are also planted in the sand and moved on a regular rotation. All this keeps the elephants stimulated and alert.



Asha is born, 7 May 2007 (still from CCTV footage)

Birthing benefits

We believe that one of the most beneficial aspects of the deep sand flooring is the help and support the sand gives during the birthing and post-birthing process. Studying old films of elephants giving birth was a great reference when investigating whether to use sand into our elephant habitat. Elephants giving birth on concrete would generally stay in a prolonged state of stress because the calf would try to get to its feet, slip and fall, and try again to stand while the mother's anxiety levels increased. On concrete it sometimes took 30 minutes (and much longer in some cases) for the newborn calf to get to its feet. A natural sand substrate, however, quickly absorbs the fluids produced during the birth process and allows calves to gain a much quicker grip on the surface when trying to stand.

Thick sand also cushions their fall and reduces dramatically the need for any kind of human intervention.

Two other institutions, Hagenbeck's Tierpark Hamburg in Germany and Chester Zoo in northwest England, have also installed sand in their elephant facilities to provide a greater degree of comfort. Interestingly, both they and we recorded that, with sand, calves were on their feet within six minutes of being born, and believe that this has also had positive effects on the young animals' early development. Observation at Chester and Hagenbeck's suggested that their calves were further developed than the other calves previously born at their zoos. Dublin Zoo's elephant team has also been surprised how independent and strong their calf became in a very short length of time.



CCTV monitoring

CCTV cameras are not widely used as an animal welfare tool or support mechanism, but Dublin Zoo embraced this technology and immediately put it to

use when our herd arrived, to follow and record the elephants' sleeping and behavioural patterns. We were very interested in how the translocation of the herd from the Netherlands and acclimatisation into their new habitat would affect them. We are happy to say they did not miss a night's sleep and continue to sleep on average four to five hours a night.

The cameras have played a crucial role during the birth of five calves born in Dublin Zoo. We were able to observe and follow the birthing process without disturbing the elephants with our presence. However, if the cow needed our help we were only seconds away, watching the situation unfold on our monitors in the elevated staff viewing quarters

CCTV monitoring for research

Keeper Brendan Walsh used interior CCTV to conduct a detailed sleep study (right). A second study using outside camera footage looked at the elephants' locomotion pattern (Brady, 2015). It showed positive results, with the daily average distance travelled by the herd in Dublin Zoo totalling 9.32km/day over a 24-hour period, a figure in line with that of their wild counterparts (3–17.8km/day). This study also examined individual locomotion, with the bull Upali recorded as travelling 14.05km/day. This result is again comparable to a study showing the estimated daily travel of wild Asian elephant bulls at 14.4km/day (Clubb & Mason, 2002).



CCTV footage shows the elephants (here, Asha and the three calves) sleeping on the sand mounds

SLEEP STUDY

Sleep is an essential aspect of Asian Elephant (*Elephas maximus*) welfare in zoos. Recent improvements in elephant habitats and husbandry, including sand substrates, feeding enrichments and related herds, have improved welfare. Studies have documented these improvements, but not many have focused on night-time behaviour. This research focuses on the quantity of nocturnal sleep behaviour and how it is connected with new standards of elephant husbandry.

704 nights of elephant behaviour were recorded over a 33-month period. A high definition, closed circuit television camera system with infrared abilities was used for nightly recordings from 19:00 to 08:00. Eight elephants were studied: three related adult cows (while pregnant and not pregnant), one sub-adult cow (related to adult cows), one adult bull, two bull calves and one cow calf.

When given the choice, no elephant ever slept on concrete, all sleep occurred on sand. Adults slept on average three hours 36 minutes per night, calves an average of five hours 28 minutes per night. There was a clear relationship between age and sleep; as individuals became older, they slept less. The bull showed quite consistent sleep quantities, the other elephants showed occasional variances based on pregnancy, giving birth and being born. Two of the three elephants who became mothers during the study slept less after giving birth – down 68.3% (188 minutes) and 11.7% (24 minutes), while the third slept 10.3% (17 minutes) more. Reduction in sleep duration appears to be due to calf guarding behaviour.

Housing an adult bull separately from the main herd for majority of time (84%) appears beneficial to harmony in the group, as it reflects what often happens in the wild. Elephants live in related, matriarchal herds in the wild, where they traverse substrates of sand and soil. The implications of this fact, and the positive results of this study at Dublin Zoo where these two factors are present, lay emphasis on the belief that zoos should aim to house elephants in related herds on sand or other natural surfaces where possible. This improves welfare, and may reduce stress and the risk of diseases such as Elephantid herpesvirus 1 (EEHV).

(for full report contact bren.walsh1@gmail.com)



Raising the hoist, indoor habitat

Feeding

The inside area is designed to encourage curiosity, searching and muscle-building behaviours during feeding. A large 'feed wall' has timed doors that give access to hay and feed balls (filled with treats and fruit) at different times throughout the night. Two reinforced joists support automatic hoists that are used to hang hay nets and browse high above the ground every evening. Encouraging our elephants to explore, reach and stretch for food has yielded remarkable results in improved body condition and muscle strength in the neck and shoulders (not usually conditioned by more traditional feeding systems). Other major zoos around the world are also exploring the use of hanging feeding nets, and the Phoenix Zoo in Arizona, USA, have reported success in reducing stereotypical behaviour by 80% with the introduction of hanging nets into their elephant habitats.



Performing foot care through a protected contact wall

Other care measures

The cow house has three adjoining training stalls. These are used every morning to separate the elephants for protected contact training sessions, in order to gain essential husbandry access to each animal. Each stall has specially designed foot and ear access ports, which are used for husbandry and minor medical procedures. All foot work and blood draws are performed in these stalls and this is where all training techniques are initiated.

All elephants are trained to walk through a large emergency restraint chute when leaving the inside habitat, so that access to them is assured if medical procedures are necessary. The chute has one moving wall so it can be matched to the size of each elephant. The floor of the chute is also a weighing scale so we can accurately weigh each elephant every day.

A suitable Calf Training Crèche (CTC) was constructed in 2014 to facilitate staff to train each calf in an enclosed area, separate but adjoining its mother in the main training stall. This area was designed specifically with the needs of both mother and calf and with the cohesion of the herd in mind. A weighing scale was built inside a small chute area that could be expanded if necessary.

Weighing scales



Challenging Tradition – redefining elephant herd management practises and training to be more proactive in the physical and psychological management of the herd.

Dublin Zoo makes every effort to ensure the elephants have everything they need for a comfortable life in their home in the Kaziranga Forest Trail.

Harmony within the herd is one of our main goals and we have built an educated, well-trained care team to provide the challenging care necessary for a successful modern elephant programme.

It is, of course, imperative that this is sustained by an ambitious and motivating training programme for our elephant team. In order to ensure that the team receives important, up-to-date information concerning elephant matters, Alan Roocroft continues to act as a consultant at all levels of the elephant programme, and to tutor and help develop the care team in protected contact training.



Keeping elephants well is a constant challenge. While we are confident that our programme is pushing the boundaries of elephant husbandry, we are determined to keep striving to provide the very highest standards of care possible for the Dublin Zoo herd.

Having secured the breeding of Asian elephants in Ireland for decades to come, Dublin Zoo is looking forward to walking in the footsteps of Upali, Bernhardine, Yasmin, Anak, Asha, Kavi, Ashoka and Samiya, into a bright future.

Gerry Creighton
Operations Manager, Animals and Grounds
Gerry.creighton@dublinczoo.ie

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