FWM 415 ZOO AND PARK MANAGEMENT TECHNIQUES

1.0 BACKGROUND

- Range of benefits of the conservation sites – ex-situ (e.g. Zoological Garden) and in-situ (e.g. National Parks and Equivalent Reserves) are not obtained spontaneously, but require conscious management.
- Management increases the benefits and enjoyment of user-publics through appropriate use of the site or area.
- Zoo and Park Management provides for the preservation/conservation of area features.
- Involves skillful treatment of an area including protection, maintenance, administration, etc.
- Management includes factors and activities undertaken to achieve the objectives for the area (Active and Passive Management).

2.0 General Management Objectives

- Maintain representative samples in perpetuity.
- Maintain ecological diversity and environmental regulation.
- Maintain genetic resources.
- Maintain human cultural heritage.
- Protect scenic beauty.
- Facilitate education, research and monitoring, to improve the understanding of the environment.
- Facilitate recreation and tourism.
- Support rural development and rational use of marginal lands.
- Maintain watersheds and control erosion.
- All sites may not be able to offer all these benefits.
- Management efforts require funds, training, equipment, organization and motivation.

3.0 Purpose of Zoo and Parks

- Posterity
- Profit
- Recreation
- Educational purposes

4.0 Management Areas – involves activities in three general areas

- Resource management (air, water, soil, vegetation and wildlife) e.g. controlled burning, management of pests and pollution, environmental impact controls, fencing, predator policy, provision of water holes and saltlick, translocation, and culling.
- Human dimension management e.g. information and educational services, safety managements, regulations, attention to the surrounding population.
- Management of facilities and services e.g. headquarters, administration and staff, accommodation, recreation and access facilities.

5.0 Skills for Zoo and Parks Management

- Regulations and laws
- Ecological principles
- Organization
- Resource protection
- Information, tourism and visitor services
- Animal handling and care
- Construction and maintenance
- Operating vehicles
- Surveying
- Public speaking and public relations
- Personnel management and fund management
- Education and extension services
- Conducting biological research, etc.

6.0 Specific Management Issues/Appropriate Management Actions

6.1 Habitat and Animal Population Management

- Basic inventory and monitoring
- Vegetation composition changes
- Ecological succession and habitat diversity
- Indices of poaching pressures
- Fire problems – controlled, uncontrolled and fire as a management tools
- Population eruption and crash
- Migration patterns and corridors
- Animal acquisition and translocation

- Endemic species
- Nutrition and care
- Veterinary monitoring of diseases
- Identification of natural hazards
- Animal nuisance factors

6.2 Human dimension management

- Anti-poaching activities
- Characteristics of user-publics – behaviours, vandalism, preferences, attitudes
- Designs for public safety
- User-carrying capacity
- Education and interpretive services and public relations
- Tourism and recreation impacts

6.3 Managerial actions

- Appropriate law enforcement
- Anti-poaching procedures
- Utility fixtures
- Facility maintenance and types (House helping, Preventive, Breakdown and no maintenance)
- Training
- Site selection for locating facilities
- Evaluating facility designs.

1. Building:

(a) Preferably should be outside the park if possible or on the periphery. There is a tendency for small towns to develop in national parks when buildings are clustered together inside the park, e.g. Serenera in Serengeti National Park. This condition arises due to demand for communal facilities such as hospitals, residential areas for workers, schools, recreational facilities, shops, etc.

(b) Wherever possible buildings should be located in areas away from normal tourist routes.

(c) When constructing buildings, local materials should be used as much as possible. Local materials retain the natural appearance and cultural history of the park and the immediate

area respectively. Buildings should therefore conform to general park standards designed by the engineering section of the Parks or Game Departments.

(d) If painting of buildings is necessary, efforts should be made to use 'soft' colours which match the surrounding landscape.

(e) When planning for buildings, consideration should be made on the ease and economy for providing utilities to all buildings, example water, electricity, disposal of waste matter, access to buildings, etc.

2. Roads: Roads are your Revenue:

(a) Determine park road system according to park needs i.e. is a road really needed:

- interpretative services
- fire-breaks
- access and administrative use, etc.

(b) Determine type of road grade/s suitable for the park

- tarmac
- murram
- tracks – depends on kind and amount of traffic. Will the park roads be for seasonal or year-round use?

(c) Roads should be planned to avoid traffic congestion. It is desirable that roads should scatter visitors over a wide area of the park – where this is feasible. Loop roads are frequently used to accomplish this.

(d) When constructing roads, care should be taken to avoid scarring adjacent land on either side of the road.

- avoid collecting murram from either side of road, since this normally leaves large scars.
- all pits should be refilled or landscaped.

(e) Wherever possible, match murram colour with colour of the natural soil found in the area. This is however not practical in black cotton soil areas.

(f) Roads should be planned to discourage speeding.

- erection of humps on potential speeding portions
- avoid straight stretches

Note: It was feared that tarmac roads in Kruger National Park, Republic of South Africa would lead to speeding, but the contrary was found true as cars went slower. There is no dust around and no corrugation and people found the driving much more relaxing. They are also cheaper to maintain but more expensive to build. The volume of traffic, type of vehicle and desired speed of travel must all be considered before a final road plan is designed.

(g) Roads should have properly planned signs, all with a standard sign, to direct visitors.

(h) After the road/s have been constructed –

- maintenance – draw up maintenance schedule if possible
- road safety – rocks, hanging or rotten trees
- road clean-up – very important to keep the park clean. Can install trash-cans along the road – especially where visitors got out of their vehicles to see particular features of the park – look-outs are ideal places to place trash-cans.

(i) The extent of the Park road system should conform to the zoning plan prepared for each park.

3. Road Signs –

They are necessary as guidelines to visitors and park staff.

1) Is putting road signs the best solution? – are there alternatives?

2) Where do you put road signs?

- areas of tourist interest
- important places, swamps, lakes, picnic sites, campsites, for direction, mileage.

3) Type of road sign –

- wood
- stone – elephant proof
- what colour – blend with environment
- standard design for part or parks

4) manpower availability –

- who will make the signs?
- Who will put them up?
- When will they be put up? – dry season?
- Who will maintain them?
- Who will supervise the sign operations?

5) Estimate costs for signs

6) Present your plan to your superior for approval.

4. Picnic Area:

These are day-use areas that are mostly used during lunch hours. When planning for such areas, it should be considered which areas the visitors would normally be by around noon when they would like to have their lunch. Other considerations are –

- benches or logs to sit on – reasonably shady area
- trash-cans or containers – very important
- toilets, packing facilities
- water for drinking – if possible
- regular maintenance of the picnic areas, especially with regard to daily or weekly clean-up, depending on intensity of use
- labeled signs locating the facilities and any hazards that may exist.

5. Campgrounds – Campsites:

Campgrounds or campsites are overnight camping areas – where visitors can spend a night or more depending on park regulations. Normally visitors come equipped with their own tents and food. Cooking sites and firewood are usually provided.

When thinking of establishing campsites in an area, the following planning criteria should be bear in mind –

a) Desirability – will the campsites in any way interfere with the well being of the park?

- is there a genuine public demand for campsites or campgrounds?

b) Site Analysis – The following site elements have to be taken into consideration

(i) Topography or Relief of Potential Campsites

- access to potential campsite/s

- usable slopes

- vantage points and views; visitors normally like to camp overlooking panoramic views

- stability of potential campsite/s

- surface drainage of potentials campsites.

(ii) Vegetation –

- will the campsite interfere with the vegetation of the area (rare species involved here). Are there poisonous plants – that pose a danger to campers.

(iii) Soil of potential campsite/s -

- dusty during dry season?
- muddy during rainy season?
- Rocky?

(iv) Wildlife -

Will the campsite/s interfere with existing wildlife movements, habits or movements?

- Safety of campers from wildlife?

(v) Campground Facilities -

- Is the potential campsite in an area where such facilities like water, toilets, firewood, etc. can be provided with ease. If visitors have to bring these things themselves, this should be indicated

(vi) Climate -

- Likely to be too hot – exposed or cold?

(vii) Fire Hazard – is the campsite located in an area safe from grass or forest fires.

c) Campsite Construction and Administration – Following should be taken under this heading -

- Finance – capital and maintenance funds
- Personnel to construct and maintain site/s –
- Campsite permits and fees
- Design of the campsite/s – pattern of individual camping units

density of campsites – how many campers allowed in single campsite

pattern of circulation around campsite or campsites if these are planned near each other

permanent or temporary.

- **Capture of Wild Animals:**

Introduction

Game capture requires both practical and scientific skills, experience and the right equipment. For these reasons, most wildlife managers make use of professional game capture teams for this purpose. Successful game capture does not only include the capture of the animals, but also the effective handling, transport and care in captivity.

At all times it's crucial to remember that during game capture and translocation operations you are dealing with live, sentient, cognizant and feeling animals.
At this point it is necessary to break one of the fundamental rules of scientific writing, Anthropomorphism. Wild animals under capture conditions are afraid, confused, stressed, frequently aggressive and highly agitated. Treat them with compassion.

- **Capturing of Herbivores**

The following factors should be taken into account when deciding upon the capture method.

- ***Cost***

This involves equipment such as:

- nets
- vehicles
- tranquillising equipment
- drugs
- feed
- bomas

The cheapest option is not always the best, though.

- ***Type of game***

Certain game species require specialized capture techniques. Elephant, rhino, hippopotamus and giraffe are examples of this. Herd animals can be captured effectively in groups using a plastic boma and a helicopter.

- ***Area of capture***

The vegetation and habitat will also determine which vehicles and method can be used.

- ***Number of animals***

For capturing large numbers of game in a single exercise, a helicopter might be needed. This adds to the cost considerably.

Planning a Capture Operation

The following aspects must be considered when planning a capture operation:

- The physical condition of the animals, number of young and possible advanced pregnancy.
- The sexes and ages of the animals.
- The time of year, specifically relating to temperature and humidity.
- The safest and most effective capture method for the specific type of animal.
- The necessity of using immobilizing and tranquillising drugs.
- The availability of vehicles and single or mass transport crates.

Animal health requirements such as the quarantining of animals in foot and mouth control areas.
Nature conservation permits which may be required for the capture, holding and transport of animals.
Import and export permits between different areas and regions.
Principles for Successful Capture
Wild animals that are captured are under stress before, during and possibly even after the capture. Although game capture operations will always contain a measure of stress, the welfare of the animals involved is always of the utmost importance. The wildlife manager must therefore ensure that the method chosen also takes this into account, and that everything possible is done to minimize the stress on the captured animals.

A basic principle of successful capture is to eliminate as many factors as possible that cause stress in the animal. The following should be taken into account:

- The operation should be thoroughly planned beforehand.
- Every person involved in the operation should be briefed in detail about their task.
- There should not be any unnecessary persons. Observers are by and large inexperienced in game capture and frequently hinder operations
- Game capture should take place in the colder months of the year, as
- overheating of the animals can easily occur during capture.
- The condition of animals deteriorates during winter, and the capture should therefore also not be done too late in the winter.
- In warm climates it is advisable that the capture should start early morning and not stretch over the heat of the day.
- Animals must never be chased over long distances or for a long period of time. This is not the way animals react in nature, and it could prove fatal. If the capture boma is far away, the animals should be given time to rest and be herded to the boma slowly.
- The animals should be handled and disturbed as little as possible.
- If the animals are kept in temporary captivity after the capture, steps must be taken to ensure they do not injure themselves in the bomas.
- Bomas should be high enough that animals, especially antelope, cannot jump over the side.
- Noise levels outside the bomas and crates should be kept very low.
- Aggressive animals and mature bulls should be separated from each other to avoid conflict and injury.
- There should be enough food and water in the bomas before the animals are brought in.
- Ensure adequate protection against sun, cold and rain.

- **Darting:**

Immobilizing animals by dating-

Animals may be captured by being injected with immobilizing drugs. This method is used in the capture of rare and valuable herbivores on an individual basis. It requires great skill, scientific knowledge and experience to immobilize wild animals. Drugs are usually injected by firing a dart from a dart gun into the muscle of the animal, but can also be administered manually, for example when animals are caught in a net.

An important distinction needs to be made at this point:

- **Immobilizing drugs** are used to immobilize the animal completely, with *the animal losing consciousness*.

- **Tranquillising drugs** are used to *sedate the animal, while the animal is conscious of its surroundings*, it remains in a relaxed state with limited movement.

It is advised that the choice and handling of immobilizing drugs for capture operations be left to a wildlife manager or veterinarian with experience in this field.

The following principles are important in the darting of antelope and other herbivores:

- *Selecting equipment*

The distance that the animal can be approached from, thickness of skin, approachability of the terrain and the method of approach being ground or air will determine which strength the dart gun should be.
The right choice of dart and needle is also very important, this being influenced by the skin thickness, size of the animal and approach distance.

- *Darting from a vehicle*

It is difficult to get the required approach distance from an animal on foot, so animals must usually be approached in a vehicle. Animals are often accustomed to certain vehicles, which could be an advantage. Using roads to approach the animals is more successful than driving off road, which often scares animals. Avoid driving directly at an animal or herd, as this tends to scare them off.

Be patient in selecting the animal to be darted, and shoot only if the target area (e.g. the hindquarters) is not obscured. The dart should penetrate at a 90 degree angle, which reduces chances of the dart bouncing off. Dart sites to use are the rump, hind leg, shoulder and occasionally the neck. The aim here is to have the dart penetrate into muscle tissue only. Once the dart is in the animal, the animal should be kept within sight at all times, but should not be chased at high speed. If, however, the animal does move out of sight, wait for the appropriate time for the drug to take effect, and then start tracking the animal.

- *Darting from a helicopter*

Making use of a helicopter for darting is often worthwhile in the capture of valuable, large or aggressive animals. An experienced helicopter pilot is of the essence. The pilot should know the habits and reactions of different game species, and be experienced in flying low and turning sharply. A strong helicopter is necessary to provide a stable platform from which to dart. Darts should be prepared in advance,

with enough to spare. There should be good communication between the pilot and the ground crew. The best time to fire is when the animal and the helicopter are moving at the same speed in the same direction. Once the dart is in the animal, try and herd the animal towards the recovery vehicle. The ground crew must be notified immediately.

Signs that the drug is taking effect -
Some or all of the following symptoms may be seen:

- An ataxic, staggering gait.
- A high-stepping knee action
- The head held high and far back, or the animal may nibble at vegetation
- Impaired vision – the animal may collide with objects
- Loss of sense of fear of people and strange objects
- The animal reacts to noise
- The ears may droop
- Some animals stay on their feet, and others may collapse

Advantages of immobilizing through darting

- The most effective and safest method to capture rare and valuable animals
- It is more economical than other methods when only single animals have to be caught
- Large and aggressive animals are manageable and can be loaded and transported while immobilized

Disadvantages

- Approach distance to dart an animal is often not adequate.
- Ruminants that collapse on their side can bloat or choke when rumen content is vomited.
- If the drug is not injected into the right muscle, or the dart does not discharge properly, the animal will not be immobilized effectively. The animal could run too far and overheat or collapse from exhaustion.
- The tracking of animals in dense vegetation or rocky areas can be difficult, and animals may not be reached in time.
- Use of a helicopter can be costly.
- Animals can injure themselves if they collide with a tree or fence.
- Over dosage could be fatal if an antidote is not administered in time.

- **Capturing Of Carnivores –**

The capture of carnivores can be done by using cage traps or camp traps that lure the animal with bait. These are best constructed and operated by professional capture teams with experience in this field. It is recommended that carnivores be tranquillised during transport, to facilitate handling and loading, and reduce stress during transportation.
It is imperative that an experienced person take full responsibility for the immobilized animal, as any carnivore is capable of inflicting serious injury to handlers.
Handling of immobilized carnivores -

An immobilized carnivore could collapse in an unnatural and inappropriate position, which could result in injury. The animal should be placed on its side, with its head extended. The tongue should be kept wet during immobilization.
Regurgitation during immobilization is life-threatening to a carnivore. Pieces of meat that are regurgitated should be removed from the mouth as soon as possible to avoid suffocation.
The immobilized animal should be turned from side to side every 20 minutes. To prevent overheating the animal should be cooled down after capture and should never be left in the sun. Direct sunlight can also cause damage to the eye, and the eyes should be protected by a blindfold. An immobilized animal is still able to perceive loud noises, so every effort should be made to reduce the noise level around the animal.
The vital signs – respiration rate, pulse rate, blood pressure and temperature - should be checked continually.
All carnivores can be lifted by 1 – 4 persons, depending on the species and the equipment available. A good stretcher will be sufficient for loading and off-loading all the larger species, while smaller species can be lifted by hand. All carnivores should be fully immobilized when loading and off-loading. Animals should be loaded as soon as possible after capture.

(Adapted from Wildlifecampus – Wildlife Management Courses Teaching Guides)

- **ANIMAL HEALTH**

The health care service is a joint responsibilities of the curators, keepers and the Zoo Veterinarians. Captive animal health care should not be restricted to the Veterinarians, medication and administration usually at sick points alone.

The whole health care services begin with the daily routine jobs of each captive wildlife keeper. He keeps the cage or enclosure of the species clean, uses various disinfectants on the floors, regularly, as well the moats and pools chlorination, observes the animals in order to discover its complaints since animals don't talk in human articulate speech.

To do these effectively, he must maintain a good relationship with the life animals as well have sound knowledge of the species life history and behavioural traits. The keeper actually is the first person to discover when an animals is sick through his daily routine observations. The Veterinary doctor depends very much on his information and the animal's life history records for diagnosis and medication.

In most Zoos of the World where there are Veterinary hospitals built and medically equipped within the Zoos, the teamwork is much more easier than when health care administrations are usually attached to outside location Veterinary hospitals. Whichever is the arrangement, the veterinarian diagonise and medicate while the keeper is the 'nurse'.

- **HANDLING AND CARE OF WILD ANIMALS IN CAPTIVITY**

The species keeper is the best handler. The way and manner the keeper handles an animals depend on his personal experience.

Good relationship between the keeper and the captive animals i.e friendship mentality in both parties, the aggressiveness or docility of individual animals, age and dynamism of the species will all determine the level of success in wildlife handling.

Yet captive animals require handling either during diagnoses or transfer to enable cage repairs or inter-zoo loans. Animals generally exhibit funny traits and behaviours which must be carefully noted. Individualism and uniqueness in handling wildlife cannot be over-emphasised. Observations and experiences reveal that members in the same enclosure, same species and age may behave differently.

A good illustration is the case of two male mangabey monkey *ceriocebus torquatus* in University of Ibadan Zoo. These animals were of the same parenthood and over 6 years in same captivity. The behavioural differences showed that while one will allow keeper direct entrance and body contact within the enclosure, the other is such readily aggressive and will not allow it has to be separated into the inner rooms.

Some Zoo inmates are fairly domesticated and their handling simple. For example, the peafowl – *Pava cristatus* and Donkeys could move around in free range as observed in wildlife Parks, Jos and University of Ibadan Zoo respectively.

- **HANDLING FACILITIES**

However, there are various facilities in Zoos usually for handling the inmates when necessary. These include capture net, for the capture of birds, and small mammals, trap cage usually small and movable, Quarantines-for new animals arriving Zoos and separation of sick ones for treatments. The hand gloves and safety boots are worn by both vet doctors and keepers etc.

- **The Quarantines:** These are special cages so to say in Zoos usually for the accommodation of new animals arriving g the zoo. They need to be quarantined for some time be it animals on transfer from another Zoo, new purchase, or when hunters have just brought them out from the wild, there is the need to separate them.

The period of separation enhance the keepers and veterinary doctors the opportunities to study the uniqueness in such animals, the state of their health as well as the level of aggression or docility. These animals in themselves too, need to acclimatize to their new home and check on their new neighbors and species.

- **Trap Cages:** They are usually movable, transferable cages for the capture of Zoo inmates whenever there is need to do so. This happen when an animals is to be taken out of its species group perhaps on breeding loan to another zoo or just mere separation from others to enhance medical diagnosis and treatment.
- **Capture Nets:** These are particularly designed for the capture of smaller animals such as birds, small mammals and reptiles. They are built into different sizes. There is a long strong handle into which the net will be hanged. The long handle keeps the handler at a distance from the animals especially in species that are completely dangerous.

➢ FEEDING OF ZOO ANIMALS

In feeding captive animals, the food habits of each species must be considered. Some are herbivores e.g. Gorillas, Rhinoceros, Donkeys etc. Yet some are insectivorous feeding primarily on insects and worms e.g. some birds, monitor lizards etc.
For a successful management of captive animals, it is important to feed each species with their particular food items.

These animals hardly have problem locating their food or prey if let alone in the wild. The experience however is that when already captured from the forest and kept in Zoos, is that when already captured from the forest and inability to get all their normal varieties. In fact, there have been cases of Zoo managers refusing acceptance of some species in Zoos because of the fear of lack of food items they needed for survival. This same reason have accounted for the death of some Zoo collections.

Consider the case of pangolin, an animal whose life and growth depend mainly on insect and worms. Its survival propensity is zero in captivity. Another dimension of feeding problem common to zoo inmates in Africa is the inability to identify all the food varieties particularly the vegetation. At time the weather changes, compound the problem during the dry seasons some grasses and biological growth. The imbalances in diets have been observed a great factor against captive animals, physical and biological growth. The only solution lies in providing substitute food varieties capable of enriching their diets. E.g. boiled eggs, vebrages, boiled beans and meat.

➢ THE CONCEPT OF FEEDING REGIME

Feeding regime involves drawing up a feeding time table for different Zoo species. The quantity and quality of food ration are worked out. Each meal will be weighed depending on the digestive system, body size and weight of each species. The food ration need be served to individual animal since there could be possible domination by older or more powerful members during scrambles at food times if species are served together in their group. Feeding of captive animal may not be compared with feeding animals in free wild. The Zoo inmates feeding is regulated while those in the wild feed as often as the opportunities abound. However, the inmates have their food supplies without any efforts of their own while those in the wild roam and hunt fending for themselves. Probably they may consume more since they are at liberty to walk off excesses.

A typical example of feeding regime is that of University of Ibadan zoo were all carnivores are fed every other day by 10am or 11.30am. They are fed every other day by 10am or 11.30am, they are fed with weighed cow, goat or ram meat.

The primates feed daily at 10a.m and reptiles once per week etc. The food must be weighed based on individual animal consumption abilities.

➢ FOOD SOURCES AND STORAGE

Zoos must make adequate arrangement such that animal foods should be available as at the feeding hours. The food items could be contracted out by giving orders to animal food contractors at quoted prizes and such supplies may be received on weekly basis.

In some zoos, farmland are acquired for planting of various food items such as fruits, yams and rearing of goats for carnivores feeding. The problem usually associated with the feeding of animals in captivity is that of wastage generally.

Food ordered and supplied need be kept in the central food store. The experience at times is that much waste may be recorded than the actual quantity served the animals. The reasons being (1) faulty storage system (2) perishable items such as vegetables and fruits remaining in store for many days. Not many zoos can afford effective cooling and preservation system. Electricity power failure is a major threat where standby generators are lacking. Another general problem of feeding could be finance. This is possible where and when financial decisions are left in the hand of people of low knowledge of zoo management and wildlife conservation. They see no strong reason why much money should be committed to feeding animals. At times the contractors bills are not paid and hence stoppage of supplies. Also, general bureaucratic bottlenecks – in cases of Zoos run under Civil Service setting.

- **ZOO SANITATION –**

Zoo sanitation simply describes management activities that keep the Zoo hygienic and free of germs.

- **Importance of Zoo Sanitation:**

- To keep zoo animal healthy
- To prevent disease outbreak within the zoo
- It ultimately keeps zoo animal alive
- It safe cost of treating sick animals
- It also prevents visitors, zoo keepers and administrators from being infected with transmissible pathogens (Zoonosis).
- Regular weeding of zoo premises also prevents visitors, zoo keepers and administrators from being injured from deadly/injurious animate and inanimate objects such as scorpions, poisonous snakes and broken bottles etc.

- **Important Zoo Sanitation Activities includes:**

- Regular cleaning of zoo animal pen and cages
- Proper disposal of zoo animal droppings
- Regular weeding of zoo premises
- Disinfection of zoo premises and surrounding
- Removal of injurious inanimate objects from the zoo premises
- Proper placement of inmate feed in pens away from droppings

- **CONTROL OF ZOO VISITORS**

Control of zoo visitors is very vital for public safety and zoo protection. Zoo managers and wardens are responsible for zoo visitors control to minimize accidents. Visitors often from distant places from cities & perhaps foreign visitors are generally unfamiliar with hazards of African environment.

- **Management actions for zoo visitors control include:**

- Regulations e.g. out of bound to visitors
- Erection of signs and provision of adequate information about hazards and important issues.
- Training of Instructors on zoo visitors control strategies/ techniques.
- Appropriate law enforcement must also be put in place to
  - Protect people from crime and conflicts with other people within the zoo
  - Protect the zoo animals and facilities from visitors
  - Protect visitors from hazards within the zoo.