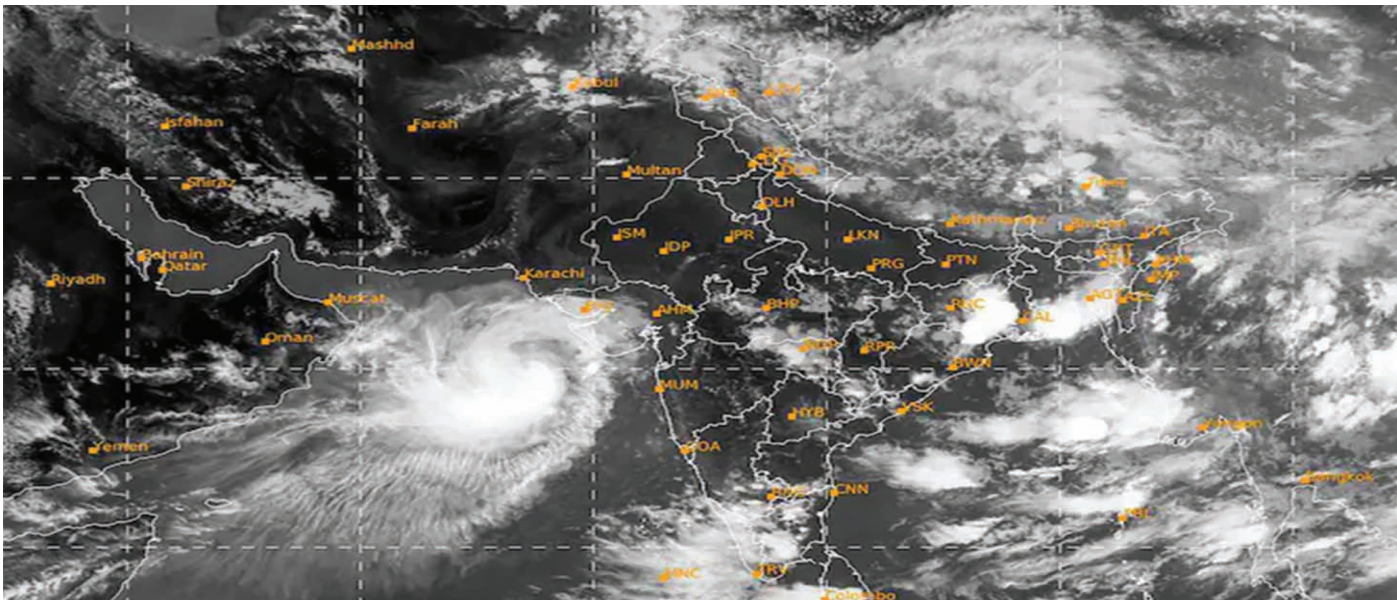


Cyclone “Biparjoy” Threat Mitigation Measures at GZRRC, Jamnagar

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Satellite image of Cyclone Biparjoy taken between 5:00 pm to 5:26 pm on June, 2023

Biparjoy, one of the longest churning cyclones in the Arabian Sea, was forecast to make landfall on the coast of Gujarat on evening 15th June 2023. In preparation the local administration of India and Pakistan shifted more than 30,000 people to safe shelters. The India Meteorological Department categorised Biparjoy as a Category 3 storm with windspeed ranging between 120 to 196 km per hour. Based on certain forecasting models, the Greens Zoological Rescue and Rehabilitation Centre (GZRRC) was deemed to be in the path of the cyclone. Hence GZRRC immediately implemented its disaster management policy and initiated all steps necessary to secure the safety of its animals, people and infrastructure. This report summarises the post-cyclone report of the threat mitigation measures undertaken by GZRRC to minimise the impact of the thunderstorms that ensued due to the landfall of Cyclone Biparjoy on the eve of 16th June 2023.

Disasters are defined as situations or events which overwhelm local capacity, necessitating a request to national or International level for external assistance.

The disaster management programme of GZRRC entails a continued integrated process of planning, organising, coordination and implementing measures which can aid in minimising the effect of the Cyclone on GZRRC facilities.

- A. Mitigating or minimising the threat posed by the Cyclone by advanced preparation.
- B. Capacity-building of staff to stay prepared against all emerging exigencies due to the Cyclone.
- C. Assessment team to conduct site-readiness evaluations and compliance with the disaster management plan to deal with any exigencies.
- D. Quick response team and advanced communication team to prepare for any exigencies.
- E. Optimisation of resources and mitigation of risks associated with the cyclone.
- F. Facilitate the resumption of normal activities.
- G. Identify areas of further improvement in case of future emergencies.

Spread across 568 acres, GZRRC has more 17 facilities constituting to the zoo, rescue centre, quarantine centres and conservation breeding programmes for various threatened fauna. All facilities are well connected by a world class road network. Each site at GZRRC has its very own security infrastructure, which is further complemented by the security infrastructure of GZRRC, thus providing a two layer security system that provides protection against any exfiltration or infiltration.

Challenges posed by the Cyclone

The Greens Zoological Rescue and Rehabilitation Centre is located in Jamnagar which is located 131 km from Dwarka where the Cyclone Biparjoy was scheduled to make a landfall on 15th June 2023. Due to the location of the zoo near a cyclone prone area, the GZRRC already had a disaster management protocol in place that was geared to deal with any exigencies.

- The risk of injuries (fatal or non-fatal) in housed animals and staff was one of the biggest concerns for GZRRC.
- Cyclones are likely to cause a significant amount of infrastructure damage, which would pose a large opportunity cost for GZRRC.
- The risk of animal escapes from GZRRC facilities to adjoining facilities and enclosures leading to injury to staff and animals.
- The risk of destruction of infrastructure that could hinder normal functioning of the zoo and its facilities.
- The risk of destruction of adjoining infrastructure due to unsecured material from GZRRC.
- Flooding
- Weakening of infrastructure that could lead to future damage and repair costs.



Wooden planks installed to prevent damage to glass barriers

Cyclone mitigation measures incorporated in the design of GZRRC

Due to its location, GZRRC has been designed to be resistant to earthquakes, thunderstorms, flooding and cyclones. Some of the salient features of GZRRC facilities to prevent against cyclones is discussed below.

The GZRRC facilities are designed to ensure that animal welfare is never compromised. Hence all enclosures are equipped with night shelters that have enough space and provide the animals ample opportunities to express species-typical behaviours while indoors. All night shelters have their very own HVAC system that can simulate the naturalistic temperature conditions required to maintain the species in homeostasis. All facilities at GZRRC are built to prevent damage from natural disasters which includes Cyclones and earthquakes. Additional steps were taken to ensure that all infrastructure and facilities were safe and secure from storm damages.

Additional Mud pumps were deployed to prevent flooding inside enclosures. A team of horticulturists ensured that all trees within and outside the enclosures were trimmed and reinforced. All glass barriers were secured with wooden planks to prevent escape of animals and avoid unnecessary injuries.

Design and construction

All enclosures and night-shelters are designed to withstand gale force winds and provide safe-refuge to animals as well as keepers. There are separate quarters attached to night houses where keepers can take shelter in case of an emergency. The HHVAC system of the keeper facility is separate from that of the animals. Biosecurity measures are put in place to ensure that keepers are not exposed to any pathogens while taking care of animals.

Staff safety protocols

All staff members are trained on the disaster management protocols of GZRRC as a mandatory part of their boarding probationary period. Monthly mock drills and training drills are conducted with all pertinent safety equipment to hone the learnings. Every site has access to emergency safety equipment to tackle any emergency, which includes fire fighting equipment, emergency animal rescue, human rescue, emergency medical equipment and other safety gear.



Light flooding post-cyclone at GZRRC

- | | |
|-----------------------|---|
| • Y poles | • Bolt cutters |
| • Large nets | • Chainsaw |
| • Anti-bite gloves | • Aluminium ladders |
| • Plastic stick | • Ropes of various length and diameters |
| • Binoculars | • Flashlights |
| • Head lamps | • Fire extinguishers |
| • Mega phones | |
| • Animal carrying rug | |



Emergency equipment distributed to all site specific staff to mitigate the threats posed by Cyclone Biparjoy

Emergency evacuation protocols

GZRRC has well-defined evacuation plans and all staff are trained about the same along through regular training and mock drills. All enclosures were furnished with adequate transport cages so that animals could be shifted to safe locations in case of any structural damage to existing housing facilities. The staff are also trained on emergency rescue and fire drills to mitigate the risk of injury among the personnel.

Emergency backup power supply

Zoos require large amounts of water, food and power to operate under normal conditions. During Cyclones and other natural calamities, regular supply of fresh water, power and feed may be interrupted or halted. Hence it is crucial to have other standalone sources of power supply that can act as an emergency backup until normal services are resumed. GZRRC facilities have backup power generator facilities that can provide emergency power backup for HVAC systems, water pumps and cold storage chains.

Emergency Pharmaceutical supply

The following veterinary medical supplies were procured and distributed across all sites to ensure that all veterinary teams were equipped with necessary prophylactic and therapeutic medications. Tranquilliser guns were secured and adequate darts along with medications were available at accessible secure facilities across sites, with quick response teams and veterinary teams.

Communication system and Control room

A central control room equipped with the latest communication system consisting of mobile network along with radio transceivers constitute the communication system at GZRRC. All site supervisors and head keepers carry official mobile phones with all pertinent numbers on speed dial along with a radio-transceiver that has ten channels of communication to the control room and other pertinent service facilitating inter and intra-site communication. The central control room ensures that all sites are coordinated in their efforts to prevent the impact of cyclones on GZRRC. The control room allows for the optimisation of resource utilisation across all sites. Additionally, the Control room ensures that all sites receive the same instruction via single chain of command to avoid confusion during emergencies.



Additional steps taken by GZRRC to mitigate the threats of Cyclone Biparjoy

A. At the onset of the Cyclone preparedness programme, the following key stakeholders were identified from each site, who would lead the programme and conduct necessary operations as per the disaster management plan in coordination with the control room.

1. Veterinary officers and curators.
2. Animal keepers and supervisors.
3. Security team
4. Carpenters, welders and helpers.
5. Ambulance coordinator
6. Ambulance team
7. Drainage team equipped with mud pumps and gully suckers.
8. Warehouse and inventory team
9. Refuelling team for vehicles and electrical backup.
10. Animal feed management and supply team
11. Horticulture team equipped with chain saws and other equipment necessary for trimming trees and conducting safety checks on trees.



Specialised mud pumps acquired and installed at GZRRC

12. Management team audited all cyclone preparations.

B. All the above mentioned teams were tasked to audit all facilities and provide comprehensive reports on possible weaknesses and resolve the same within a limited timeframe.

C. Separate site-wise plans were developed based on the unique location of the site in relation to the coast (orientation). Vulnerable structures were identified and secured. All construction was halted across sites and all construction materials were secured or shifted to secure facilities.

D. For 24 hours preceding the landfall of the cyclone, all



Large nets deployed to prevent flying objects from damaging enclosures and injuring animals

animals were brought indoors. The only exceptions were large herbivores and other herd living animals. Large windbreaks were installed across all herbivore enclosures and nets were deployed to prevent large flying objects from breaching the enclosures. Animals that were housed inside the retiring cells were furnished with cognitive enrichments and could view the paddock through the glass viewing area inside each night shelter. The HVAC system and drainage system ensured that the animals were comfortable during the prolonged stay inside the retiring cells.



Naman Dani, Facility-In-charge at Leopard Rescue Centre briefing the animal care takers.

Rescue and Outreach efforts of GZRRC to provide relief to surrounding areas

GZRRC has been founded on the principles of global biodiversity conservation through animal welfare and people empowerment. In consonance with that goal, GZRRC provided relief support to adjoining areas via veterinary relief camps. GZRRC Veterinarians, support staff and vehicles were available and prepared to meet any veterinary medical emergency arising due to the cyclone. GZRRC was in constant contact with the local administration, forest department office and police headquarters regarding the developing situation of the cyclone.

Post-event evaluation

A comprehensive post-event evaluation has been conducted to assess the resiliency of the infrastructure and the feedback of the unground staff regarding the scope of improvement of the same. 50 keepers across all sites along with site supervisors, curators, veterinarians participated in a on ground post-event evaluation exercise and filled the post-event evaluation. The significant outcomes from the post-event evaluation are shared as follows.

Preparedness and planning

- GZRRC staff executed the disaster management plan on the ground effectively which resulted in minimal loss in property or life.
- Our office comprehensively perused the cyclone emergency plan of GZRRC and found it more than adequate to tackle any or all emergencies arising out of the incoming cyclone.
- The cyclone preparedness and disaster management plan clearly outlined the plan of action for all stakeholders in case of any emergencies.
- A clear chain of command was established to ensure that there was minimal chance of communication errors during the said emergency.
- The entire management team constituting of director, assistant directors, and curators along with veterinarians regularly audited the compliances with regard to cyclone preparedness and disaster management plan of GZRRC.
- All aspects of the compliance were regularly reviewed and any exigencies arising from the same was addressed immediately.

Early Warning System

GZRRC implemented multiple modes of communication across all sites and facilities to ensure that there was a clear mode of site-specific instruction relayed through a single chain of command. This included providing timely and accurate information about the cyclone and site wise wind speeds. The staff upon interview highlighted that the clear communication of evacuation routes and other safety instruction was crucial in realising the zero-injury policy of the organisation. The early warning system of GZRRC complemented with the efficient communication tools ensured that all staff were adequately updated.

Animal Health and Welfare

Animal health and welfare is the top priority of Greens Zoological Rescue and Rehabilitation Centre. All animals except for the herd living herbivores were brought inside for the duration of the storm. GZRRC staff used positive reinforcement based conditioning techniques to create a positive rapport with the animals allowing the staff to shift the animals by hand signals without resorting to tranquillisation. Due to the good keeper-animal relationship promoted as a policy at GZRRC, animal welfare is never compromised. All animals that were brought indoors had access to food, water, and conspecific interactions. Appropriate storm-resistant shelters were provided to group-living herbivores to protect them from the inclement weather patterns. All night shelters at GZRRC are pre-equipped with a highly functional HVAC system and automated water bowl fillers. Each night house has its very own deep freezer, that is used to store food-based enrichment devices that were periodically provided to animals to keep them engaged and stimulated. Emergency evacuation protocols along with transport cages, ambulances and transportation vehicles were made available at each site.

Summary

Due to its unique location Greens Zoological Rescue and Rehabilitation Centre enjoys a mild maritime climate for most parts of the year. However, this location also makes it vulnerable to Cyclonic events during the onset of summers. According to meteorologists, Arabian Sea Cyclones are going to become more frequent and severe in the coming years. Therefore it is important for GZRRC to have a robust cyclone threat mitigation plan which is constantly updated to meet the challenges posed by the vagaries of ever changing weather patterns. GZRRC prides itself on the unique design of its infrastructure and facilities that suffered close to no damage during the severe thunderstorms that occurred as consequence of Cyclone Biparjoy making a landfall on 16th June 2023. More importantly, GZRRC's cyclone threat mitigation policy and disaster management plan was executed by well trained on-ground staff, which further minimised the damages and resulted in no injuries to any staff member or animals housed at GZRRC. GZRRC will use the learnings from this event to improve its policies and provide better training to its staff and offer better protection to its animals.