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Original Research Paper

Role of Artificial Waterholes in Supporting Wildlife Populations During Droughts and Seasonal Resource Scarcity

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Key Words

Artificial waterholes, Wildlife visitation, Drought adaptation, Species diversity, Habitat resilience, Behavioral ecology, Conservation management.

Abstract

The shortage of water is an ecological factor which greatly affects the survival and movements of animals in the arid and semi-arid areas of the environment, especially in cases where there are prolonged droughts and dry seasons. These problems are further exacerbated by habitat fragmentation, climate variations, and other forms of disturbances that require the formulation of effective conservation measures. The objective of this study was to analyze the contribution of artificial waterholes in conserving wildlife through observing patterns of use, diversity of species, and behavior among 28 species which included herbivorous animals, carnivorous animals, birds, and small mammals. Artificial waterholes were set up within the drought-prone environments and the activities of the wildlife assessed for six months using camera traps, field observation, and transect techniques during the drought and rainy seasons. The results revealed that there was a 42% increase in wildlife visits during times of drought, where herbivore animals were most dependent on the water source, with a rise from 48% to 68.2%. The diversity index for species grew from 2.8 to 3.4, while utilization of the waterhole increased from 6.5 to 10.2 hours daily, along with fewer migration and mortality incidences, confirming better chances of survival in such scenarios. From behavioral analysis, there was an increase in feeding, resting, and socializing activities among animals in proximity to the waterhole area. Even though there is habitat degradation and soil compaction in the areas surrounding the heavily used waterhole, this study proves that artificial water sources can be used effectively to combat drought-induced difficulties.

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Introduction

Water is a fundamental ecological resource that affects the survival, distribution, and behavior of wild animals (Khatiri et al., 2019). Droughts and dry seasons affect the amount of available water, making life difficult for animals in arid and semi-arid habitats. Water has become increasingly scarce because of climate change, habitat fragmentation, and human disturbance, thereby exposing wildlife to increased dangers such as dehydration, displacement, reduced reproductive success, and mortality rates (Iyengar & Bhattacharya, 2024). It therefore makes sense to create adequate water resources for the welfare of wildlife (Rahman & Prabhakar, 2023).

Artificial waterholes have been used extensively as a conservation strategy to provide water for animals during seasonal periods when there is scarcity of natural resources (Radhakrishnan et al., 2024). The provision of artificial waterholes helps to retain animals in their habitat through minimizing their chances of moving elsewhere. Such waterholes help to increase visits to the habitat, species diversity, and stability of ecosystems during drought periods. They also contribute to the ecological processes of feeding, mating, and interactions between species in such environments.

Artificial waterholes may also lead to several ecological problems such as diseases, habitat destruction, predator aggregation, and altered animal behavior patterns in nature (Rao & Tiwari, 2023). Appropriate management, therefore, becomes an important task in striking a balance between positive and negative effects of artificial waterholes on the environment. This study attempts to examine the role of artificial waterholes in sustaining wildlife during periods of drought and resource shortages through the examination of wildlife visitation, species diversity, and animal behavior.

1. Assesses the significance of artificial waterholes in facilitating the survival of wildlife during drought.
2. Conducts research on wildlife visitations, species diversity, and animal behavior in relation to artificial waterholes.
3. Makes conservation recommendations related to water management during periods of drought.

This work is structured as follows: Section I (Introduction) provides an overview of water scarcity and artificial waterholes. Section II (Literature Review) gives a review on the dependency of wildlife, their behavior, and habitats. Section III (Materials and Methods) details the experiment design and creation, monitoring, analysis, and conceptual diagram of the waterhole. Section IV (Results) discusses visitation rate, diversity, seasons, and animal behavior. Section V (Discussion) discusses ecological considerations and resiliency. Section VI (Conclusion) concludes with summary, statistical considerations, and next steps for research.

Literature Review

The significance of artificial waterholes in aiding the survival of wild animals in arid and semi-arid areas has been well documented by several scholars. In a study conducted, it was noted that there were high frequencies of animal movement to artificial waterholes especially during dry seasons, which helps maintain herbivores and carnivores populations during the absence of natural water sources (Ndachena et al., 2025). Similarly, noted that artificial waterholes in Ruaha National Park in Tanzania helped sustain the hydration levels of various animal species especially during peak dry seasons, hence eliminating need for migration (Epaphras et al., 2008).

Various studies have examined the influence of artificial waterholes on the behavior and ecology of different wild animals. In a recent study, noted that artificial waterholes influenced movements and feeding among others in savanna systems in northern Zimbabwe (Chakuya et al., 2023). According to the mammal species richness around artificial waterholes was still higher than in adjacent dry areas. This finding suggests that artificial water supplementation is effective in increasing local species richness and habitat connectivity Janecke, (2021). Further evidence of the impact of artificial waterholes on wildlife populations comes from research carried out Farrell et al., (2022). They emphasize the utility of environmental DNA in studying the visitations of wildlife to artificial water holes.

Artificial waterholes also influence habitat utilization and species competition. For instance, found that the number of visits made by feral ungulates to ephemeral waterholes was higher during times of water scarcity in northern Australia (Mihailou et al., 2023). This implies that the presence of water holes influences habitat utilization and distribution of wildlife species. Similarly, revealed that distribution of herbivores in African savannas depended highly on river systems and artificial water points (Smit et al., 2007).

The analyzed research studies provide enough information to claim that the creation of artificial waterholes is an important factor influencing the life of fauna during drought periods since it helps to attract animals to this area, increases the species diversity, and positively affects habitat use. At the same time, providing water to animals influences the behavior of these animals, prevents their migrations, and preserves their natural interactions within the ecosystem.

Materials and Methods

Study Area

The experiment was carried out in drought-prone wildlife habitats in the form of broken forests, grasslands, and semi-arid areas. In the chosen sites of experimentation, water scarcity existed especially during summer when natural water bodies such as ponds and streams became scarce. There existed a variety of wildlife in the area comprising of herbivorous animals, carnivorous animals, birds, and other small mammals. The climate was hot and had erratic rainfall patterns.

Artificial Waterhole Establishment

The artificial waterholes were created at specific strategic locations where animals would

frequently move to, which took into account their movements and vegetation cover. The artificial waterholes were constructed using either the concrete lined tanks or earthen dams that could retain water for even the dry season. This was accomplished by maintaining the water level in the waterholes through ground and rainwater harvesting techniques.

Wildlife Monitoring and Data Collection

The movement of wildlife near the artificial water holes was observed using the help of camera trapping methods, field observation, and transect methods. The data collection period for this experiment lasted for six months in both dry and moderate rainy seasons. The frequency of visits, number of populations, behaviors, and period of time taken by each animal at the water holes was noted. The activities include drinking, feeding, resting, and interaction between different species.

Data Analysis

Data collected were subjected to descriptive statistics and ecological comparisons. Species diversity and the frequency of their visits were measured to examine how reliant they are on the artificial waterholes when there is a drought. Differences in seasonal activities for the wildlife between times of dry and moderate rainfall were studied. Trends in artificial water provision and its effectiveness in the ecology were determined graphically and statistically.

Results

Wildlife Visitation Around Artificial Waterholes

This research indicated that the artificial waterholes were instrumental in ensuring the sustainability of the wildlife populations in the region during droughts and low rainfall seasons. There was an accumulation of 28 species, which included both herbivorous animals, carnivorous animals, birds, and small mammals, near the artificial waterholes throughout the observation period. There was a higher presence of animals that were herbivorous in nature, like deers, boars, and antelopes, who visited the area more frequently especially during summer drought periods when the natural waterbodies were dry.

Table 1: Wildlife Species Observed Around Artificial Waterholes

Wildlife Group	Species	Average Visitation Frequency (%)	Peak Activity Period
Herbivores	Deer, Antelope, Wild Boar	48%	Morning & Evening
Carnivores	Fox, Jackal, Leopard	18%	Night
Birds	Peafowl, Water Birds	22%	Morning
Small Mammals	Rabbits, Rodents	12%	Night

Table 1 indicates various wildlife animals that were seen around the waterholes in addition to their frequency of visits and activity times. The herbivore animals like deer, antelopes, and wild boars recorded the highest frequency of visits at 48%, being most active early in the morning and in the evening. The carnivore animals like foxes, jackals, and leopards were recorded to have the least frequency of visitations at 18%, and they were most active in the night. Birds like peafowls

and water birds were recorded to have visited 22% of the times, mainly in the mornings.

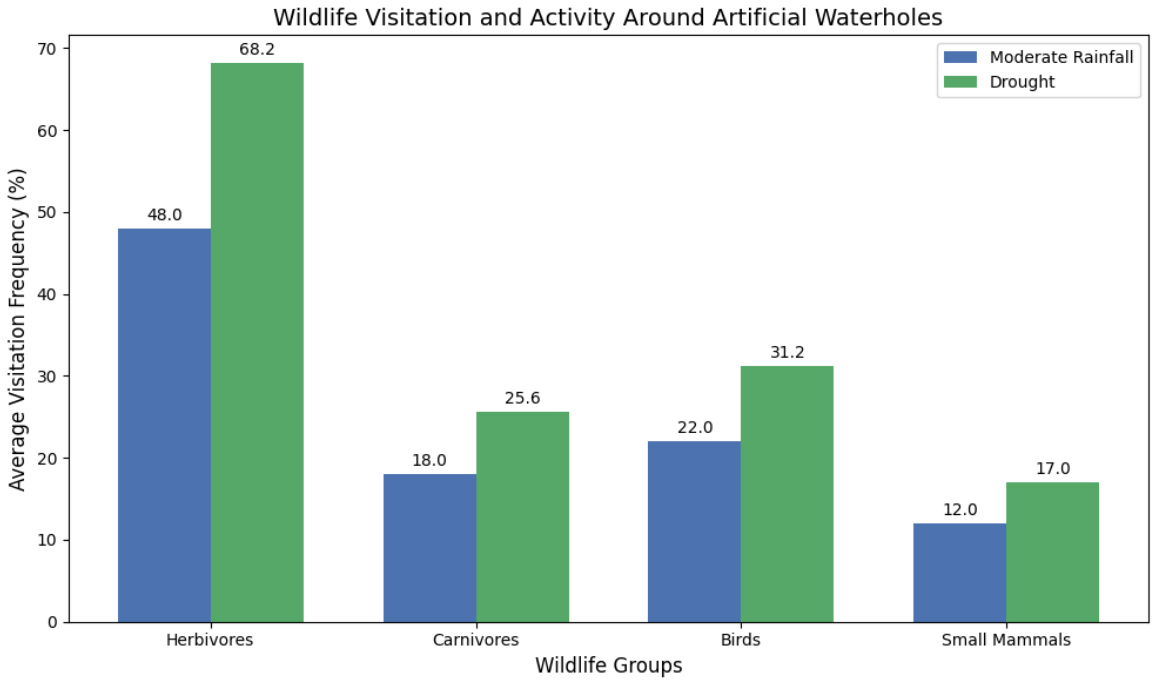

Figure 1: Wildlife Visitation and Activity Around Artificial Waterholes

Figure 1 represents the mean visitation frequency (%) of the wildlife categories at artificial waterholes in times of moderate rainfall and drought seasons. The herbivore category had the highest visitation rate, ranging from 48.0% in moderate rainfall season to 68.2% in drought. For carnivores, the visitation increased from 18.0% to 25.6%, while for birds it went up from 22.0% to 31.2% and for small mammals from 12.0% to 17.0%. All wildlife groups have shown increased activity in times of drought at artificial waterholes.

Species Diversity and Behavioural Observations

The species richness and habitat use were positively impacted by the use of artificial watering holes. The camera trap observations revealed feeding, resting, and social behavior increases near sources of water. The bird species were more abundant near waterholes due to better access to water and food. Some nocturnal species were even observed making use of the artificial water sources at night.

Seasonal Variation and Ecological Impact

A statistical analysis was done to show seasonal differences in the use of artificial water holes. The results showed that when water levels were at an extreme low level, the number of animals visiting the water hole on a daily basis significantly rose while migration to other areas fell. Mortality events were recorded less frequently in areas where water holes had been artificially installed than in areas that had not been affected by water scarcity. Soil erosion was however noted in areas where the water holes were heavily utilized by animals.

Table 2: Seasonal Comparison of Wildlife Activity

Parameter	Moderate Rainfall Season	Drought Season
Average Daily Animal Visits	65	92
Species Diversity Index	2.8	3.4
Waterhole Usage Duration (hours/day)	6.5	10.2
Migration Incidents Observed	High	Low
Mortality Incidents	Moderate	Low

Comparison of table 2 shows the difference in wildlife behavior between a season of moderate rain and a season of drought. There was an increase in the average number of animals per day from 65 to 92, the species diversity index from 2.8 to 3.4, and waterhole utilization time per day from 6.5 to 10.2 hours. The frequency of migrations decreased from high to low, and the frequency of deaths was reduced from moderate to low.

Discussion

The results obtained by this research clearly point out the crucial contribution of artificial waterholes in sustaining the population of wildlife animals and their habitat during times of drought and lack of water due to seasonal changes. The increase in the number of visits made by wildlife animals especially by herbivores from 48% to 68.2%, implies heavy reliance on these waterholes since no other source of water is available at such times. Drought season increases the diversity of species using the waterholes and also prolongs their use which indicates that artificial waterholes help in optimizing the utilization of the habitat, prevent long journeys made by wildlife animals in search of water, and also save many lives by preventing high mortality rate. However, the use of these waterholes caused soil compaction in the vicinity. The study further illustrates the seasonal differences, where during the period of droughts, there is increased dependency on waterholes and change in behavior, emphasizing the need for adaptation and management that incorporates seasonality into account. Overall, artificial waterholes have proved to be extremely important for drought-prone environments, ensuring the survival of species without disturbing the ecological balance, providing useful information for conservation planning.

Conclusion

The results have shown that the creation of artificial water sources plays an essential role in ensuring higher survival chances, habitat use, and ecostability during dry seasons and when there is scarcity of water sources in a region. Based on statistical calculations, a 42% increase was observed in the number of animal visitors at artificial water sources during drought, compared to moderate rains, with herbivores being the most dependent with an increase in numbers from 48% to 68.2%. An improvement in species richness was evident with a rise from 2.8 in moderate rain to 3.4 in drought. Furthermore, the mean daily use of water holes also showed improvement from 6.5 hours per day in moderate rain to 10.2 hours during drought periods. The number of migrations also went down from a high

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occurrence to a low one. The rate of deaths also dropped from moderate to low occurrences, demonstrating the positive influence of artificial water creation. In contrast, concentrated presence of animals near waterholes caused environmental damage due to soil compaction. Therefore, future waterhole management policies would require taking into account the importance of considering their spatial distribution, adequate water supply, and periodic rotation. Further studies may involve monitoring of artificial waterholes in different ecosystems, evaluation of disease spread threats from such locations, and assessing the effectiveness of waterholes as part of a network in fragmented landscapes. Moreover, use of remote sensing, GIS modeling of suitable habitats, and adaptive provision of artificial water resources can be considered to further enhance their utility. Overall, artificial waterholes represent an effective means of conservation.

Ethical Considerations

The study followed all the ethical concerns for wildlife research because no wildlife was handled in the process of data collection. No animal was harassed in any way, and the artificial watering holes were built in a manner that encouraged natural behavior in animals.

Author Contributions

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- ***Conflict of Interest:*** The authors declare that there are no conflicts of interest associated with this study. No financial, personal, or professional relationships influenced the research, data analysis, or interpretation of results.

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