Human-Wildlife Interactions with an Emphasis on the Feral Water Buffalo and the Conservation Consequences for Indian Rhinoceros in Pobitora Wildlife Sanctuary.

Article DOI: https://doi.org/10.69627/NOL2024VOL1ISS2-02

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Noesis Literary Volume 1 Issue 2 (Jul- Dec) 2024, pp 19-35
ISSN : 3048-4693
Issue DOI : ttps://doi.org/10.69627/NOL2024VOL1ISS2
Journal DOI: https://doi.org/10.69627/NOL2024

Abstract:

Interactions between humans and wildlife are common throughout the world. There are often conflicts between humans and wildlife, particularly in areas were human settlements and agricultural lands border protected wildlife habitats. There is often crop damage and livestock predation caused by these conflicts, as well as human injuries or deaths, which can present sig-

nificant challenges for conservation efforts and local communities. In this study, we examined the phenomenon of buffaloes wandering into the fringe areas of Pobitora Wildlife Sanctuary in order to understand the interaction between Feral Water Buffaloes and humans. These occurrences were studied to determine the causes and measures taken by local farmers to prevent them. This study involved field surveys, open-ended questionnaires, and community engagement over the course of eight months between July 2023 and February 2024. Based on our research, we identified zones of human-buffalo interaction within a 7-kilometer radius of the sanctuary where the most significant impacts occurred. Solitary buffaloes, rhinoceroses, and buffalo groups frequently stray out of the sanctuary, escalating tensions among villagers. Particularly solitary buffaloes posed a greater threat to humans than herds. In the Pobitora Wildlife Sanctuary, cropping patterns, agricultural practices, and wildlife behavior have changed significantly, highlighting the need for targeted mitigation measures in order to maintain a peaceful coexistence between humans and wildlife and to maintain rhinoceros' populations.

Keywords: *Human-Wildlife interaction, Pobitora Wildlife Sanctuary, Feral Water Buffalo, Rhino, Conservation.*

1.Introduction

The straying of wildlife from protected areas (PAs) is a common phenomenon, particularly when the perimeter of the PA is surrounded by fringe villages. Pobitora Wildlife Sanctuary (PWS) is a notable example of this, where Feral Water Buffaloes (FWB) (*Bubalus arnee*), Greater One-Horned Rhinos (GOH) (*Rhinoceros unicornis*), and Wild Boars (*Sus scrofa*) frequently venture into nearby villages. These animals often raid crops and seek refuge in suitable habitats outside the park. PWS is home to the highest density of Rhinos and supports a significant population of Buffaloes. According to the 2022 census, PWS hosts 107 rhinos within the 17 square kilometers of suitable habitat in the park. Similarly, the sanctuary houses approximately 200 feral buffaloes in the same areas. The presence of thousands of cattle further exacerbates grazing competition, leading to insufficient resources for these large herbivores and prompting regular straying (Bhatta, 2011).

The history of buffaloes in Pobitora Wildlife Sanctuary dates back to before 1971 when the sanctuary was designated as a grazing reserve. The local community engaged in buffalo farming, which was integral to the rural economy. Buffaloes were reared for milk production, farming, and cultivation. However, when the grazing reserve was converted into a Reserve Forest in 1971, residents abandoned their settlements, as well as buffalo sheds due to legal issue. These buffaloes later became feral and now form a strong population within the sanctuary.

There are approximately 27 fringe villages surrounding PWS, where agriculture is the primary occupation. The close proximity of these agricultural lands to the sanctuary boundary frequently results in human-wildlife interactions. These interactions manifest in both visible and hidden forms, such as crop raids or destruction of stored food (Kolinski and Milich, 2021), prop-

erty damage, livestock depredation, psychological effects, food insecurity, attacks on humans, and disease transmission (Ogra, 2008).

In many parts of the developing world, wildlife inhabits landscapes outside PAs, leading to conflicts and competition for space and food resources with local communities (Madden, 2004). In the case of Pobitora Wildlife Sanctuary, the boundary often overlaps with cattle grazing fields. The habitat of the sanctuary is severely degraded due to extensive cattle grazing, invasion of alien species and anthropogenic factors. So, approximately 40% of the total rhino population moves out of the sanctuary at dusk and returns at dawn (Bhatt, 2011; Talukdar et al., 2007), likely in search of food and space, resulting in conflicts with people.

Similarly, herds of buffaloes have been reported to stray out of PA regularly, entering crop fields mainly to graze and mate, leading to predominantly negative interactions with humans.

In light of these incidents, this study aims to understand the phenomenon of Feral Buffaloes straying outside PA and their interactions with fringe villagers. The objectives of the study are to:

1. Assess the presence of Feral buffaloes outside PWS.
2. Understand community perceptions towards the conservation of rhinos and other wildlife within Sanctuary.

By addressing these objectives, the study seeks to provide insights into human-wildlife interactions in the region and inform targeted mitigation strategies to foster coexistence and preserve the biodiversity of PWS.

2. Study area

Pobitora Wildlife Sanctuary falls between 26°14'-16'N, 91°57'-92°05' E, in Morigaon district of Assam and is located in the floodplains of river Brahmaputra and constitutes of two south bank tributaries Pokoria and Kolong river and a hillock (Raja Mayang). The Brahmaputra River and the Garanga Beel provides a natural boundary to the north and south of the sanctuary and a total of 27 villages residing in the eastern and western periphery of the sanctuary.

PWS constitutes a total area of 38.81 sq. km. The sanctuary was initially covered with dense marshland and was surrounded by farmlands and paddy fields. It was in the year 1971 when it was declared as a Reserve Forest and due to unexpected decrease in the rhino population, the Reserve Forest was declared as a Wildlife Sanctuary in 1987

The vegetation type of the sanctuary is broadly of two types- i.e. a) Tropical alluvial plain vegetation and b) Tropical moist semi evergreen hilly forest (Bhatta, 2011; Bora and Kumar, 2003).

The climate of the area can be treated as subtropical monsoon type with four distinct seasons like other parts of the state i.e.- Winter (December–February), Pre-monsoon (March–May), Monsoon (June- September) and Retreating-monsoon (October-November) (Bhatta, 2011; Borthakur, 1986).

In addition to GOH and FWB, the sanctuary is also home to Wild boars, Leopard, Jungle cat, Golden Jackal and a large number of birds, amphibians, reptiles and fish species.

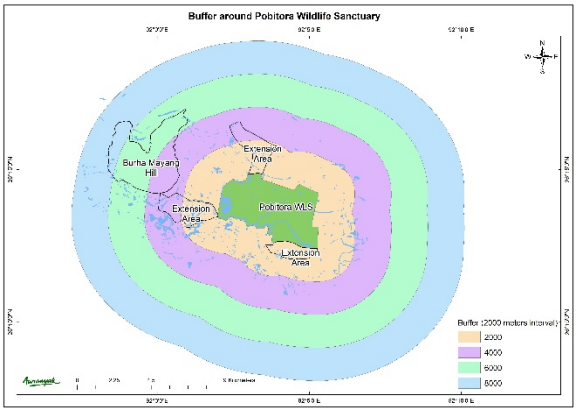

Figure 1. Map of Pobitora Wildlife Sanctuary.

3. Methodology

The study is underpinned by the Grounded Theory that begins with documenting individual's observations (respondent's responses) rather than hypothesis (Babbie, 2013). We focused on the fringe villages that are present in the periphery of the sanctuary. The study was carried out from July 2023 to February 2024 covering monsoon and dry seasons.

3.1 Data Collection

The data collected for this study was carried out using three different methods- Observation, Surveys, and Secondary Research.

3.1.1 Primary Data

Observations-

We surveyed the periphery of the sanctuary and sought for signs such as grazing and browsing, foot trails such as hoof marks, and dung sighting. All the signs were recorded via photographs through camera and mobile phones. GPS locations were taken from the sites where signs of presence were found. All the primary data were collected and recorded on Microsoft excel and were later analyzed. We used QGIS domain to analyze the coordinates.

Surveys-

To understand the depth of the situation of Buffalo stray incidence we conducted a survey via open-ended questionnaire. The motive to conduct an open-ended questionnaire was to give the respondents the freedom of sharing their viewpoints and insights of the situation. We interacted with the respondents which helped us to understand their perspective on Feral buffaloes constantly raiding their crops. The survey also helped us to cover a wide range of concerned topics such as constancy of stray buffalo encounters, locations of interactions and its effect on local community and their perspective towards it.

3.1.2 Secondary data

For secondary data we reached out to the Range office of Pobitora Wildlife Sanctuary, the village heads and the local community residing near the sanctuary.

4. Results and Findings

The sample size of the survey was 120 (n= 120 respondents). Their age ranged from 25 to 65 years. 78% of the respondents were male and 22% were female. A total of 24 villages were affected by stray Feral buffaloes. It was observed that most of the affected areas are within 7 kilometers from the sanctuary's boundary.

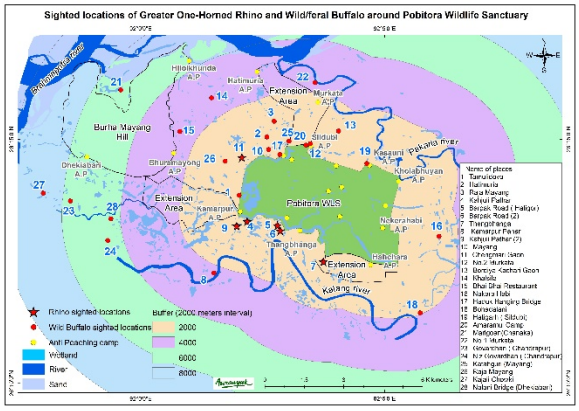

Figure 2- Sighted locations of Feral Water Buffalo and Greater one-horned rhino around Pobitora Wildlife Sanctuary.

4.1 Buffalo Stray Behavior

From the data collected, 21.42% of the buffaloes stray out of the sanctuary are solitary, 57.14% of Buffaloes stray out in groups while the rest 21.42% of groups of buffaloes were seen straying out with rhinos. According to our study, the solitary buffaloes tend to cover long distances and they possess more threat to humans. They travel approximately 6-7 km beyond sanctuary's boundary. Whereas the buffalo that strays out in groups, cover short distances and possess less threat to humans and travel approximately 3-4 km beyond the sanctuary's boundary. I also found that there were incidents of buffaloes occasionally straying out along with Rhinos.

4.2 Patterns of Buffalo encounter

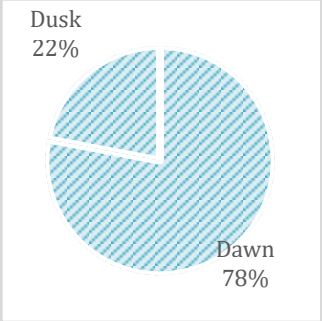

Figure 3- Percentage of buffalo encounters with humans.

78% of the incidents occurred during early mornings. As per the data collected from the respondents, the time between 3 am to 5 am is considered as peak for the buffaloes to stray out of the sanctuary. Most of the crop raiding and human encounters occurred during these hours. And 22% of the incidents took place during the evenings.

Table 1: Stray and Temporal Pattern of Buffaloes.

Study Pattern	Time (in %)		Occurrences (in 8 months)
	Dawn	Dusk	
Solitary	66.7 %	33.3%	12 times
Groups	87.5%	12.5%	32 times
Buffalo along with Rhinos		100%	12 times

4.3 Crop choices and Crop depredation

The data analysis revealed that, Buffaloes mostly preferred Paddy, followed by Maize and Mustard as the least preferred crop.

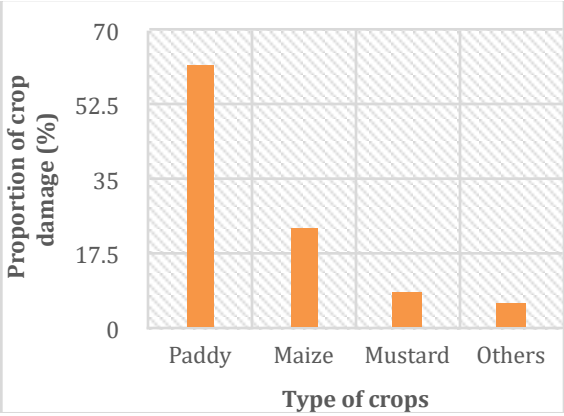

Figure 4- Percentage of crops preferred by Buffaloes.

As per our survey, 60.71% of the affected crop fields are < 1 bigha in area, whereas 39.29% are > 1 bigha. Chanaka and Khalsila villages were reported the highest crop field damage by buffaloes i.e. 6 bigha and 5 bigha respectively.

Table 2: Total area affected by stray buffaloes.

Crops Damage	Total Villages Affected	Total area affected (approx. in hectare)
Paddy	15	2.44
Maize	6	1.73
Mustard	3	0.25

4.4 Fatality and Injury

The data collected from the forest department, revealed that a total of 5 incidents were reported. Among these individuals, 4 of them sustained injuries while one tragically succumbed to dead.

Table 3: Total Fatality and injuries due to feral buffaloes.

Name of village	Date	Age	Fatality/Injured
Niz Gobardhan	15/12/2023	12	Injured

Niz Gob-ardhan	15/12/2023	65	Injured
K a-marpur	17/12/2023	55	Injured
Niz Gob-ardhan	15/12/2023	11	Death
N a k a r a Habi	11/03/2024		Injured

4.5 Mitigative measures against Feral buffaloes.

To protect their lands from getting ravaged, the villagers often built ‘Tongi Ghar’ in the crop field where they spent the night till early morning guarding their lands. Apart from this, the villagers also rely on other measures such as human dummies, bamboo barriers, barricade made of Betel nut trees and sometimes digging shallow trenches. Despite of these measures, the buffaloes tend to find their way in to these agricultural lands. The villagers sometimes use more aggressive ways to keep these animals away from their lands, such as bursting crackers, using fire-sticks, banging metals and utensils and high beam lights.

The data revealed that the community is mostly depended on Bamboo barriers as a mitigative measure, followed by bursting of crackers, banging metals and were least depended on Human dummies.

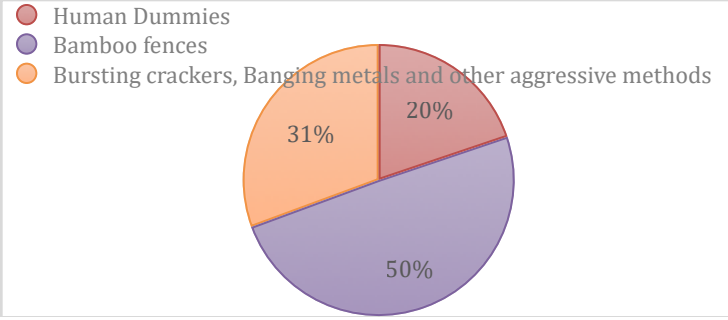

Figure 5- Mitigative measures taken by villagers.

4.6 Community Perceptive.

The community mostly thinks buffaloes as nuisance. 75.10% of the respondents holds a negative view of buffaloes. The chart below illustrates a comparison of attitude towards Buffaloes and Rhinos.

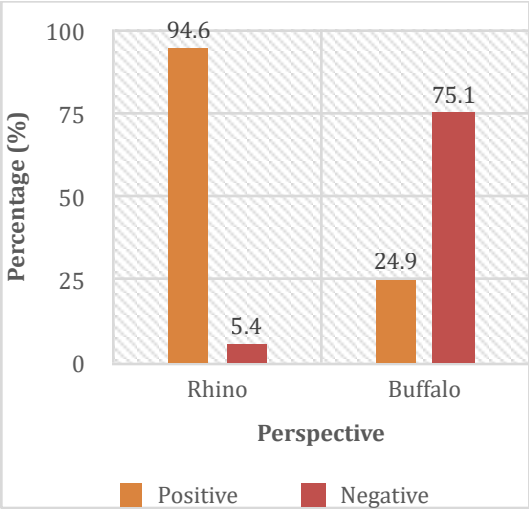

Figure 6- People's view towards Rhino and Buffaloes.

5. Discussion

PWS has always been in the spotlight for its rhino population, not much attention has been given to one of the other major species of the sanctuary that is thriving very successfully i.e., the Feral Water Buffalo. Till date there have been limited researches or studies conducted on Feral Buffaloes and almost none in PWS.

Human-buffalo interactions has drastically escalated in the past few years. In this study, out of 27 villages surveyed, 24 villages have reported incident of Buffalo raiding their crops, of which 15 villages have reported incidents of buffalo raiding paddy of approx. 2.44 hectares.

This study highlighted the villages that were mostly affected by FWB but it also led us to understand the stray behavior of the buffaloes. As per the results, 78% of the incidents where humans interacted with FWB is during the early mornings and a total of 5 such incidents were reported within the study period and all of these incidents were recorded during early mornings.

Apart from FWB, GOH straying out of the sanctuary and wandering into these crop field is a well-known phenomenon. The rhinos raid crops too, but surprisingly the villager's perspective towards Rhinos is generally positive. 71.5% of people mentioned FWB as a nuisance. (Fig-6) The respondents expressed that the buffaloes damaged crop to extent than GOH. Buffaloes usually stray out in groups, and ravage the entire field rather be it paddy or maize. Whereas rhinos eat only their share of the crop. There is also fear psychosis observed among the villagers and they found rhinos are not as aggressive as the FWB. So, sudden accident with rhinos also less as compared to buffaloes

The villagers were seen adapting different mitigative measures such as human dummies, firecrackers, metal banging, digging shallow trenches, night guarding etc. The most common measures used by the villagers were bamboo fences followed by bursting firecrackers, but even

these measures were proved to be less effective as sometimes the buffaloes are seen jumping over the fences. However few fences in combination of trenches, strong bamboo poles and regular human surveillance found successful to retard both rhino and buffalo movement. Hence, modern methods like electric fence, solar street lights and regular monitoring are desirable to mitigate such incidents.

Due to rising incidents of Human-Buffalo negative interactions may highlight negative conservation attitude of surrounding villagers towards the conservation of PWS and its rhino and other wildlife.

In addition, thousands of cattle (also feral cattle) grazing, invasion alien species like *Ipomoea* sps., *Parthenium* and decreasing of grassland due to natural succession process as well as due to annual flood affected suitability habitat condition of rhinos inside the park. The rapid land use change and construction of road also affected water regime pattern inside park and that influence habitat condition and compel anima to move outside for sake of food and movement. Therefore, a strategic conservation measures for conservation of GOH and FWB highlighted in this study.

6. Conclusion

Pobitora Wildlife Sanctuary, though comparatively small, hosts world densest GOH population and other diverse array of wildlife. Presence of thousands of cattle as well as feral cattle decreased habitat quality of park since past. The intra and inter species competition among herbivores might more due to limited resources. Additionally, the sanctuary's grassland shrinkage due to invasion of plant like *Chromolaena odorata*, *Mikania micrantha*, *Ipomoea*, *Parthenium*. The natural succession process, annual flood also decreasing grassland and wetland hence major

habitat management strategies necessary to address these issues to make suitable habitat for rhinos and other animals.

The close proximity of villages to the sanctuary boundary heightens the risk of human-wildlife conflicts. To promote harmony and peaceful coexistence between humans and wildlife, effective measures are essential. These include creating buffer zones (where possible), educating locals about buffalo and rhino behaviors, establishing village-based crop monitoring groups, regular awareness, promoting alternate livelihood, compensation on crop lost and human injury and death may help to instilling a coexisting environment across the Pobitora WLS. The sanctuary might get more space by free from human encroachment.

The overpopulation of Greater One-Horned Rhinos and Feral Water Buffaloes can be managed through translocation to other suitable habitats such as Manas National Park and other National Park which hosts suitable habitats for both, where more animals can be accommodated. Finally further research is necessary to understand demographic pattern of rhino and buffaloes as well as habitat interaction inside the Pobitora Wildlife Sanctuary.

Acknowledgements

The authors are grateful to the entire Pobitora Wildlife Sanctuary Park authority, local community, Binod Deka, Nripen Nath for providing support during the tenure of the study. The authors are also thankful to Zoo Berlin for funding and supporting the study. We would also like to thank Mr. Arup Kumar Das and the entire Geo-Spatial Technology and Application Division of Aaranyak and also Rahul Das and Pranjal Deka of Aaranyak for their support. Finally, we like to thank the Ranger Officer of Pobitora Wildlife Sanctuary Mr. Nayan Jyoti Das for his support and cooperation.

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