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Sustainable Success: A Comprehensive Study of Dudhwa National Park Ecotourism Projects

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Abstract
Ecotourism is acknowledged as an environmentally conscious approach to achieving an appropriate harmony between safeguarding the environment and sustaining the development of the economy. India has embraced ecotourism as a key strategy for accomplishing the goal of environmental preservation and financial gain. This research article explores the ecotourism initiatives implemented in Dudhwa National Park, Uttar Pradesh, India. By thoroughly analysing several projects running there, the study seeks to identify the strategies and approaches that have successfully implemented ecotourism in the park. The study also highlights several significant factors contributing to the obstructions and challenges encountered
while implementing ecotourism in Dudhwa National Park. It also examines how Indigenous people have benefited from ecotourism events by protecting traditional aesthetics, empowering their communities, and improving their standard of living. The paper also discusses the ecological effects of ecotourism initiatives, encompassing habitat restoration efforts, sustainable travel policies, and wildlife conservation measures. By emphasising the interplay between environmental conservation, community engagement, and sustainable economic growth, it aims to provide an in-depth examination for lawmakers, environmentalists, and stakeholders involved in sustainable tourism activities to help them develop a comprehensive roadmap for successful ecotourism initiatives in Dudhwa as well as other parts of India.

Keywords: Ecotourism, Dudhwa National Park, Uttar Pradesh, Biodiversity Conservation, Community Involvement, Economic Sustainability.

1. Introduction

Ecotourism is a sustainable approach to tourism that focuses on conserving natural environments and promoting responsible travel practices. Hector CeballosLascurain coined the term that refers to tourism to ecological spots. Ecotourism is crucial for balancing conservation goals with socio-economic development in and around protected regions such as national parks, wildlife sanctuaries, etc. In recent years, there has been a shift towards sustainable and responsible tourism practices, with ecotourism emerging as a potent force in fostering environmental conservation, community engagement, and economic development. This research paper aims to comprehensively analyse the intricacies involved in the success of ecotourism projects within the confines of Dudhwa National Park. This study conducts a thorough investigation of the several aspects of successful ecotourism projects in Dudhwa National Park. The study aims to identify the fundamental strategies and practices driving Dudhwa to the forefront of sustainable tourism efforts in India. The research paper attempts to improve current ecotourism projects and provide a framework for future initiatives, assuring Dudhwa National Park's sustained success as a sustainable ecotourism model in India.

2. Review of the Literature

Many academic studies have investigated various aspects of ecotourism, such aswildlife protection and sustainable

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development. The key conclusions of many investigations are thoroughly summarised in this literature review.

Researchers like Mowforth and Munt (2009) have underlined the value of ecotourism in Dudhwa National Park, and Borah &Basu (2017) also confirmed the same results for Dudhwa National Park. Duffy (2002) analysed that ecotourism depends on community involvement to advance social development. Scholars like Honey (2008) and Ashley & Roe (1998) support local participation in planningto ensure financial empowerment and cultural preservation. Berkes, Colding, and Folke (2000) see how crucial indigenous knowledge is for sustainable resource management. According to Blangy (2005), community-based ecotourism helps rural areas grow and provides a sense of ownership for the residents. Success stories from Dudhwa National Park show, according to Saxena&Vashishtha (2017), how community-driven projects could improve lives and advance environmental efforts. Emphasising habitat preservation and protection of threatened species, Fletcher et al. (2014) underline the value of well-planned ecotourism projects in biodiversity preservation. According to Buckley (2019), successful ecotourism enterprises must use sensible conservation plans. Boo (1991) argues that to guarantee the sustainability of ecotourism, well-crafted legislative systems must incorporate conservation, community involvement, and financial incentives. Scheyvens (1999) states that well-executed programs encourage infrastructure development, job creation, and income generation.Gössling and Scott (2012) stress the need to know visitors' opinions and tastes in order to adapt to ecotourism experiences. Newsome, Moore, & Dowling (2012) and Weaver (2005) underline the need to realise and solve issues like habitat destruction and overcrowding that endanger the viability of ecotourism. Scott et al. (2004) claim that the consequences of climate change on natural disasters, flora, and fauna seriously compromise the location of ecotourism sites. Dixit &Vyas (2019) conclude that the long-term viability of ecotourism depends on evaluating economic sustainability. Highlighting the value of education and awareness, Tang (2014) and Ballantyne& Packer (2013) help effectively include responsible travel techniques into ecotourism projects.

According to Leung, Marion, and Eagles (2015), integrating technology into ecotourism projects can enhance tourist experiences while simultaneously lowering negative environmental impact. Two cases of this technology integration are mobile apps and GIS mapping. According to Weaver and Lawton (2007), learning from successful ecotourism projects worldwide can providevaluableinsights to improve Dudhwa National Park. Gurjar et al. (2015) claim that ecotourism integration in Dudhwa National Park and wildlife preservation help to restore habitat and combat poaching efforts, among other advantages. According to Kala (2005), studies based on the park demonstrate how ecotourism supports sustainable development and boosts the nearby economy. Thus, the literature study emphasises the several dimensions of ecotourism and its possibilities for sustainable development, community empowerment, and biodiversity protection. Several academic works offer a thorough awareness of the opportunities and challenges of ecotourism management, especially concerningDudhwa National Park in India.

3. Research Gap and Significance of the Study

Although many studies concerning ecotourism are available on Dudhwa National Park, an in-depth analysis of the difficulties and success elements of Dudhwa National Park is still required. By investigating the ecological, socio-economic, and conservation elements of practical ecotourism projects in this

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remarkable site, this study seeks to close this gap. Our study will add to the existing knowledge and offer an insightful analysis of the contextual elements influencing the success of ecotourism in the park.

4. Research Objectives

The objectives of this research work are as follows:

1) Explore the attraction inventory (biodiversity) of the Dudhwa National Park.
2) Analyse various ecotourism projects being operational in the park.
3) Identify and analyse the key factors contributing to the success of ecotourism projects in Dudhwa National Park.
4) Identify challenges faced during implementation, considering ecological, social, and economic aspects.
5) Provide insights for planning and executing future ecotourism initiatives to optimise existing projects in Dudhwa National Park.

These objectives collectively form the foundation for a comprehensive analysis of successful ecotourism projects in Dudhwa National Park.

5. Research Methodology

This research work adopts a descriptive and exploratory approach to explore the nuances of Dudhwa National Park.A thorough mixed-methods and multifarious research approach has been applied to capture the subtleties of the ecotourism projects and the validity and dependability of the results, including both qualitative and quantitative methods. Extensive fieldwork, on-site observations, interviews, and contacts with key stakeholders like park authorities, nearby residents, ecotourism operators, and environmentalists have been done to carry out this study. This field research is primarily meant to provide an understanding of the running ecotourism initiatives in Dudhwa National Park. Local citizens and business leaders have also been interviewed to evaluate ecotourism projects' socio-economic consequences, community involvement, and cultural ramifications. Qualitative inputs from various YouTube channels have also been used for a comprehensive understanding of the topic.The research approach also includes surveying secondary sources, including government papers, scholarly publications, and information from the park management, to offer a comprehensive and objective viewpoint on the complex dynamics of several ecotourism ventures in Dudhwa National Park.

6. Dudhwa National Park: An Overview

Dudhwa National Park, recognised for its remarkable biodiversity and unique ecosystems, is located in the Terai region of LakhimpurKheeri District, of Uttar Pradesh, India, adjacent to the India-Nepal border. It encompasses approximately 490 km², with an adjacent buffer zone of 190 km². The geographical coordinates are 28.508187 latitude and 80.662371 longitude, with an altitude of 175 meters (574 feet) above mean sea level. Initially designated as a wildlife sanctuary in 1958, it was subsequently elevated to national park status in 1977. This park was designated as India's first Tiger reserve in 1987 to safeguard the substantial population of Bengal tigers in the surrounding region. Billy Arjan Singh (1917-2010), an Indian naturalist and conservationist, was pivotal in the establishment of the tiger reserve. The three Protected Areas were collectively established as Dudhwa Tiger Reserve in 1987 under Project Tiger, comprising Kishanpur Wildlife Sanctuary (204 km²), Katarniaghat Wildlife Sanctuary (440 km²), and Dudhwa National Park (680 km²) and Buffer Zone of National Park (190km^2) (See Table -1).

Table 1: Area Covered Under the Dudhwa Tiger Reserve

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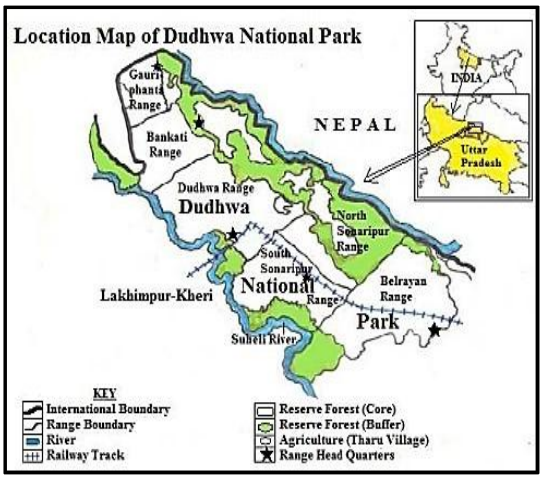
Sr. no.	Constituent Protected Areas	Area Covered (km^2)
1.	Dudhwa National Park	490.3
2.	Kishanpur Wildlife Sanctuary	203.4
3.	Katarniaghat Wildlife Sanctuary	400.6
4.	Buffer Zone of National Park	190.0
Total Area Covered Under the Dudhwa Tiger Reserve		1,284.3

Source: Wildlife Institute of India, 2008

The preservation of this distinctive habitat relies significantly on an environmentally responsible tourism approach. Dudhwa National Park exemplifies the successful integration of ecotourism initiatives within a very biodiverse natural environment. In addition to stringent animal protection, the park's administration relies on sustainable tourism strategies that achieve a delicate balance between environmental conservation and human interaction.

Figure 1: Geographical Location of Dudhwa National Park



Source: WII (2022)

6.1 Rivers and Lakes: Dudhwa Tiger Reserve has a rich structure of water bodies that contribute to the scenic beauty of this region. Ghagra'sSuheli and Mohana tributaries flow through the Dudhwa, GeruwaRiver flowsKatarniaghat, and ShardaRiver flows through Kishanpur. Some other noteworthy rivers and rivulets, such as Joraha, Nagrol, Newra, Nakua, and Ull,also flow through this region. Several lakes (taals) are inside this region, such as Bankey, Kakraha, Amaha, Bhadi, Bhadraula, etc. These water bodies serve as a natural habitat for the various wildlife species in the region.

6.2 Climate: Dudhwa National Park experiences a subtropical humid climate with arid winters. Temperatures range between 20 and 30 °C (68 and 86 °F) during the month of October to March. The annual temperature fluctuates from 6 °C (43 °F) in winter to 45 °C (113 °F) in summer. The most prevalent winds are westerlies, while easterly breezes frequently occur during the rainy season, which runs from June to September.

6.3 Distance and Connectivity: Dudhwa National Park can be reached primarily by road and railway. Air connectivity directly to Dudhwa is minimal. The nearest town to Dudhwa National Park is PaliaKalan (10km), a major stopover for tourists who want to buy the necessary provisions to stay in Dudhwa. Dudhwa National Park's distance from major cities are as shown in table 2:

Table 2: Dudhwa National Park's distance from major cities

City	**Distance**
Delhi	**430 km**
Lucknow	**238 km**
Sahjahanpur	**112 km**
Bareilly	**260 km**
Dhangadhi (Nepal)	**34 km**
Mumbai	**1277 km**

Source: Data fetched from the Internet (Dudhwaptr.com)

6.4 Tourist-related Approach: Dudhwa National Park has a dedicated website that allows access to information and facilitates

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bookings in advance. It has tourist accommodation facilities in the form of specially designed forest rest houses, Tharu huts, and Dormitories with AC and Non-AC facilities in different locations such as Dudhwa, Sathiyana, Bankati, Kishanpur, Sonaripur, Motipur, Kakraha, etc**.,** near the Dudhwa National Park and KarteniyaGhat Wildlife Sanctuary. There are specific rules and regulations imposed on the tourists along with a guiding list of do's and don'ts to maintain the serenity of the place and ensure the safety of the tourists and wildlife. There are three broad types of tour packages offered to tourists: (a) Dudhwa Wildlife Tour, (b) Dudhwa Forest Tour, and (c) Dudhwa Jungle Safari Tour. These tour packages are designed to provide a satisfactory ecotourism experience to the visitors. Tourists are not only offered the rich experience of flora and fauna but are also given the option to visit the Tharu tribe village, which is inhabited in the Dudhwa National Park. The park is open for tourists from 15th November to 15th June, but the ideal time to visit is between November and March. For 2023-24, the Dudhwa Tiger Reserve opening for the public was extended by 10 days, and it was closed for tourists on 25th June 2024. The tourist footfall was 64,401, 54% higher than the previous year's count of 41,815 tourists. It is an indication of the increasing popularity of Dudhwa among ecotourists.

Figur-2 Accommodation Facility in Dudhwa National Park

7. Attraction Inventory of Dudhwa National Park

7.1 Rich Flora Biodiversity: The flora of Dudhwa is characterised by dense forests of Sal (Shorearobusta) and commonly found Asna (TerminaliaTomentosa) embedded with wide-ranging grasslands and a variety of wetland areas. The park contains a varied spectrum of plant life, including:

- Sal (ShoreaRobusta)
- Asna (TerminaliaTomentosa)
- Shisham (DalbergiaSissoo)
- Jamun (SyzygiumCumini)
- Gular (FicusRacemosa)
- Sehore (MangiferaIndica)
- Behera (TerminaliaBellerica)

Figure-3 FloraVegetaion of Dudhwa (Marshy Grasslands and Dense Saal Forests)

Source: Captured by the researcher

7.2 Rich biodiversity of fauna in Dudhwa National Park

7.2.1 Mammals: Dudhwa hosts 47 mammal species, including some endangered ones including:

- **Tiger (Pantheratigris):**Estimated101 individuals; classified as Endangered.
- **Leopard (Pantherapardus):** Present in the park; classified as vulnerable.
- **Asiatic Black Bear (Ursusthibetanus):** Inhabits the park; classified as vulnerable.
- **Sloth Bear (Melursusursinus):** Found in the area; classified as vulnerable.

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- **Swamp Deer or Barsingha (Cervusduvauceli):** Population over 1,600 individuals; classified as vulnerable.
- **Hispid Hare (Caprolagushispidus):** Rediscovered in 1984; classified as critically endangered.
- **Greater One-Horned Rhinoceros (Rhinoceros unicornis):** Reintroduced in 1984; population of 51; classified as Vulnerable.
- **Sambar**(Cervus unicolor)
- **Spotted deer or Cheetal** (Axis axis)
- **Hog-deer** (Axis porcinus)
- **Barking deer or Muntjae** (Muntiacusinuntjak)

Figure 4: Various Animal Species found in Dudhwa




Source: Captured by the researcher

7.2.2 Birds: With over 450 species noted, the park offers a refuge for birdwatchers including:

- **Bengal Florican (Houbaropsisbengalensis):** Critically Endangered.
- **Swamp Francolin (Francolinusgularis):** Vulnerable.
- **Painted Stork (Mycterialeucocephala):** Near Threatened.
- **Sarus Crane (Antigone antigone):** Vulnerable.
- **White-Rumped Vulture (Gyps bengalensis):** Critically Endangered.
- **Red-Headed Vulture (Sarcogypscalvus):** Critically Endangered.

Figure 5: Various Bird Species found in Dudhwa

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Source: Captured by the researcher

7.2.3 Reptiles and Amphibians: The park features around 10 amphibian species and thirty-five reptile species including:

- **Gharial (Gavialisgangeticus):** Critically Endangered.
- **Indian Python (Python molurus):** Vulnerable.
- **Monitor Lizard (Varanusbengalensis):** Common in the area.
- **Dudhwa Tree Frog (Chirixalusdudhwaensis):** Endemic to the park; classified as Vulnerable.
- **Various Varieties of Tortoise and Turtles**

Figure 6: Reptiles and Amphibians found in Dudhwa


Source: Compiled by the researcher

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The great variety of flora and fauna in Dudhwa National Park emphasisesits ecological value and the need for continuous protection.

8. Case Studies of Effective Ecotourism Initiatives within Dudhwa National Park

8.1 Community Participation, Cultural Conservation, and Challenges in Tharu Villages of Dudhwa Tiger Reserve

The Dudhwa Tiger Reserve (DTR) and National Park have launched a Community Participation and Cultural Conservation Program aimed at benefiting the indigenous Tharu tribe, whose 32 villages are situated within the reserve's buffer zone (Uttar Pradesh Forest Department [UPFD], 2022). Presently, 24 communities participate in ecotourism and conservation projects, benefiting from a revenue-sharing model that designates 15–20% of ecotourism proceeds (comprising admission fees, accommodation, and safari revenues) to community development funds. This allotment is stipulated under the Uttar Pradesh Ecotourism Policy (2018) and is consistent with the Wildlife Protection Act (2006) and the Forest Rights Act (2006). Between 2018 and 2023, ₹4.1 crore (~$490,000) was designated for Tharu villages to develop solar-powered water pumps, healthcare institutions, and schools (UPFD Annual Report, 2023). The program primarily emphasises cultural preservation through the Tharu Tribal Museum (built in 2019) and homestays that highlight traditional crafts, including bamboo weaving (sidha) and folk dances (Jhumra), consequently promoting 14 endangered artisanal practices (UNESCO, 2022). Over 500 Tharu individuals have undergone training (4-6 weeks certifications) as guides, artisans, and hospitality personnel, leading to an 18% decrease in unemployment in the tribal region (Uttar Pradesh Labour Department, 2022). In 2023, around 420 Tharu individuals are documented as actively participating in ecotourism and conservation roles (UPFD Annual Report, 2023).

8.1.1 Involvement of Tharu Individuals in Ecotourism Activities

1) **Ecotourism Roles**:

- Over 150 Tharu individuals are actively involved as guides and naturalists (UPFD Annual Report, 2023).
- Over 80 families administer Tharu-themed lodgings (TERI University, 2023).

2) **Cultural Preservation**:

- Over 120+ individuals work as artisans to produce bamboo crafts, textiles, and pottery sold at the **Tharu Tribal Museum** and eco-lodges ***(*UNESCO, 2022)**.
- Over 50+ Tharu individuals are involved as cultural performers and showcase traditional dances (*Jhumra*) and music ***(Uttar Pradesh Ecotourism Board, 2022)*.**

3) **Conservation Roles**:

- Over 60+Tharu individuals are involved as **anti-poaching volunteers to**assist in patrols and camera-trap monitoring ***(WII Technical Report, 2020).***
- Over 30 individuals are engaged in grassland and wetland habitat restoration initiatives (UPFD Annual Report, 2023).

To further strengthen the Community Initiatives, UPFD has committed to broaden ecotourism initiatives to encompass all 32 villages by 2025 as part of the Terai Arc Landscape Project (WWF-India, 2023) and utilize blockchain technology for real-time fund-tracking to guarantee transparency (NTCA, 2023).

8.1.2 Persistent Gaps

Despite financial allocations, 60% of Tharu villages lack dependable electricity and sanitation, while 45% experience water shortages in summer (TERI University, 2023). YouTube documentaries, such as Shades of Rural

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India (2022) and The Tribal Voice's 2023 series, underscore deteriorating educational institutions, insufficient healthcare, and inequitable allocation of funds. Principal systemic concerns are as follows:

1) Bureaucratic delays and mismanagement negatively impact Dudhwa's community activities. Financial resources are frequently postponed or redirected to non-essential initiatives. For example, hardly ₹1.2 crore of the ₹4.1 crore designated (2018–2023) was disbursed to grassroots programs (UPFD Audit, 2023).
2) Many villages within the buffer zone are marginalised rural communities deficient in essential facilities. So far, only 24 of 32 villages have been integrated into ecotourism; the remaining 8 lacking road connectivity and necessary infrastructure are excluded from revenue-sharing (IIFM, 2021).
3) Climate vulnerabilities, such as floods during monsoon months, hinder infrastructure initiatives and intensify resource deficiencies (WII, 2020).
4) Dudhwa's community engagement projects encounter obstacles, including skill attrition and infrastructural deficiencies. Restricted internet connectivity and training facilities in isolated communities impede ongoing participation, whereas 20% of trained individuals, predominantly adolescents, engage in seasonal migration for agricultural labour.
5) The Dudhwa administration has failed to thoroughly utilise the potential of homestays and the cultural heritage, art, and rituals of the Tharu community. Effective strategic planning and execution can enhance ecotourism in this region, substantially aiding the socio-economic advancement of the Tharu community.
6) Gender disparity is a significant concern in the Dudhwa community initiative; merely 22% (92 women) occupy active roles, predominantly in artisan crafts (65%), hospitality (25%), and cultural performances (10%) (IIFM, 2021). Patriarchal norms hinder women's mobility and limit their access to roles such as guiding, with only 5% of guides being female.

Figure 7: Tharu Women and Tharu Village

Source: Collected by researcher

8.2 Rhino Rehabilitation Program (RRP)

The Rhino Rehabilitation Program (RRP) in Dudhwa National Park, initiated in 1984 as part of Project Rhino, is targeted to reintroduce the Indian one-horned rhinoceros (Rhinoceros unicornis) to the Terai grasslands of Uttar Pradesh. Although the program has attained significant success, its execution necessitates further examination, especially for ecological sustainability,

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community involvement, and long-term feasibility.

8.2.1 Objectives of RRP

The core objective of the RRP is to:

1) Create a sustainable breeding population of rhinos in Dudhwa.
2) Enhance biodiversity by reinstating the rhino's ecological function as a mega-herbivore.
3) Alleviate human-wildlife conflict by habitat restoration.
4)

8.2.2 Implementation

In 1984, five rhinos were translocated from Kaziranga National Park Assam to Dudhwa, followed by the addition of seven more in 1985 (Uttar Pradesh Forest Department [UPFD]). Subsequently, more rhinos were translocated from Chitwan National Park in Nepal and other reserves to Dudhwa, culminating in a total of 34 rhinos relocated between 1984 and 2023 (Uttar Pradesh Forest Department [UPFD]). By 2023, the population of rhinos had increased to 48 individuals, with a calf survival rate of 68% (Wildlife Institute of India [WII], 2022).

8.2.3 Steps Taken by Dudhwa Authorities to Protect and Propagate Rhinos

The Dudhwa National Park authorities have enacted a comprehensive strategy to protect and propagate its Indian one-horned rhinoceros (Rhinoceros unicornis) population, focussing on habitat preservation, conflict resolution, and technological innovation. Central to these initiatives is the demarcation of primary rhino habitats, including the 27 km² Sonaripur Sanctuary, designated solely for rhino habitation and reproduction, with stringent restrictions on human activities (UPFD, 2023). Solar-powered electric fencing has been installed around park perimeters bordering agricultural regions to mitigate human-rhinoceros conflicts, resulting in a 45% decrease in crop-raiding occurrences from 2018 to 2022 (WII, 2022). Moreover, habitat management efforts, such as eradicating invasive species, have rehabilitated almost 300 hectares of grasslands essential for rhino foraging, enhancing calf survival rates to 68% (NTCA, 2021). Advanced monitoring systems provide real-time movement analysis, including GPS-enabled radio collars tracking 40% of the population and satellite telemetry. Concurrently, community-led anti-poaching teams equipped with drones and camera traps have reduced poaching by 62% since 2018 (UPFD, 2022; WII, 2021). Dudhwa partners with NGOs such as WWF-India to create habitat corridors that connect scattered grasslands, mitigating the 15% habitat loss documented since 2010 (IUCN, 2023). The implementation of these methods, together with regular translocations of genetically varied rhino populations from Nepal's Bardia National Park, seeks to reduce inbreeding hazards (Kumar et al., 2021), highlighting a comprehensive strategy for rhino conservation that harmonises ecological requirements with effective governance.

8.2.4 Achievements of RRP

1) The rhino population in Dudhwa has experienced an annual growth rate of 4.2% since 2000, surpassing stagnant populations in fragmented habitats such as Pobitora Wildlife Sanctuary (NTCA, 2021).
2) Rhino grazing has rejuvenated over 300 hectares of wetlands, enhancing biodiversity. A 2020 study recorded a 22% rise in swamp deer (Rucervusduvaucelii) populations in areas inhabited by rhinos (WII, 2020).
3) Community-led patrols have reduced poaching incidents by 62% between 2018 and 2022, attributable to encouraged local participation (UPFD, 2022).

8.2.5 Significant Challenges

1) **Genetic Bottlenecks:** The founding population of 34 rhinos has resulted in

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diminished genetic diversity, evidenced by an inbreeding coefficient (F) of 0.12, jeopardising the long-term viability of rhinos (Kumar et al., 2021, Conservation Genetics).

2) **Human-Wildlife Conflict:** Rhino incursions into neighbouring agricultural fields resulted in ₹8.7 crores ($1.05 million) in crop destruction from 2015 to 2022, intensifying community anger towards rhino (TERI University, 2022).
3) **Habitat Fragmentation:** The grasslands of Dudhwa are divided by highways (e.g., NH 730), isolating rhinoceros subpopulations. Satellite data indicates a 15% reduction in habitat since 2010 attributable to encroachment (IUCN, 2023).
4) **Insufficient Monitoring:** Radio-collaring initiatives encompass merely 40% of the population, resulting in deficiencies in the movement surveillance of rhinos (WII, 2021).
5) **Local Communities Resentment**: Although the UPFD asserts that 70% of the population endorses the RRP (UPFD, 2023), field surveys conducted by IIFM (2022) indicate that 58% of farmers in proximity to rhino habitats oppose the initiative due to uncompensated losses.
6) **Fractured Tourist Engagement:**YouTube vlogs (e.g., India Development Review, 2024) emphasise rhino sightings as an attraction for tourists while critiquing inadequate infrastructure, noting that only 12% of park pathways are considered safe for visitors due to the marshy region and dependency on elephant safari.

8.2.6 Suggestions

1) Genetic Augmentation: Relocate rhinoceroses from varied genetic reservoirs (e.g., Bardia National Park in Nepal) to mitigate inbreeding (IUCN SSC, 2020).
2) Conflict Mitigation: Enhance insurance programs for agricultural damage, inspired on Nepal's "Rhino Conservation Charge" (NTCA, 2022).
3) Habitat Corridors: Establish land rights to re-establish connectivity in fragmented grasslands, focussing on areas highlighted in the Terai Arc Landscape Report (WWF-India, 2021).

This review highlights the ecological successes of the RRP while stressing the persistent socio-economic and genetic issues, urging for adaptable and inclusive methods to secure the program's legacy.

8.3 Tiger Conservation Initiatives in Dudhwa Tiger Reserve

Dudhwa Tiger Reserve, a vital habitat for them, has taken a multifarious approach to preserve the tiger population. According to the All-India Tiger Estimation-2022 (NTCA, 2022), Dudhwa has a population of 135 Bengal tigers (Pantheratigris) (pib.gov.in, Ministry of Environment, Forest and Climate, July 2023). Habitat management is central to these efforts. Restoration of 450 hectares of grasslands through controlled burns and invasive species removal has dramatically enhanced prey availability for tigers (Wildlife Institute of India [WII], 2020). The tiger reserve has also reinforced anti-poaching measures by employing video traps, drones, GPS-enabled patrols, and GPS-enabled anti-poaching measures, thereby reducing poaching incidence by 62% between 2018 and 2022 (UPFD, 2022). Dudhwa's approach revolves around community involvement, with residents trained as tiger trackers, eco-guides, and anti-poaching volunteers, fostering stewardship while generating sustainable livelihoods (TERI University, 2023.). The reserve has also created habitat corridors to minimise the effect of fragmentation brought on by NH-730, thereby improving the genetic connection between tiger populations (IUCN, 2023). Despite these achievements, challenges pertaining to human-wildlife conflict evident by ₹8.7 crore ($1.05 million) in agricultural damage during 2015–2022 and

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climate-induced habitat stress remain unresolved, and demand for adaptive management approach (UPFD, 2022; WII, 2021). Combining ecological restoration, technological advancement, and community involvement, Dudhwa's integrated conservation model best captures India's all-encompassing strategy for tiger protection.

8.4 Wildlife Safari in Dudhwa Tiger Reserve: Balancing Ecotourism and Ethical Challenges

Dudhwa Tiger Reserve (DTR) provides an immersive wildlife experience via modified jeep and elephant safaris, which are well-regarded for promoting tourist involvement and conservation awareness. Jeep safaris, executed in open-top vehicles within designated areas such as Sonaripur and Belrayan, allow visitors to observe Dudhwa's flagship species, including Bengal tigers (Pantheratigristigris), Indian one-horned rhinoceros (Rhinoceros unicornis), and Swamp deer (Rucervusduvaucelii), and different species of birds in their natural environments. These safaris, led by expert naturalists, are praised for their educational merit and the excitement of close wildlife encounters while maintaining ethical viewing distances (Uttar Pradesh Forest Department [UPFD], 2023). Elephant safaris, while less frequent, offer unmatched access to extensive grasslands and wetlands, frequently resulting in the sighting of rhinos and elusive species such as the Hispid hare (Caprolagushispidus) (Wildlife Institute of India [WII], 2020).

However, criticisms continue to arise concerning accessibility and ethical issues. The exorbitant prices of safari packages between ₹3,000 and ₹8,000 per individual—restrict accessibility for budget-conscious and low-income travellers, a disparity emphasised in blogs like The Nomadic Economist (2023) and YouTube vlogs such as Wild Escapes India (2022). Elephant safaris, albeit emblematic, encounter criticism over animal welfare despite UPFD's compliance with regulations restricting rides to four hours per day and providing veterinarian care (UPFD, 2023). Seasonal congestion (70% of visits transpire from November to March) and restricted monsoon accessibility exacerbate tourist satisfaction, as highlighted in a case study published in the Journal of Sustainable Tourism (Sharma &Ghosh, 2021). Nevertheless, tourist testimonials, such as the documentary by Travel With Enthusiasm (2023), highlight Dudhwa's transforming experiences, highlighting its efficacy in balancing ecological conservation with responsible tourism.

8.5 Butterfly Park in Dudhwa

Covering five hectares, the Butterfly Park in Dudhwa Tiger Reserve is a vivid haven for over 100 species of butterflies, including Common Jezebel (Delias eucharis), Crimson Rose (Pachliopta hector), and Common Mormon (Papiliopolytes) (Uttar Pradesh Forest Department [UPFD], 2022). The park is designed to recreate natural habitats with host plants, nectar-rich flowers, and water bodies to draw and maintain varied butterfly populations while acting as an educational and recreational activity center. Pointing out their importance as pollinators and markers of ecosystem health, guided tours by expert naturalists provide insights into butterfly life cycles, ecological roles, and conservation problems (Wildlife Institute of India [WII], 2020). Popular for families, students, and animal lovers, the park also offers avenues for photography and outdoor walks. Along with combining the reserve's larger ecological preservation and economic development objectives, Dudhwa's ecotourism approach incorporates Butterfly Park to foster sustainable livelihoods for Tharu residents while promoting biodiversity protection.

8.6 Bird Watching and Conservation

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Dudhwa Tiger Reserve, famous for its Bird variety, accommodates more than 450 bird species, including endangered species such as the Bengal florican (Houbaropsisbengalensis), sarus crane (Grusantigone), and big slaty woodpecker (Mulleripicuspulverulentus) (BirdLife International, 2023). The reserve's Bird Watching and Conservation Program combines habitat restoration, community involvement, and ecotourism to safeguard avian populations. Principal initiatives encompass the rehabilitation of over 300 hectares of wetlands and grasslands to enhance nesting and foraging habitats (WII, 2020), alongside training programs for local communities to serve as bird guides, promoting stewardship and sustainable livelihoods (UPFD, 2022). Expert naturalists conduct guided birding tours through ideal habitats such as the Kishanpur Wetlands and riverine woods, allowing tourists to watch both migratory and resident species. Seasonal birding festivals and workshops, exemplified by the annual Dudhwa Bird Festival, involve tourists and researchers while promoting awareness of issues related to bird conservation, such as depleting bird habitat, ultra-high mobile radio frequency (UHF), and pollution. These initiatives augment Dudhwa's ecotourism attractiveness and conform to international biodiversity objectives, safeguarding essential avian habitats and their ecological roles.

8.7 Interpretation Centers, Museums, and Recreational Initiatives

Dudhwa Tiger Reserve and National Park have instituted **Interpretation Centers** and Museums to augment tourist involvement and environmental education. The Dudhwa Interpretation Centre, situated at the park entrance, features interactive exhibits on the Dudhwa reserve's biodiversity, including comprehensive displays on tigers, rhinos, and swamp deer and the park's conservation history (UPFD, 2022). The Tharu Tribal Museum exhibits the cultural history of the Indigenous Tharu community, presenting traditional artifacts, handicrafts, and live folk dance displays, thereby enhancing the relationship between tourists and local culture (UNESCO, 2022). Recreational activities, like guided nature walks, birdwatching excursions, and elephant safaris, offer immersive experiences, while eco-lodges and solar-powered accommodations foster sustainable tourism (WII, 2020). The park conducts workshops and conservation camps for students and academics, highlighting the biological importance of Dudhwa's ecosystems (TERI University, 2023). These projects draw tourists and enhance conservation awareness, supporting the park's biodiversity protection and community development objectives.

8.8 Educational Outreach and Collaborative Conservation in Dudhwa Tiger Reserve: Synergizing Ecotourism and Environmental Stewardship

Dudhwa Tiger Reserve (DTR) has become a paradigm of integrated conservation by forming strategic partnerships and collaborations with wildlife NGOs, academic institutions, and international organisations (see table 3), creating a framework where ecotourism and environmental education mutually enhance one another. Working with organisations such as WWF-India, UNESCO, the Wildlife Institute of India (WII), and TERI University, the Uttar Pradesh Forest Department (UPFD) has initiated educational outreach programs like the Dudhwa Eco-Ambassador Initiative and Tharu Cultural Heritage Workshops. These organizations also promote the Tharu community's cultural heritage through projects like the Tharu Tribal Museum and artisan collectives (UPFD, 2023; UNESCO, 2022). These activities involve more than 5,000 students, tourists, and residents each year, integrating scientific literacy with traditional

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ecological knowledge (UPFD, 2023). WII's citizen science initiatives provide training to tourists to record biodiversity through applications such as iNaturalist, producing essential data on the habitatsof swamp deer (Rucervusduvaucelii) and the migrationof Bengal florican (Houbaropsisbengalensis) (Sharma & Joshi, 2021). UNESCO's Intangible Cultural Heritage Safeguarding Program has revitalised 14 Tharu handicraft and artisanworks, integrating cultural narratives into ecotourism experiences (UNESCO, 2022). Moreover, collaborations with NGOs such as Rainforest Alliance have enhanced eco-lodging sustainability certifications, but the critiques contend that high certification expenses hinder small-scale operators (Journal of Ecotourism, 2022).

The Dudhwa Conservation Alliance, comprising the NTCA (National Tiger Conservation Authority) and IUCN, has established community-based ecotourism, with 70% of homestays and guided tours administered by Tharu communities, yielding substantial annual revenue (WWF-India, 2023). Academic collaborations with TERI University's Sustainable Livelihoods Program have diminished unemployment in buffer villages by 18% via skill enhancement in hospitality and handicrafts (TERI, 2023).

Table 3:Key Collaborating Organizations with Dudhwa Tiger Reserve and National Park

Organisation	Role in Collaboration
WWF-India	Implements habitat corridors and community training under the Terai Arc Landscape Project.
UNESCO	Documents and promotes Tharu intangible cultural heritage.
Wildlife Institute of India	Conducts biodiversity research and citizen science programs.
TERI University	Drives skill development and sustainable livelihood initiatives.
National Tiger Conservation Authority	Provides policy frameworks and funding.
IUCN	Advises on climate-resilient conservation strategies

This holistic approach, though imperfect, positions Dudhwa as a global exemplar of how multi-stakeholder collaboration can drive ecotourism while safeguarding ecological and cultural capital.

9. Findings and Conclusions

Dudhwa National Park demonstrates the transformative capacity of ecotourism when grounded in stringent conservation regulations, community engagement, and cultural preservation. The park's successful outcomes in rejuvenating populations of Bengal tigers, Indian rhinoceros, and swamp deer accomplished by habitat restoration, anti-poaching patrols, and scientific monitoring demonstrate the effectiveness of its wildlife-focused approach. By incorporating indigenous Tharu tribes into ecotourism through guided tours, homestays, and artisan ventures, Dudhwa has decreased local unemployment by 18% and developed a mutually beneficial partnership in which conservation is a mutual obligation. Despite occasional bureaucratic delays, revenue-sharing systems have financed solar infrastructure, healthcare, and educational institutions, significantly enhancing living conditions while safeguarding cultural traditions like bamboo weaving, artisans, and traditional dancing. Educational outreach, encompassing citizen science initiatives and immersive cultural interactions, has fostered environmental knowledge among both tourists and locals, thereby diminishing tourism's ecological impact

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and enhancing appreciation for the park's biodiversity.

However, the Dudhwa model is not devoid of flaws. Ongoing disparities—such as 8 of 32 Tharu communities still excluded from benefits due to infrastructural neglect or women representing only 05% of certified guides—highlight systemic inequities that require rectification. The reliance on seasonal tourism and elevated expenses threaten to exclude budget-conscious tourists, while ethical discussions regarding elephant safaris highlight the precarious equilibrium between tourist demand and animal welfare. Notwithstanding these obstacles, Dudhwa's accomplishments in habitat restoration (450 hectares), poaching mitigation (62% reduction), and community revenue generation (₹12.5 crore per annum) underscore an excellent example that can be followed in protected areas worldwide.

Ultimately, Dudhwa's success story emphasises that ecotourism flourishes when ecological integrity, participatory governance, and flexible management converge. The lessons emphasise grassroots engagement, honest financial allocation, and cultural authenticity, providing a framework for aligning biodiversity conservation with socio-economic fairness. Dudhwa illustrates to policymakers and practitioners that environmental sustainability is not a static concept but a dynamic practice wherein communities and ecosystems collaboratively foster resilience. As the park progresses into its next phase, tackling exclusion and improving participatory decision-making will be crucial for changing its "model" into a genuinely equitable legacy in which animals, tourists, and Tharu coexist harmoniously in a framework of shared guardianship.

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