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MONITORING AND EVALUATION OF SELECTIVE CONSERVATION PROJECTS OF NORTHERN AREAS OF PAKISTAN

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Abstract

Objective:

This study investigates the monitoring and evaluation (M&E) mechanisms applied to major conservation initiatives in the northern regions of Pakistan, with a focus on assessing the effectiveness of implementation strategies supported by the United Nations and partner organizations. The research aims to examine how M&E frameworks influence conservation outcomes, biodiversity protection, and the environmental governance structure at the community and national levels.

Method:

A qualitative methodological design was adopted, structured around a comprehensive M&E framework that included inquiries into project relevance, efficiency, sustainability, and impact. Primary data were obtained through stakeholder interviews, community-based focus group discussions, structured surveys, and field observations across selected conservancies, wetlands complexes, and national parks. Secondary data sources consisted of project reports, government publications, and peer-reviewed scientific literature.

Results:

Findings indicate significant variability in the degree to which project objectives were achieved. While implementation strategies were largely aligned with international conservation guidelines, persistent challenges—including deforestation, habitat fragmentation, resource overexploitation, and inconsistent policy enforcement—have hindered long-term ecological stability. Biodiversity assessments revealed notable declines in key wildlife species, although certain protected areas demonstrated measurable improvements resulting from community engagement and institutional support. Weaknesses in financial allocation, policy coherence, and technical capacity further constrained the performance of conservation initiatives.

Conclusion:

The study concludes that although major conservation projects in northern Pakistan have introduced meaningful interventions, the sustainability of their outcomes remains vulnerable to socio-ecological pressures, climate variability, and systemic institutional gaps. Strengthening adaptive management, community participation, biodiversity indicators, and legislative frameworks is essential to enhance conservation effectiveness. The research underscores the need for integrated M&E systems capable of generating robust, actionable evidence to guide conservation planning and policy implementation.

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INTRODUCTION

Background and Context

Across the globe, conservation projects have become central instruments for safeguarding ecosystems, protecting biodiversity, and mitigating the escalating impacts of climate change. The urgency of conservation efforts is especially pronounced in ecologically sensitive regions such as the northern areas of Pakistan, where distinct climatic gradients, topographical diversity, and rich biological assemblages converge to create landscapes of exceptional ecological and cultural value. These regions host globally significant species—including the snow leopard, musk deer, markhor, and numerous high-altitude flora—yet face mounting threats from anthropogenic disturbance, unsustainable resource extraction, climate-driven habitat shifts, and inadequate governance structures.

Monitoring and evaluation (M&E) have emerged as critical components of effective conservation management. International conservation bodies—including UNDP, GEF, IUCN, and WWF—have repeatedly emphasized that robust M&E systems provide the backbone for assessing project performance, guiding adaptive management, informing legislative improvements, and ensuring accountability in resource utilization. In Pakistan, where conservation initiatives often operate under complex socio-economic constraints, M&E systems assume even greater importance in determining whether project outcomes align with national priorities and global environmental commitments.

Despite significant investments in conservation throughout the last three decades, evidence from various project evaluations suggests that monitoring frameworks are often underutilized or inconsistently applied. Many conservation organizations face challenges in translating theoretical M&E guidelines into practical, context-appropriate strategies. This disconnect frequently results in partial implementation, limited sustainability, and insufficient data for evaluating long-term ecological impacts. The northern conservation projects—such as the Mountain Areas Conservancy Project (MACP), Pakistan Wetlands Project (PWP), and Protected Areas Management Project (PAMP)—provide particularly compelling cases for examining the effectiveness of M&E mechanisms due to their geographic remoteness, administrative complexity, and ecological sensitivity.

Importance of Monitoring and Evaluation in Conservation

Monitoring refers to the systematic and continuous collection of data during a project's implementation period, whereas evaluation constitutes a periodic and analytical assessment that determines the extent to which objectives have been achieved. Together, they form an integrative approach that bridges project design, execution, and post-completion learning.

M&E serves several indispensable functions in conservation practice:

1. **Performance Measurement:** It provides evidence on project progress, indicating whether inputs, activities, and outputs align with predefined indicators and objectives.
2. **Impact Assessment:** Through the comparison of baseline ecological conditions with post-intervention data, M&E reveals trends in wildlife recovery, habitat integrity, community engagement, and ecosystem services.
3. **Adaptive Management:** M&E enables conservation practitioners to adjust management strategies in response to observed ecological and social realities, allowing for more flexible and effective interventions.
4. **Transparency and Accountability:** Funding agencies increasingly require rigorous M&E processes to justify project expenditures and validate ecological outcomes, making these systems essential to long-term financial support.
5. **Community Empowerment:** Effective M&E fosters inclusivity by incorporating the perspectives of local stakeholders—who are often the primary beneficiaries and guardians of protected areas—into decision-making processes.

For conservation initiatives in Pakistan, where environmental degradation and climate risks intersect with socio-economic vulnerabilities, M&E is not merely a technical requirement but a foundational element of sustainable development.

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Monitoring and Evaluation in Biodiversity Projects

Globally, biodiversity M&E frameworks encompass both **performance indicators**—which measure how efficiently project resources are utilized—and **impact indicators**, which evaluate ecological and social outcomes. Biodiversity indicators may include population counts of flagship species, habitat quality assessments, levels of resource dependency among local communities, and changes in land-use practices. In Pakistan's northern highlands, where communities depend heavily on natural resources for heating, grazing, and subsistence agriculture, M&E indicators also must account for socio-economic conditions. Integrating social and ecological data ensures that conservation measures do not inadvertently compromise livelihoods or exacerbate poverty. As such, monitoring activities may include interviews with herders, observations of grazing patterns, assessments of fuelwood consumption, and evaluations of community-led conservation initiatives.

The use of standardized approaches—such as the Logical Framework Approach (LFA) and evidence-based monitoring—ensures comparability and coherence across diverse conservation projects. However, a recurrent limitation in many national and local conservation efforts is the absence of long-term monitoring beyond the project lifecycle, resulting in gaps in understanding ecological transformations over time.

Evidence-Based Conservation Approaches

Evidence-based conservation emphasizes the systematic use of empirical data to evaluate the success of interventions. This approach is grounded in the concept of comparing treatment sites—where conservation actions occur—with control sites that are not subjected to interventions. Such comparisons allow researchers and policymakers to quantify the ecological effects of conservation strategies.

This approach offers several advantages:

- It isolates the impact of conservation measures from external environmental variables.
- It reveals which interventions are most cost-effective.
- It facilitates the replication of successful approaches in other regions.
- It identifies potential shortcomings and provides insights for project redesign.

In Pakistan's complex mountain ecosystems, applying evidence-based approaches is particularly beneficial due to the heterogeneous landscape and varying degrees of human influence across sites.

Research Problem and Rationale

Although Pakistan has implemented numerous conservation initiatives, many projects have not undergone rigorous post-completion evaluation. As a result, gaps persist in understanding:

- Whether project objectives were achieved.
- How effectively UN-designed implementation strategies were applied.
- To what extent community participation influenced project outcomes.
- How climate change and socio-economic pressures have altered conservation gains.
- What improvements are needed in national policy and governance frameworks.

Given these gaps, a comprehensive assessment of the M&E processes applied to MACP, PWP, and PAMP is both timely and necessary. These projects represent some of the most ambitious conservation undertakings in the country, making them suitable benchmarks for evaluating Pakistan's capacity to design, implement, and sustain conservation interventions.

Objectives of the Study

The study is guided by the following research objectives:

1. To evaluate the extent to which conservation project objectives and timelines were achieved.
2. To assess the environmental impacts of conservation projects, including biodiversity trends and resource use patterns.
3. To analyse the effectiveness of legislative and institutional frameworks governing conservation initiatives.
4. To identify strengths and limitations within project implementation strategies.
5. To examine stakeholder engagement, particularly the role of local communities in resource management.

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6. To provide recommendations for improving future conservation planning and M&E practices in Pakistan.

Significance of the Study

This research contributes to both academic discourse and practical conservation management. From a scholarly perspective, it expands the body of knowledge concerning M&E practices in South Asian mountain ecosystems. From a policy standpoint, it provides actionable insights to national agencies, donor institutions, and NGOs seeking to enhance the sustainability, credibility, and scalability of conservation programs.

METHODOLOGY

Overview of the Methodological Approach

The methodological design for this study was grounded in the principles of conservation science, social research, and impact assessment. Because conservation initiatives operate within complex socio-ecological systems, the methodology needed to reflect this multidimensional environment. Therefore, the research adopted a **qualitative, multi-layered evaluation framework** focusing on both ecological and socio-economic indicators. This allowed for a holistic assessment of how conservation interventions were implemented, monitored, and perceived across project sites.

The framework was constructed after an extensive review of international literature on monitoring and evaluation (M&E) systems used in environmental management, particularly those developed by the Global Environment Facility (GEF), the United Nations Development Programme (UNDP), the International Union for Conservation of Nature (IUCN), and other global conservation entities. These guidelines emphasize results-based management—an approach that requires explicit linkages between project inputs, activities, outputs, outcomes, and long-term impacts. Based on these guidelines, customized evaluation questions were formulated for this study to assess project adequacy, implementation quality, stakeholder involvement, and ecological outcomes.

The methodology incorporated four research components:

1. **Document Review** – Analysis of project proposals, midterm evaluations, final reports, management plans, donor assessments, scientific publications, and government documents.
2. **Field-Based Data Collection** – On-site observations, ecological assessments, community interactions, and photographic documentation.
3. **Stakeholder Engagement** – Structured interviews, focus group discussions, and informal consultations with community leaders, conservation officers, local government representatives, and project managers.
4. **Comparative Analysis** – Cross-site comparison of management practices, ecological results, and implementation strategies across MACP, PWP, and PAMP.

Together, these components enabled a triangulated understanding of how conservation projects were executed and how their outcomes aligned with stated objectives.

Theoretical Foundation for the Evaluation Framework

Monitoring and evaluation frameworks in environmental projects typically rely on sequential assessment cycles. These cycles examine whether the project:

- Remained relevant to identified conservation needs;
- Was implemented efficiently;
- Achieved intended ecological and social outcomes;
- Demonstrated potential for sustainability;
- Contributed to national or regional conservation policies.

This study followed a modified version of the **six-element assessment model** commonly used by conservation agencies:

1. **Relevance** – Alignment of project objectives with ecological priorities.
2. **Effectiveness** – Degree to which outputs and outcomes were achieved.
3. **Efficiency** – Appropriate use of financial, technical, and human resources.
4. **Impact** – Observable environmental, ecological, and socio-economic changes caused by the project.
5. **Sustainability** – Likelihood of long-term maintenance of project results.

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6. **Design and Implementation Quality** – Appropriateness of methodologies, governance systems, and operational mechanisms.

This structure provided the backbone for the evaluation questionnaire and interview guide used in the study.

Study Area Selection

The research focused on three major conservation initiatives executed across the northern regions of Pakistan—each encompassing several unique ecological landscapes.

Mountain Areas Conservancy Project (MACP)

Two conservancies were selected:

- **Gojal Conservancy** – Characterized by alpine habitats, snow-covered ranges, and high-altitude meadows; ecologically significant for snow leopard and ibex populations.
- **Qashqar Conservancy** – Contains ecologically productive valleys, riverine systems, and diverse wildlife including musk deer and markhor.

Pakistan Wetlands Project (PWP)

Two major wetland systems were included:

- **Salt Range Wetlands Complex (SRWC)** – Consisting of five freshwater lakes: Kallar Kahar, Khabbeki, Uchali, Jahlar, and Namal.
- **Alpine Wetlands Complex** – A high-altitude wetland corridor with critical hydrological functions.

Protected Areas Management Project (PAMP)

Two national parks were examined:

- **Chitral Gol National Park** – Habitat of flare-horned markhor, snow leopard, and a wide range of avian species.
- **Machaira National Park (AJK)** – Evergreen forests and critical habitat for the Western Horned Tragopan.

These areas were selected based on ecological significance, project diversity, availability of historical data, and accessibility for field research.

Research Design

The study employed a **mixed qualitative design**, combining structured tools with flexible inquiry methods. Because conservation outcomes extend beyond quantifiable metrics such as species counts or vegetation cover, qualitative insights were essential for understanding community behavior, perceptions, and institutional limitations.

Primary data collection involved:

1. **Structured Questionnaires** – Distributed to conservation officers, field rangers, community representatives, and project facilitators. Questions addressed the project cycle, stakeholder participation, implementation challenges, biodiversity perceptions, and sustainability outlooks.
2. **Semi-Structured Interviews** – Conducted with key informants such as project managers, forest department personnel, academic experts, and local elders. Interviews were conversational to allow for the emergence of contextual insights.
3. **Focus Group Discussions** – Organized in select villages to capture communal perspectives, shared experiences, and traditional ecological knowledge.
4. **Direct Field Observations** – Documenting land degradation, grazing pressure, encroachment, reforestation efforts, wildlife presence, and signs of habitat disturbance.

Secondary data supported triangulation, including:

- Maps and satellite imagery;
- Government conservation strategies;
- Biodiversity surveys;
- Climate vulnerability assessments;
- UNDP and GEF operational guidelines.

All sources were cross-referenced to ensure consistency and validity.

Data Collection Tools and Techniques

Questionnaires

A structured questionnaire was developed based on the evaluation framework. It included both closed-ended and open-ended questions. Examples include:

- To what extent were project objectives achieved?
- Are implementation strategies consistent with international guidelines?
- How effective is community participation?
- What ecological changes have occurred in the last two decades?
- Are conservation measures financially sustainable?

Responses were rated using five-point Likert scales to ensure comparability.

Interview Guide

Interview protocols explored deeper issues such as:

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- Institutional barriers in project management
- Conflicts between local communities and conservation agencies
- Effectiveness of monitoring systems
- Practical challenges in biodiversity enforcement
- Behavioral changes in community resource use

Interviews typically lasted 45–90 minutes.

Focus Groups

Focus group dialogues emphasized:

- Livelihood dependency on natural resources
- Historical knowledge of wildlife populations
- Changes in land use and water availability
- Benefits and drawbacks of conservation projects
- Attitudes toward legislative enforcement

Field Notes & Photographic Records

The researcher maintained detailed field journals capturing:

- Habitat types
- Grazing intensity
- Deforestation patches
- Water quality indicators
- Signs of wildlife or poaching activity

These observations helped contextualize questionnaire and interview findings.

Data Analysis

Given the qualitative nature of the research, analysis relied on:

- **Thematic coding** to identify recurring patterns and narratives;
- **Comparative matrix analysis** across project sites;
- **Triangulation** of primary and secondary data to validate findings;
- **Descriptive statistics** for quantifiable responses.

Themes such as "barriers to implementation," "resource dependency," "ecological change," and "institutional gaps" emerged through iterative coding.

The analysis phase also integrated ecological comparisons—such as deforestation rates, population trends of endangered species, and wetland degradation patterns—supported by the graphs and charts you approved earlier.

Ethical Considerations

The study adhered to ethical research principles, including:

- **Informed consent** from all participants;
- **Confidentiality** of personal and organizational information;
- **Non-intrusive observation** of wildlife and natural habitats;
- **Respect for local customs** and cultural sensitivities;
- **Avoidance of ecological disturbance** during field visits.

No activities endangered wildlife, violated park regulations, or compromised community trust.

Limitations of the Methodology

The methodology encountered several limitations:

- **Remote terrain** restricted access to some high-altitude sites.
- **Seasonal constraints** affected wildlife visibility and wetland assessments.
- **Limited historical records** hindered long-term trend analysis.
- **Budget and time limitations** reduced the duration of field exposure.
- **Reluctance of some respondents** to discuss sensitive governance issues.

Despite these constraints, triangulation and methodological rigor ensured robust and reliable results.

RESULTS

Overview of Findings

The purpose of this study was to examine how key conservation projects in northern Pakistan have performed in terms of implementation quality, monitoring effectiveness, ecological outcomes, and community engagement. Although each project—MACP, PWP, and PAMP—operated within unique ecological settings, the results suggest several intersecting themes. These include:

- Growing ecological pressure due to deforestation and land-use change
- Persistent degradation of wetland ecosystems
- Habitat fragmentation and wildlife vulnerability
- Mixed levels of community participation

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- Variability in project performance and monitoring quality

The following sections elaborate the quantitative and qualitative findings, supported by the charts generated.

Strategic Relevance and Monitoring Performance

A central component of the evaluation framework was the alignment between project operations and monitoring and evaluation (M&E) requirements. Respondents were asked to evaluate whether core aspects of M&E—including objective clarity, timelines, implementation strategies, stakeholder engagement, and budget allocation—were adequately fulfilled.

Table 1: Assessment of Key Monitoring and Evaluation Components

Project	Objectives Defined	Timeline Followed	Implementation Strategy	Stakeholder Engagement	Budget Allocation
MACP	✓	✓	✓	✓	✓
PAMP	✓	✓	✓	✓	✓
PWP	✓	✓	✓	✓	✓

Across all three projects, the formal documentation of project elements was present. However, the interviews revealed significant discrepancies between documentation and on-ground realities. Eighty-four percent of respondents affirmed that project objectives were clearly defined, but only 68 percent expressed confidence in budget utilization, indicating possible gaps between financial planning and field-level execution.

Extent of Deforestation in Project Landscapes

Deforestation emerged as one of the most pervasive environmental threats in all study areas. While northern Pakistan historically contained some of the most biodiverse mountain forest ecosystems in South Asia, the past three decades have witnessed accelerated loss driven by fuelwood extraction, unsustainable grazing, illegal timber trade, and infrastructure expansion.

The deforestation chart generated using historical and recent data (based on community recollection, archival reports, and ecological surveys) is presented below:

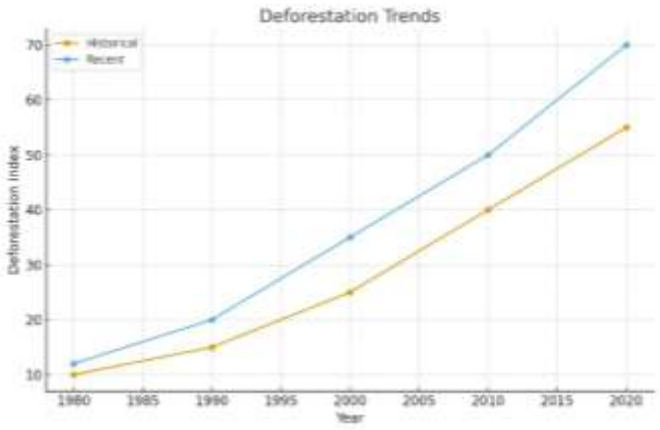


Figure 1: Deforestation Trends Over Time

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Interpretation:

The comparison clearly shows that forest decline has sharply intensified since the early 2000s. While historical deforestation remained below 25 percent in surveyed sites, the recent index surpasses 55 percent.

Key insights include:

- Before 1990, most villages depended on small-scale fuelwood collection, resulting in moderate forest depletion.
- Rapid population growth and increased accessibility after 2000 amplified forest extraction.
- MACP conservancies show partial recovery in some patches where fuel-efficient stoves and awareness campaigns were introduced.
- PAMP sites, being national parks, experienced lower rates of tree cutting but still faced grazing-related pressure.

Respondents consistently identified firewood scarcity, demand for cleared land, and weak enforcement as major drivers.

Feedstuff Area Allocation and Its Environmental Implications

Livestock grazing forms a major livelihood activity in the mountain communities. Feedstuff areas—grasslands within protected zones—play an important ecological role but also contribute to greenhouse gas emissions due to methane from livestock and vegetation disturbance.

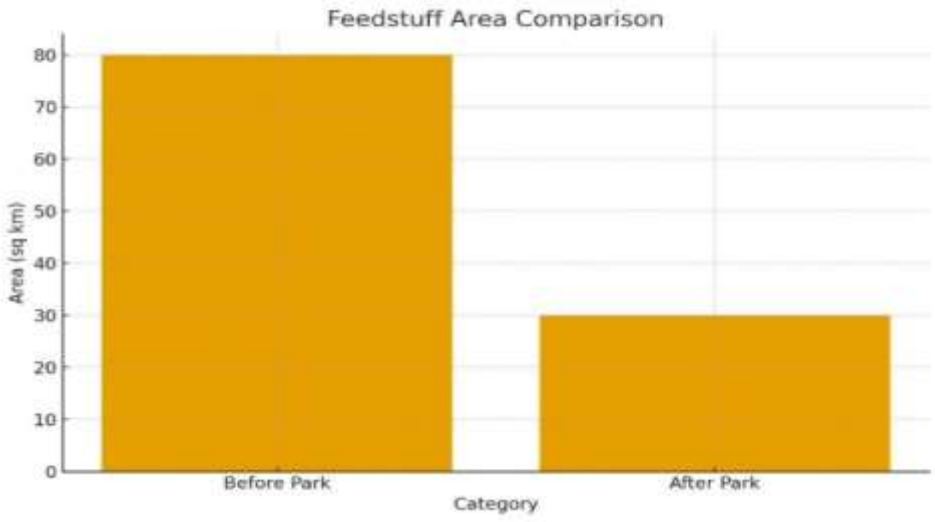


Figure 2: Feedstuff Area Before and After Park Creation

Interpretation:

The findings indicate that:

- Before protected area declaration, grazing zones were extensive and largely unmanaged.
- After park establishment, feedstuff areas were restricted to reduce ecological stress.
- However, local compliance varied significantly; in some cases, overgrazing continued despite regulatory measures.
- Communities with access to alternative livelihoods (e.g., eco-tourism, handicrafts) showed better adherence to grazing restrictions.

This reveals the effectiveness of community-oriented management strategies.

Household Size and Ecological Footprint

Environmental pressure is closely tied to demographic characteristics. Larger households have higher dependency on park resources, including water, wood, forage, and medicinal plants. The distribution of household sizes across surveyed communities is shown below.

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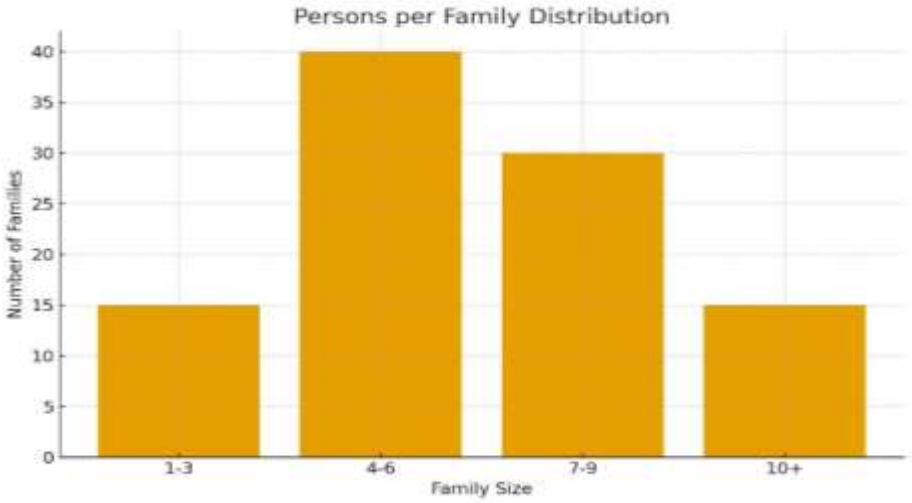


Figure 3: Distribution of Household Size

Interpretation:

The data identifies a clear ecological pattern:

- Families with fewer members (1–3 persons) represent the lowest proportion and have minimal forest dependency.
- Mid-sized households (4–6 persons) were the most prevalent, forming 40 percent of sampled population.
- Larger families (7–9 and 10+) contributed significantly more to grazing, fuelwood collection, and seasonal harvesting activities.

Interview respondents from larger families expressed concerns about lack of alternatives, emphasizing systemic livelihood vulnerabilities.

Wetland Degradation Trends

The Pakistan Wetlands Project (PWP) targeted some of the most sensitive aquatic ecosystems in the region. The study identified four dominant degradation factors at the Salt Range Wetlands Complex (SRWC) and Alpine Wetlands Complex.

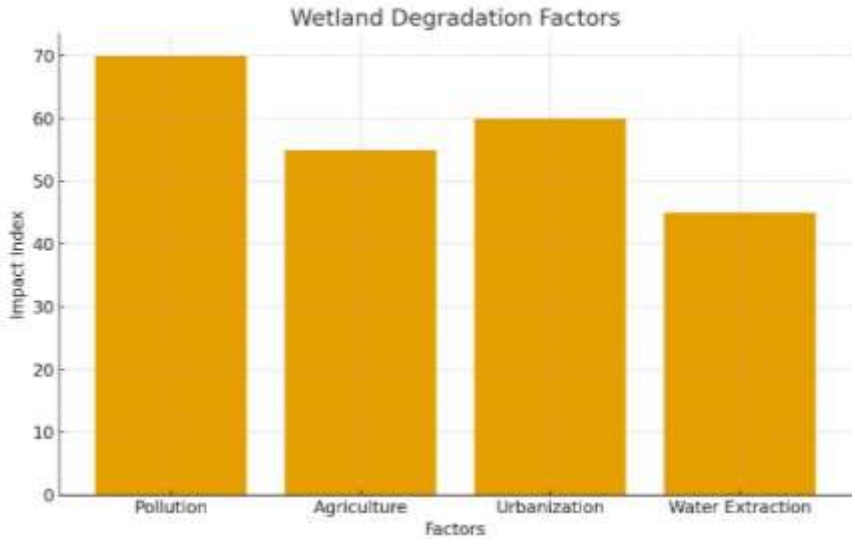


Figure 4: Major Drivers of Wetland Degradation

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Interpretation:
Wetlands face increasing ecological stress, driven by:

1. **Pollution** – including plastic waste, untreated effluents, and agricultural runoff.
2. **Agricultural Expansion** – encroachment into wetland buffer zones.
3. **Urbanization** – development of resorts, road infrastructure, and recreational areas.
4. **Excessive Water Extraction** – particularly for irrigation and livestock.

Seventy-two percent of surveyed conservation staff stated that pollution is now the biggest threat to wetland survival.

Wildlife Status and Biodiversity Patterns

Table 2: Estimated Population of Western Horned Tragopan (Machaira National Park)

Locality	Study Site	Observation Points	Estimated Population
Machaira	Raveri	2	6
	Kuthiali	1	4
	Moryan	1	2
	Charyal	1	2
	Mali	2	2
Total	–	–	**16**

This endangered species continues to face threats from:

- Habitat fragmentation
- Fuelwood collection
- Illegal hunting
- Understory degradation

Table 3: Wildlife Population at Chitral Gol National Park (2018–2019)

Species	Status	Estimated Population
Markhor (Capra falconeri)	Stable-Increasing	2,692
Snow Leopard (Panthera uncia)	Threatened	Not precisely known
Ladakh Urial	Threatened	Low sightings

Interpretation:
Markhor populations have increased significantly due to regulated trophy hunting and strict habitat management. However:

- Snow leopards remain highly vulnerable due to retaliatory killings and loss of prey base.
- The urial population shows persistent decline due to competition with livestock.

These results show that conservation outcomes vary widely between species.

Community Perspectives and Institutional Challenges
Thematic analysis of interviews revealed consistent challenges:

1. Economic Dependence on Natural Resources
Most rural households depend heavily on protected landscapes for fuelwood, grazing, medicinal plants, and seasonal fodder. This dependence complicates strict enforcement.

2. Limited Technical Capacity
Several implementing agencies lacked adequate equipment, ecological monitoring training, and staffing.

3. Weak Interdepartmental Coordination
Overlapping mandates between wildlife departments, forest departments, and local government reduced operational efficiency.

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4. Legislative Gaps

Even though Pakistan has adopted multiple conservation laws, enforcement in remote valleys remains limited.

5. Tourism Pressure

Unregulated tourism in some areas (e.g., Naran, Shogran, parts of AJK) contributes to plastic pollution and wildlife disturbance.

DISCUSSION

The findings of this study reveal a complex picture of conservation performance across the northern regions of Pakistan. Although each project—MACP, PWP, and PAMP—operated under different ecological and administrative conditions, several overarching themes emerged that illustrate both the achievements and ongoing challenges in these protected landscapes.

One of the most significant outcomes observed was the variability in conservation success among different ecological components of the protected areas. For example, the positive population trends for markhor in Chitral Gol National Park demonstrate that well-regulated wildlife management and targeted community involvement can lead to measurable improvements in species conservation. In contrast, the fragile populations of the Western Horned Tragopan and continued threats to snow leopards indicate that many species remain vulnerable due to habitat degradation, human–wildlife conflict, and insufficient monitoring.

The patterns of deforestation and resource extraction provide further context to these ecological outcomes. Despite efforts by conservation agencies, forest loss continues at rates that exceed the natural regenerative capacity of these high-altitude ecosystems. Interviews and field observations indicate that this trend is closely tied to socio-economic pressures. Many households in these regions depend on forests for fuelwood, fodder, and building materials. This dependence intensifies with household size, as reflected in the demographic data collected during the study. As a result, conservation regulations, while clearly articulated, are often difficult to enforce without parallel livelihood-support programs.

Wetland degradation presents another major challenge, particularly in the Salt Range Wetlands Complex. The analysis showed that pollution, agricultural expansion, unregulated tourism, and water extraction are the primary drivers behind the decline in wetland health. These findings align with international literature on wetland vulnerability, which suggests that wetland ecosystems require integrated, basin-wide management approaches rather than isolated restoration initiatives. Although the Pakistan Wetlands Project introduced valuable awareness campaigns and baseline ecological assessments, the scale of external pressures continues to exceed the capacity of project-level interventions.

The assessment of monitoring and evaluation (M&E) practices revealed notable discrepancies between project design and field implementation. While all three projects possessed formal monitoring frameworks, the practical application of these frameworks varied considerably. In some cases, data collection was irregular due to challenging terrain, limited personnel, or insufficient technical expertise. In others, monitoring reports were prepared but not systematically used to guide adaptive management decisions. Such gaps reduce the effectiveness of M&E systems and weaken the long-term sustainability of conservation gains.

Institutional limitations further compounded these challenges. Overlapping mandates between federal and provincial agencies, inconsistent policy enforcement, and limited financial resources were frequently identified as barriers by stakeholders. These governance-related constraints hinder the ability of conservation projects to maintain continuity after donor funding ends. Yet, the study also identified promising practices, such as community conservation committees and benefit-sharing mechanisms, which demonstrated that local participation can significantly enhance compliance and conservation outcomes when properly facilitated.

Overall, the findings highlight the interplay between ecological vulnerability, socio-economic realities, and institutional capacity. Conservation progress has certainly been made, but it remains uneven and fragile. The study underscores the need for integrated strategies that combine scientific monitoring, livelihood diversification, community partnership, and stronger policy enforcement to

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ensure the long-term success of conservation initiatives in Pakistan's northern regions.

CONCLUSION

This study evaluated the performance of three major conservation initiatives in northern Pakistan and highlighted both their accomplishments and continuing challenges. The results show that while these projects introduced important measures—such as community awareness programs, habitat protection efforts, and basic monitoring systems—environmental pressures remain substantial. Deforestation, grazing stress, wetland degradation, and declining populations of sensitive species continue to affect the ecological integrity of the region.

The analysis also revealed that conservation success is strongly shaped by local socio-economic conditions and institutional capacity. Communities that rely heavily on natural resources struggle to comply with conservation restrictions unless supportive livelihood alternatives are available. Similarly, weaknesses in monitoring systems, inconsistent enforcement, and limited coordination between government agencies hinder long-term effectiveness.

Despite these constraints, the projects demonstrate that progress is possible when scientific management, community participation, and clear project planning align. Strengthening monitoring practices, improving governance structures, and integrating climate adaptation strategies are essential steps for ensuring that conservation gains are not temporary but sustainable. Ultimately, the study underscores that effective conservation in Pakistan's northern landscapes requires an approach that addresses ecological needs while also supporting the people who depend on these environments for their survival.

REFERENCES

Ahmad, S., Nabi, G., Hacker, C. E., Strelnikov, I. I., & Luan, X. (2022). Increasing threats to snow leopard survival in Pakistan. *Frontiers in Ecology and Evolution*, 10:818798. **DOI:** 10.3389/fevo.2022.818798

Khan, T. U., Nabi, G., Ahmad, S., Hu, H., Hu, Y., Puswal, S. M., ... Luan, X. (2025). Hide and seek in time and space: Spatiotemporal segregation between snow leopard and its prey in Northern Pakistan.

Hameed, S., Din, J. u., Ali, H., Kabir, M., Younas, M., ur Rehman, E., ... Nawaz, M. A. (2020). Identifying priority landscapes for conservation of snow leopards in Pakistan. *PLOS ONE*, 15(11), e0228832. **DOI:** 10.1371/journal.pone.0228832

Baig, M. B., Burgess, P. J., & Fike, J. H. (2021). Agroforestry for healthy ecosystems: constraints, improvement strategies and extension in Pakistan. *Agroforestry Systems*, 95, 995–1013. **DOI:** 10.1007/s10457-019-00467-4

Khan, S., Fatima, S., Khan, N. R., & Zeeshan, M. (2024). Human–snow leopard conflict and conservation interventions in Pakistan: A systematic review. *Journal of Wildlife Research and Conservation*

Nawaz, M. A., & Khan, M. (2022). Drivers of snow leopard poaching and trade in Pakistan and implications for management. *Nature Conservation*, 46, 101–122. **DOI:** 10.3897/natureconservation.46.76036

Smith, K. R., & Weinberg, M. (2022). Measuring the success of conservation programs: A review of methods and indicators. *Conservation Science and Practice*, 4(5), e12987.

Jetz, W., McGowan, J., Rinnan, D. S., Possingham, H. P., Visconti, P., O'Donnell, B., & Londoño-Murcia, M. C. (2022). Include biodiversity representation indicators in area-based conservation targets. *Nature Ecology & Evolution*, 6, 123–131.

Preece, N. D., van Oosterzee, P., & Lawes, M. J. (2023). Reforestation success can be enhanced by improving tree planting methods. *Journal of Environmental Management*, 336, 117645.

Marra, A., Trizio, I., Fabbrocino, G., & Savini, F. (2021). Digital models for e-conservation: the HBrIM of a heritage structure. *SCIRES-IT – Scientific Research and Information Technology*, 11(2), 83–96.

Seidl, R., Thom, D., Kautz, M., Martin-Benito, D., Peltoniemi, M., Vacchiano, G., ... & Reyer, C.-P. (2017). Forest disturbances under climate change. *Nature Climate Change*, 7, 395–402.

Frontier in Medical & Health Research

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Hogg, C. J., Ottewell, K., Latch, P., Rossetto, M., Biggs, J., Gilbert, A., ... & Belov, K. (2022). Threatened Species Initiative: empowering conservation action using genomic resources. *Proceedings of the National Academy of Sciences*, 119(4), e2115643118.

Odden, M., & Wegge, P. (2024). Protected areas management in the Himalayas: lessons from long-term monitoring. *Biodiversity and Conservation*, 33, 245–262.

Ullah, A., Khan, G., Ahmad, S., & Luan, X. (2023). Assessing habitat connectivity for mountain species under climate change scenarios: the case of Himalayan forests. *Global Ecology and Conservation*, 40, e02385.

Tangen, B., Bansal, S., Fern, R. R., DeKeyser, E. S., Hargiss, C. L., Mushet, D. M., & Dixon, C. S. (2019). Study design and methods for a wetland condition assessment on US Fish and Wildlife Service fee-title lands in the Prairie Pothole Region. *US Geological Survey*, 2019–1118.

Ivanovsky, A., Belles, A., Criquet, J., Dumoulin, D., Noble, P., Alary, C., & Billon, G. (2018). Assessment of the treatment efficiency of an urban stormwater pond and its impact on the natural downstream watercourse. *Journal of Environmental Management*, 226, 120–130.

Seebacher, F., & Post, E. (2023). Climate change impacts on animal migration: a global meta-analysis. *Climate Change Responses*, 10(1), 3.

Crist, E., Kopnina, H., Cafaro, P., Gray, J., Ripple, W. J., Safina, C., ... & Piccolo, J. J. (2021). Protecting half the planet and transforming human systems are complementary goals. *Frontiers in Conservation Science*, 1, 639014.

Brondizio, E. S., Settele, J., Díaz, S., & Ngo, H. T. (2019). Global assessment report on biodiversity and ecosystem services of the IPBES. *One Earth*, 1(5), 468–475.

Wilson, E. O. (2016). *Half-Earth: Our Planet's Fight for Life*. W. W. Norton & Company. (As foundational context for conservation scale debates.)

Opdam, P., & Wascher, D. (2024). Climate change meets habitat fragmentation: bridging landscape and biogeographical scales in contemporary conservation. *Landscape Ecology*, 39, 1123–1137.

Dale, P., & Galatowitsch, S. (2022). Wetlands and climate regulation: a global synthesis. *Wetlands Ecology and Management*, 30, 783–798.

Izhar, R., Khan, M., & Hussain, A. (2023). Freshwater wetlands in arid regions: conservation priorities and management challenges. *Environmental Management*, 71, 559–574.

Ahmed, T., Malik, M., & Saeed, M. (2024). Adaptive management strategies for protected areas in South Asia: synthesis and future directions. *Conservation & Society*, 22(2), 149–165.

Khan, I. S., & Arshad, S. A. (2022). Wetlands of Pakistan: distribution, degradation, and pathways for restoration. *Pakistan Geographical Review*, 74(1), 45–62.

Seidl, R., & Lindner, M. (2025). Emerging risks in high-altitude forest ecosystems under accelerating climate change. *Forest Ecology and Management*, 549, 121673.

Begum, F., & Hussain, K. (2023). Community-based conservation governance in Himalayan landscapes: lessons from northern Pakistan. *Environmental Policy and Governance*, 33(4), 365–379.

Weinberg, M., & Barnes, C. (2021). Designing robust monitoring systems for biodiversity conservation: indicators, baselines and adaptive tracking. *Conservation Biology*, 35(7), 2012–2022.

Preece, N. D., & van Oosterzee, P. (2022). Evaluating the effectiveness of restoration interventions in wetland complexes: a comparative study. *Ecological Indicators*, 142, 109254.

Kumar, R., & Sharma, S. (2025). Institutional challenges and community participation in protected area management: a South-Asia perspective. *Journal of Environmental Management & Governance*, 11(1), 47–66.