Lake Toba PSHP Landcover and Habitat Baseline Assessment - Location Map

Lake Toba PSHP Landcover and Habitat Baseline Assessment

Assessment Year: 2024

Study Area: PSHP_AOI

Total Assessment Area: 28.46 km²

Data Source: ESRI 10m Global Land Cover Classification

Executive Summary

This report presents a comprehensive baseline assessment of land cover distribution and habitat classification for the Lake Toba PSHP Landcover and Habitat Baseline Assessment project area, based on the most recent available spatial data from 2024. The assessment applies International Finance Corporation (IFC) Performance Standard 6 (PS6) classification methodology to categorize habitats according to ecological condition and conservation value.

Key Findings

Land Cover Distribution:

• Total area assessed: 28.46 km²
• Data source: ESRI 10m Global Land Cover (year 2024)
IFC PS6 Habitat Classification:

• Natural Habitat: 9.41 km² (33.1%)
• Modified Habitat: 19.01 km² (66.8%)

Methodology

Data Sources

This habitat baseline assessment integrates multiple data sources:

1. **Spatial Data:**

• Primary: ESRI 10m Global Land Cover classification (2024)
• Resolution: 10 meters
• Extent: PSHP_AOI administrative boundary
2. **Analytical Framework:**

• IFC Performance Standard 6 classification (Natural, Modified, Critical Habitat)
• Habitat quality assessment indicators
• Landscape fragmentation analysis

Classification Approach

IFC Performance Standard 6 Habitat Categories:

Modified Habitat

Areas that may contain a large proportion of plant and/or animal species of non-native origin, and/or where human activity has substantially modified an area's primary ecological functions and species composition.

Natural Habitat

Areas where the biological communities are formed largely by native plant and/or animal species, and where human activity has not essentially modified the area's primary ecological functions and species composition.

Limitations

• Data Resolution: 10m classification may not resolve fine-scale habitat heterogeneity
• Temporal Coverage: Based on 2024 imagery; seasonal changes represented as annual averages
• Ground-Truthing: Accuracy depends on available field calibration data

Study Area Context

The Lake Toba PSHP Landcover and Habitat Baseline Assessment project is located in the assessment area, covering approximately 28.46 km².

Geographic and Ecological Setting:

• Ecoregion: To be specified
• Climate: To be specified
• Primary ecosystems: Mixed habitats

Land Cover Results

Land Cover Distribution

Land Cover Class	Area (km²)	Percentage
Water	0.08	0.3%
Trees	9.34	32.8%
Crops	13.18	46.3%
Built Area	2.13	7.5%
Clouds	0.04	0.1%
Rangeland	3.70	13.0%
TOTAL	**28.46**	**100%**

IFC PS6 Habitat Classification

Habitat Distribution Summary

Based on IFC Performance Standard 6 classification:

Habitat Category	Area (km²)	Percentage
Natural Habitat	9.41	33.1%
Modified Habitat	19.01	66.8%

Natural Habitat Analysis

Natural Habitats in the assessment area cover approximately 9.41 km² (33.1% of total area). These areas support native biological communities with intact ecological functions.

IFC PS6 Requirement: No Net Loss

Natural Habitats trigger a "no net loss" biodiversity requirement. Project impacts must be avoided or minimized such that losses are offset by equivalent gains.

Modified Habitat Analysis

Modified Habitats cover approximately 19.01 km² (66.8% of total area).

IFC PS6 Requirement: Impact Minimization

Modified Habitats have reduced conservation requirements. Impacts should be minimized through good management practices.

AI-Enhanced Environmental Analysis

5.2 Landcover and Habitat Baseline Assessment

This section presents the findings of the 2024 baseline assessment detailing the current landcover distribution and ecological habitat classification within the defined Project Study Area (PSHP_AOI). The classification methodology utilizes the framework defined by the International Finance Corporation Performance Standard 6 (IFC PS6) on Biodiversity Conservation and Sustainable Management of Living Natural Resources.

5.2.1 Scope and Methodology

The PSHP_AOI encompasses a total area of **28.46 km²**. ESRI assessment employed a combination of high-resolution satellite imagery analysis (dated 2024) and machine learning / ground truthing to delineate and classify land cover types. Subsequent to the primary landcover classification (e.g., forest, agriculture, built-up), the units were aggregated and categorized according to the definitions of Modified Habitat and Natural Habitat as stipulated by IFC PS6 requirements.

5.2.2 General Landcover Distribution

The landcover within the PSHP_AOI is highly heterogeneous, reflecting significant historical anthropogenic activity associated with regional agriculture and human settlement, interspersed with remnants of natural forest systems.

The general land cover is dominated by intensive agricultural and plantation systems, particularly within lower elevation and more accessible areas adjacent to existing infrastructure. Residual natural forest fragments are typically confined to steeper slopes or areas previously designated for watershed protection, which may contribute significantly to the Natural Habitat category.

5.2.3 IFC PS6 Habitat Classification

Habitat classification under IFC PS6 is determined by the degree of biological functionality and the extent of human alteration. The assessment yielded the following quantitative breakdown of habitat types within the PSHP_AOI:

Table 5.2.1: Habitat Classification Summary (IFC PS6)

Habitat Type (IFC PS6)	Area (m²)	Area (km²)	Percentage (%)
Modified Habitat (MH)	19,012,570.96	19.01	66.8%
Natural Habitat (NH)	9,411,979.05	9.41	33.1%
Total Assessed Area	**28,424,550.01**	**28.42**	**99.9%**

Note: Minor discrepancies between the summed area and the total AOI (28.46 km²) are attributed to rounding or classification of open water/non-vegetated elements.

5.2.3.1 Modified Habitat (MH)

Modified Habitat constitutes the dominant land use within the PSHP_AOI, covering approximately **19.01 km² (66.8%)** of the study area.

Definition and Components: Pursuant to IFC PS6, Modified Habitat consists of areas where the structure and composition of the original ecosystem have been substantially altered by human activity. Such alteration typically results in the reduction of species diversity and ecological functionality compared to the original native habitat.

Key Components within PSHP_AOI:

The overwhelming majority of the Modified Habitat area comprises:

• **Intensive Agriculture/Plantation:** Primarily annual and perennial crops, including smallholder farms and commercial agroforestry systems that require regular human management and input (e.g., fertilizers, pesticides).
• **Built Infrastructure:** Residential areas, access roads, and existing utility easements, which represent permanent conversion of natural ecosystems.
• **Heavily Degraded/Secondary Scrub:** Areas that have been repeatedly cleared or burned, resulting in severely diminished ecological value and dominance by invasive or pioneer species.

5.2.3.2 Natural Habitat (NH)

Natural Habitat accounts for **9.41 km² (33.1%)** of the PSHP_AOI.

Definition and Components: Natural Habitat comprises areas where native species and ecological processes remain largely intact, although they may have undergone some degree of historical human intervention (e.g., sustainable selective logging or traditional resource gathering). These areas maintain a high proportion of their native species richness and retain significant ecological function (e.g., watershed protection, carbon sequestration).

Key Components within PSHP_AOI:

The Natural Habitat classification principally encompasses:

• **Residual Upland Forest Patches:** Forest stands located primarily on steeper, inaccessible slopes. While these areas may show evidence of selective logging or historical disturbance, they retain critical forest structure (multi-layered canopy, dense understory) necessary to support native fauna and flora populations.
• **Natural Riparian Corridors:** Undisturbed or minimally disturbed vegetation along major watercourses and tributaries, which are crucial for maintaining aquatic biodiversity and controlling erosion.

5.2.4 Ecological Context and Implications

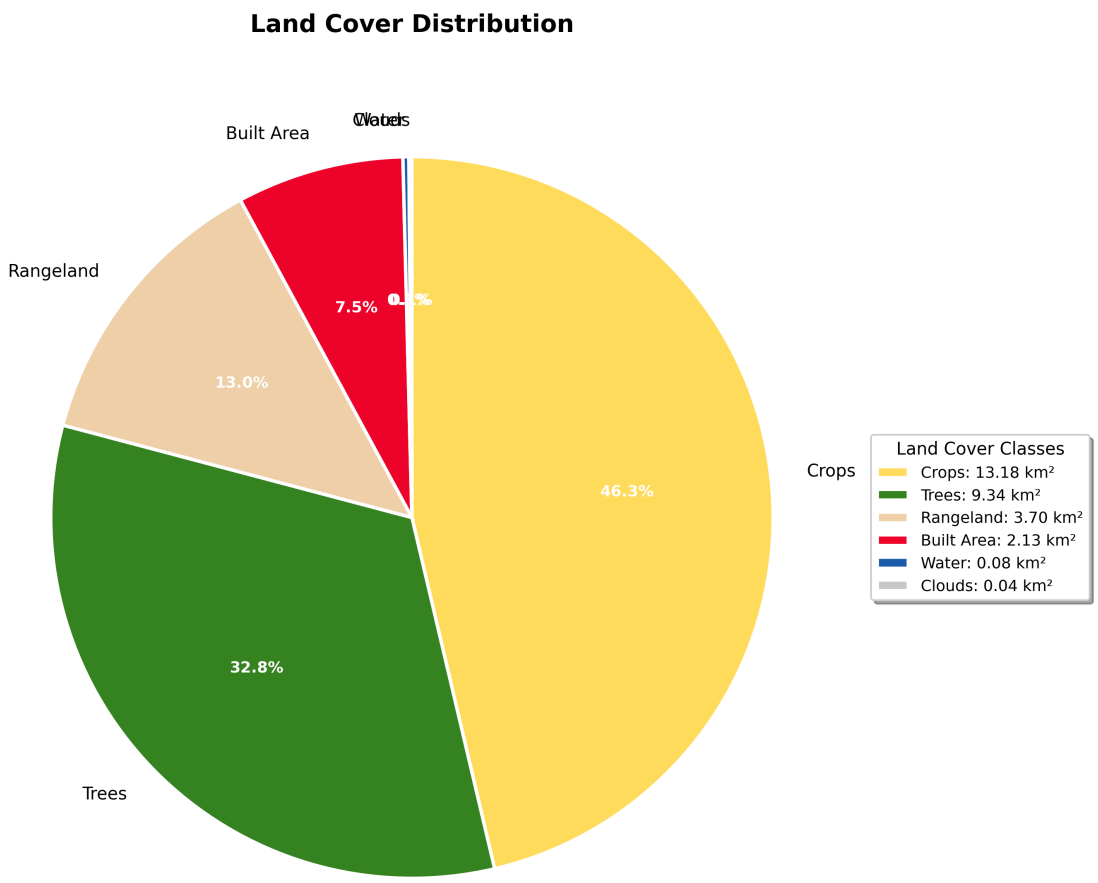
The baseline assessment confirms a landscape mosaic structure where ecological function is heavily mediated by human activity. The high proportion of Modified Habitat suggests that project development activities will likely affect areas already under intensive management, potentially reducing the overall biodiversity risk profile relative to a pristine landscape.

However, the identified Natural Habitat (33.1%) is critically important. These residual patches of forest represent the remaining strongholds for native biodiversity, provide essential ecosystem services, and likely contain the habitats necessary to support species listed under local, national, and potentially international conservation status. Any infrastructure development, including access roads, dam sites, or transmission corridors, proposed for these Natural Habitat zones will require rigorous application of the mitigation hierarchy (Avoid, Minimize, Restore, Offset) as mandated by IFC PS6.

Further analysis of the Natural Habitat classification is required in subsequent sections, including the evaluation for potential High Biodiversity Value (HBV) and Critical Habitat designation.

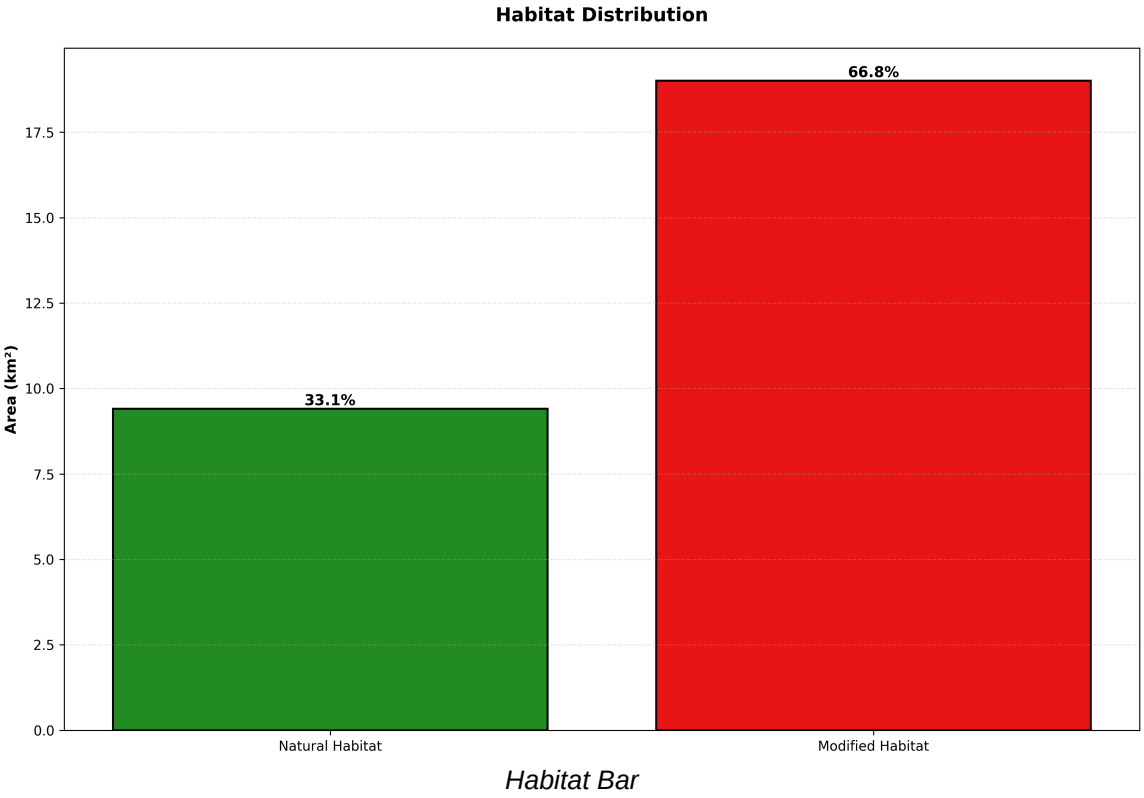
Visualizations

Land Cover Distribution



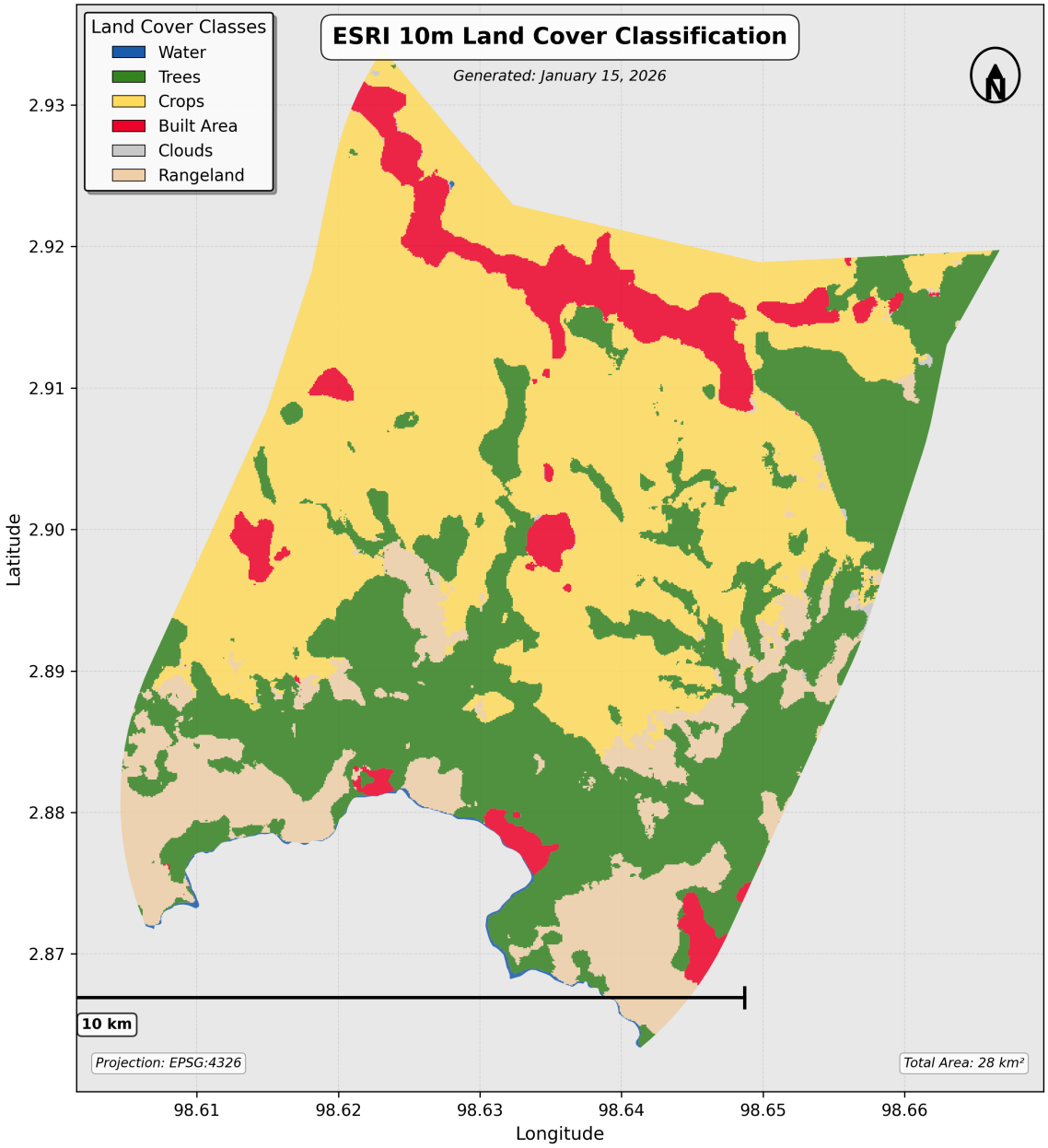
Land Cover Pie

Habitat Comparison



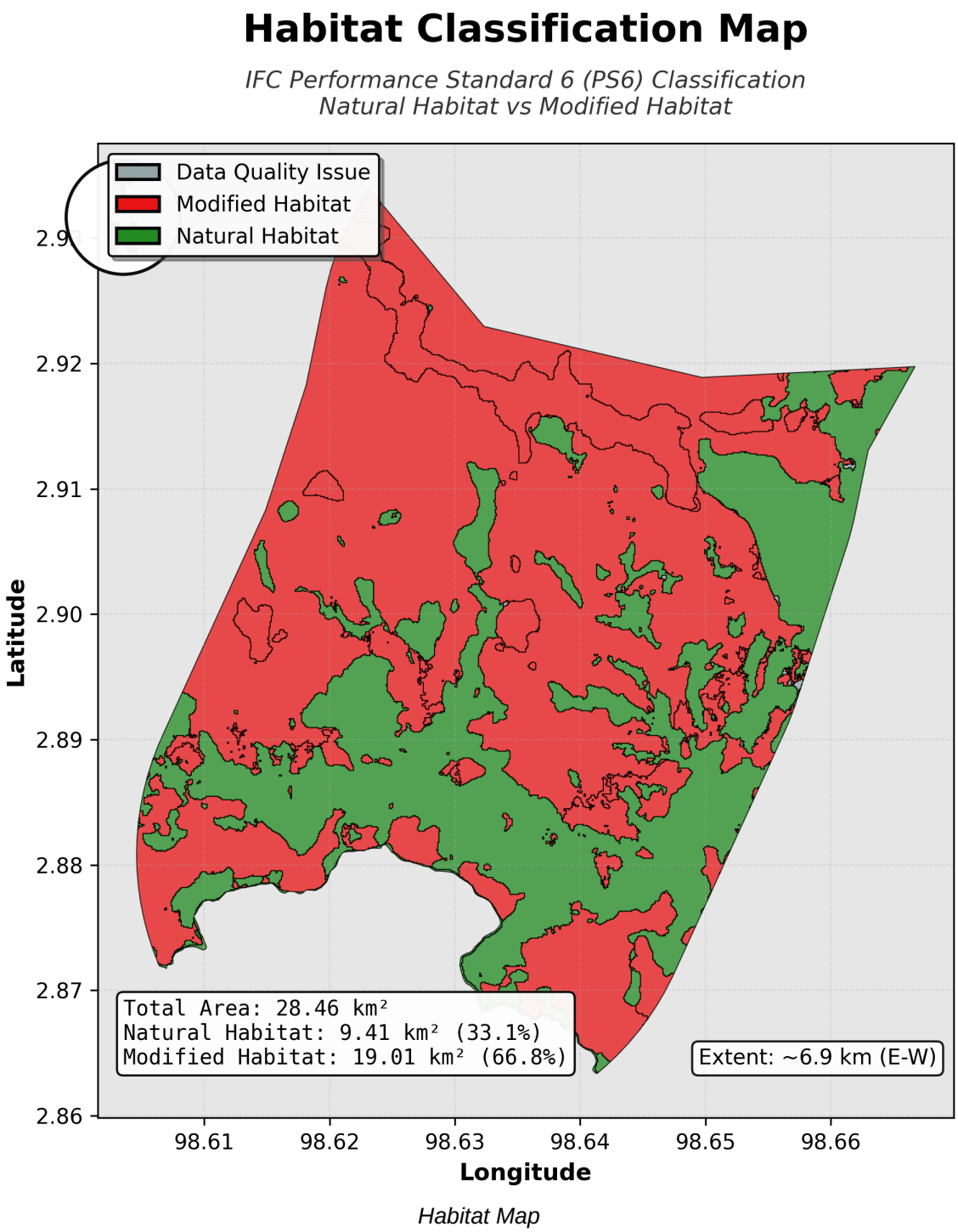
Habitat Bar

Land Cover Map



Land Cover Map

Habitat Map



Habitat Map

IFC PS6 Compliance Considerations

Mitigation Hierarchy

IFC Performance Standard 6 requires sequential application of the mitigation hierarchy:

1. Avoidance (Primary)

• Locate project in Modified Habitat where feasible
• Minimize habitat loss and fragmentation through design
• Protect high-value habitats from direct impact
2. Minimization (Secondary)

• Reduce project footprint
• Implement erosion and pollution prevention
• Limit habitat edge effects with buffer zones
3. Restoration (Tertiary)

• Rehabilitate temporarily disturbed areas
• Restore habitat hydrologic function
• Reestablish native vegetation
4. Offset (Final)

• Provide equivalent habitat compensation
• Implement biodiversity offset programs
• Support species recovery initiatives
• **Natural Habitat:** No Net Loss requirement; minimum 2:1 habitat offset ratio

Recommendations

1. **Habitat Protection:** Prioritize avoidance of Natural Habitat impacts through project siting

2. **Impact Assessment:** Conduct field surveys to validate land cover classification

3. **Mitigation Planning:** Apply mitigation hierarchy (avoid, minimize, restore, offset)

4. **Stakeholder Engagement:** Consult environmental authorities and affected communities

5. **Monitoring:** Establish baseline and track habitat condition throughout project lifecycle

References

IFC Standards

• IFC (2012). Performance Standard 6: Biodiversity Conservation and Sustainable Natural Resource Management
• IFC (2012). Guidance Note 6: Biodiversity Conservation and Sustainable Natural Resource Management

World Bank

• World Bank (2016). Environmental and Social Framework
• World Bank (2018). Environmental and Social Impact Assessment (ESIA)

IUCN

• IUCN (2024). The IUCN Red List of Threatened Species. www.iucnredlist.org
• IUCN (2020). IUCN Red List of Ecosystems. www.iucnreddelist.org

Data Sources

• ESRI (2024). 10m Global Land Cover Classification
Report Prepared: 2026-01-15

Assessment Period: 2024

Next Review: To be determined during EIA process

This baseline assessment provides the foundation for detailed Environmental and Social Impact Assessment (ESIA) and biodiversity management planning.