Sustainable Agriculture for Forest Ecosystems



HCV-HCS Screening in Lampung Tengah and Pesawaran Regency

Informing sustainable development through district-level High Conservation Value and High Carbon Stock screening in Lampung Tengah and Pesawaran, supported by high-level provincial HCV insights

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Executive Summary

This HCV/HCS Screening provides an early, desk-based indication of where High Conservation Values (HCVs) and High Carbon Stock (HCS) forest classes are most likely to occur. While the primary focus of this study is to develop a deeper understanding of HCV-HCS probability in Lampung Tengah and Pesawaran, a high-level HCV screening was also conducted for the broader Lampung Province. The purpose of this exercise is to highlight areas that may require closer attention or enhanced consideration in future land-use planning and decision-making processes.

High-probability HCV 1 (Species Diversity), 2 (Landscape-level Ecosystem, Ecosystem Mosaics and Intact Forest Landscape/IFL), and 3 (Ecosystem and Habitats) areas in **Lampung Province** are strongly concentrated within the province's remaining natural ecosystems – lowland rainforests, swamps, mangroves, riparian corridors, limestone formations, and large intact forest blocks including IFL and primary landscape corridors. These areas also overlap with the ranges of key RTE species such as the Sumatran Elephant, Sumatran Tiger, and Sumatran Rhinoceros.

The most significant clusters of high-probability HCV areas occur around Bukit Barisan Selatan National Park (BBSNP) in the west and Way Kambas National Park (WKNP) in the east, as well as along major wetland and riparian systems in the northeast, particularly within the Tulang Bawang and Way Seputih river basins. Highland regions across Lampung Barat, Tanggamus, Pesawaran, Lampung Selatan, and parts of Way Kanan, Lampung Utara, and Lampung Tengah also show strong concentrations of HCV 1 and 3.

These findings highlight the need to safeguard remaining intact ecosystems in Lampung Province, maintain and restore ecological connectivity, integrate HCV considerations into spatial planning, and collaborate with local stakeholders to ensure that future development in Lampung supports long-term landscape resilience.

The results of HCV-HCS screening at Lampung Tengah and Pesawaran show that both districts retain important ecological features, but the distribution, condition, and threats differ. These differences matter for how sustainable agriculture, spatial planning, restoration, and community engagement should be prioritized.

In **Lampung Tengah**, high-probability HCV areas are concentrated in two main systems:

- ✓ the western uplands, where remnant forest blocks support biodiversity, water sources, and erosion-control functions; and
- ✓ the eastern and northeastern swamp landscapes, where extensive wetland ecosystems (>20,000 ha) provide hydrological regulation, flood buffering, and important habitat for waterbirds and migratory species.

When overlaid with HCS classes, the western uplands show the strongest overlap between medium–high density forests and high-probability HCV 1 (Species Diversity), 3 (Ecosystem and Habitats), 4 (Ecosystem Services), and 5 (Community Needs), signalling priority areas for protecting connectivity, managing slopes, and preventing further forest loss. The swamp system emerges as a landscape-scale priority (HCV 2 Landscape-level Ecosystem) for both ecological and disaster-risk reasons, but it is also one of the most exposed to land conversion, fire, and hydrological alteration.

In **Pesawaran**, high probability of HCV areas spread across the district due to the presence of steep slopes and forests around the southwestern of the district, Tahura WAR (Wan Abdul Rahman) at the center of the region, as well as mangrove ecosystems around its coastal area. HCV 4 is the dominant value, with 21,216 ha of high-probability zones (16.6% of the district), reflecting the strong role of upland forests, steep slopes, and mangrove/coastal systems in maintaining watershed stability,

erosion control, and flood mitigation. Smaller, but ecologically important, high-probability cores of HCV 1 and HCV 3 occur in forest blocks around Tahura WAR, Register 20 and 21, and coastal mangrove clusters. HCV 5 hotspots are localised around forest area reflecting dependence on springs (high probability), mangrove and coastal ecosystems to provide alternative livelihood (low probability).

HCS analysis shows that while majority of Lampung Tengah and Pesawaran is non-forest or low carbon HSC class, the remaining HDF–MDF–LDF–YRF classes largely overlap with HCV areas. These forests are highly fragmented, indicating that restoration and corridor enhancement can substantially improve biodiversity, hydrological resilience, and long-term habitat viability.

Across both districts, the most important zones for immediate attention are those where high-probability HCV areas coincide with higher threats, particularly deforestation, fire, landslides, agricultural expansion, and mining. These areas represent the highest leverage points for safeguarding ecological functions, maintaining landscape connectivity, and reducing disaster risks that directly affect communities and agricultural productivity.

At the same time, this screening highlights strategic opportunities, among others:

- ✓ corridor restoration between remnant forest patches
- ✓ riparian rehabilitation to reduce flood and erosion impacts
- ✓ wetlands, including swamp, riparian and mangrove protection, and
- ✓ alignment of agricultural expansion with landscape-level safeguards.

These opportunities need to be refined through targeted field verification and multi-stakeholder engagement to ensure that interventions are context-appropriate, socially acceptable, and aligned with district and provincial spatial planning (RTRW).

The findings should therefore be interpreted as a decision-support baseline: a starting point for planning, dialogue, risk screening, and targeted ground truthing, not a substitute for detailed HCV/HCS assessments or regulatory processes.

Limitation:

This report presents an initial, desk-based screening of potential HCV and HCS areas and is not intended to provide definitive delineation, compliance verification, or final “no-go” decisions. Formal designation of HCVs or HCS forests requires field-based assessments and stakeholder engagement beyond the scope of this exercise. All area figures are estimates derived from digital mapping and spatial analysis, and actual field-measured areas may differ.

Abbreviations

AMAN	: Indigenous Peoples Alliance of the Archipelago / *Aliansi Masyarakat Adat Nusantara*
ANOVA	: Analysis of Variance
ASL	: Above sea level
BAPPEDA	: Regional Development Planning Agency
BBSNP	: Bukit Barisan Selatan National Park
BIG	: Geospatial Information Agency / *Badan Informasi Geospasial*
BNPB	: National Disaster Management Agency / *Badan Nasional Penanggulangan Bencana*
BPS	: Statistical Agency / *Badan Pusat Statistik*
BPDAS	: Watershed Management Agency / *Balai Pengelolaan Daerah Aliran Sungai*
BRWA	: Ancestral Domains Registration Agency / *Badan Registrasi Wilayah Adat*
CR	: Critically Endangered
DAS	: River Basin Area / Daerah Aliran Sungai
DEM	: Digital Elevation Model
EN	: Endangered
ESDM	: Energy and Mineral Resources / *Energi dan Sumber Daya Mineral*
FAO	: Food and Agriculture Organization
FGD	: Focus Group Discussion
GAP	: Good Agricultural Practices
GEDI	: Global Ecosystem Dynamics Investigation
GEDSI	: Gender Equality, Disability, and Social Inclusion
GIZ	: German Society for International Cooperation / *The Deutsche Gesellschaft für Internationale Zusammenarbeit*
HDF	: High Density Forest
HCS	: High Carbon Stock
HCSA	: High Carbon Stock Approach
HCV	: High Conservation Value
HK	: Conservation Forest / *Hutan Konservasi*
HL	: Protected Forest / *Hutan Lindung*
HP	: Production Forest / *Hutan Produksi*
IBAs	: Important Bird and Biodiversity Areas (IBAs)
IFL	: Intact Forest Landscape
IPSDH	: Directorate of Forest Resource Inventory and Monitoring / *Direktorat Inventarisasi dan Monitoring Sumber Daya Hutan*
IUCN	: International Union for Conservation of Nature
IUP	: Mining Business License / *Izin Usaha Pertambangan*

KBA	: Key Biodiversity Area
KEK	: Special Economic Zone / *Kawasan Ekonomi Khusus*
KLHK	: Ministry of Environment and Forestry / *Kementerian Kehutanan dan Lingkungan*
KPH	: Forest Management Unit / *Kesatuan Pengelolaan Hutan*
KPHK	: Forest Management Unit Conservation / *Kesatuan Pengelolaan Hutan Konservasi*
KPHL	: Forest Management Unit Protection / *Kesatuan Pengelolaan Hutan Lindung*
KTH	: Forest Farmer Group/ *Kelompok Tani Hutan*
KPHK WAR	: Wan Abdul Rachman Forest Management Unit Conservation
LC	: Least Concern
LDF	: Low Density Forest
LiDAR	: Ligt Detection and Ranging
MASL	: Meters above sea level
MDF	: Medium Density Forest
MoF	: Ministry of Forestry
NE	: Not Evaluated
NDVI	: Normalised Difference Vegetation Index
NT	: Near Threatened
NTFPs	: Non-Timber Forest Products
RBI	: Indonesia Topographic Base Map / *Rupa Bumi Indonesia*
RePPProT	: Regional Physical Planning Programme for Transmigration
RTE	: Rare, Threatened, and Endangered
RTRW	: Ministry of Forestry Provincial Spatial Planning
SAFE	: Sustainable Agriculture for Forest Ecosystem
SRTM	: Shuttle Radar Topography Mission
Tahura	: Forest Park / *Taman Hutan Raya*
Tahura WAR	: Wan Abdul Rachman Forest Park
TRHS	: Tropical Rainforest Heritage of Sumatra
UNESCO	: United Nations Educational, Scientific and Cultural Organization
VU	: Vulnerable
WAR	: Wan Abdul Rahman
WCS	: Wildlife Conservation Society
WKNP	: Way Kambas National Park
YRF	: Young Regenerating Forest

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1. Introduction

Preferred by Nature conducted an HCV–HCS Screening in Lampung Tengah and Pesawaran, commissioned by the GIZ SAFE Project[1]. In Lampung, SAFE program collaborates with a private sector partner to support 2,000 natural rubber smallholders by improving traceability, legality, sustainable farming, and strengthening farmer organisations. The screening aims identify probability of High Conservation Value (HCV) and High Carbon Stock (HCV) areas in the target districts to support sustainable development and environmental protection.

The screening provides an initial overview of deforestation risks and highlights areas of potential HCV and HCS significance. Its purpose is to inform spatial planning dialogue and serve as a baseline for future sustainable development, helping stakeholders balance multiple sectors such as licensing of industry, infrastructure planning, or agriculture development, with biodiversity protection and climate resilience.

The objectives of this exercise are to:

1. Identify the likelihood of HCV and HCS areas within the two districts.
2. Assess potential threats to these areas and determine priority zones for HCV management.
3. Provide actionable recommendations to local governments, partners, and stakeholders to promote sustainable agricultural practices and prevent harm to HCVs.

The primary users of this report are local government agencies, particularly those involved in regional development planning, as well as other stakeholders engaged in advancing sustainable development in Lampung, including donors and private sector actors.

Scope of the HCV-HCS Screening

The screening covers two bordering districts in Lampung Province – Lampung Tengah and Pesawaran – and also provides indicative insights on the probability of HCV 1–3 occurrence at the provincial level. The screening combined spatial desk analysis with stakeholder consultations to build a comprehensive understanding of ecological and socio-economic conditions. Activities included reviewing relevant spatial and contextual data to identify potential HCV-HCS presence, along with interviews, consultations, and focus group discussions with government, communities, and civil society to validate findings and guide recommendations for landscape management.

Limitations of This Study

1. This report presents the results of a desk-based HCV/HCS screening intended to provide an initial understanding of potential conservation priorities across the landscape. The analysis is not designed to serve as a definitive delineation of HCV or HCS areas, nor should it be used as a basis for compliance assessments, management prescriptions, or final “no-go” decisions. Any formal designation of HCVs or HCS forests requires field-based verification, stakeholder engagement, and site-specific assessments that go beyond the scope of this screening exercise.
2. All area figures presented in this report are estimates derived from digital mapping and spatial analysis[2]. As a result, the values represent estimations generated through desk-based analysis,

[1] More information on GIZ SAFE Project: https://www.giz.de/en/downloads/giz2024-en-sustainable-agriculture-for-forest-ecosystems.pdf

[2] Area calculations were conducted under the WGS 84 geodetic datum and UTM projection system, which are internationally recognised standards for spatial referencing and cartographic measurement (Snyder, 1987); the reported figures represent GIS-based estimations derived from mapped boundaries and may differ from actual ground-measured extents. Reference: Snyder, J. P. (1987). Map Projections: A Working Manual. U.S. Geological Survey Professional Paper 1395.

and actual field-measured areas may differ. These limitations should be considered when interpreting the results or using them to guide further planning.

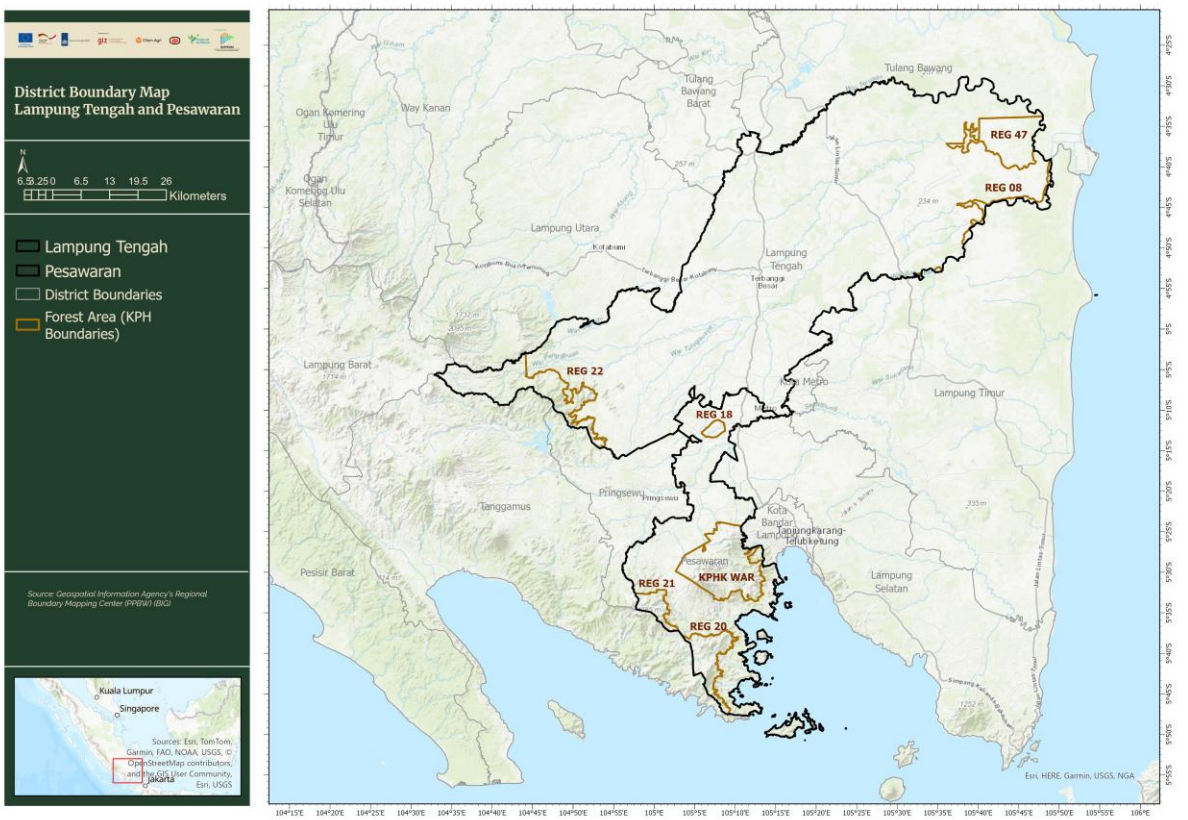


Figure 1. Map of Lampung Tengah and Pesawaran District

2. Methods

The identification of HCVs in this study follows the HCV Screening Guide developed by the HCV Resource Network (2020). The screening design was developed taking into consideration HCV indicators and criteria recommended by HCV Screening Guidance, HCV Common Guidance, and National Toolkit Indonesia. The HCS classification refers to the method described by Lang et al. (2021).

A structured decision tree was developed for each HCV category to identify areas with higher or lower probability of containing HCVs. The approach applies a sequential set of filters – using available spatial data, ecological indicators, and stakeholder insights – to evaluate whether an area is likely to contain important conservation values.

2.1. HCV 1 Species Diversity

HCV 1 refers to areas that have concentration of biological diversity including endemic species, and RTE species that are significant at global, regional, or national levels. HCV 1 screening was carried out using available information on the presence of key species, combined with spatial data to justify the likelihood of suitable habitat presence.

HCV 1 areas are characterized by the presence of key biodiversity features, including:

- *Centers of High Biodiversity.* Protected and high-biodiversity areas such as conservation zones, national parks, KBAs, and protection forests with intact natural forest are considered HCV 1

higher probability. Lower probability where protection forests have been converted or lack natural cover.

- *Concentrations of RTE and flagship species.* Habitats for RTE species such as natural forests with permanent water sources and low human disturbance are considered higher probability. Lower probability in shrublands, buffer zones, or regenerating forests along natural forest edges.
- *Forest patches that functions as corridors to support species population.* Natural forest cover with core area of > 100ha, and distance between patches of < 200 m is considered as higher probability. Lower probability in smaller patches (10–100 ha) with <200 m apart.
- *Migratory bird habitat.* Stopover sites with natural or semi-natural ecosystem such as forest, rivers, wetlands, swamps, and floodplains are considered higher probability. Lower probability in non-natural or heavily altered habitats.

Overall, intact natural forests, connectivity, and key species presence increase HCV 1 probability, while degraded or non-forest area lower the probability of HCV 1 presence.

Key data source: IUCN, BBSNP, WCS, WKNP, Land Cover Data, BirdLife, HCV National Toolkit for Indonesia.

2.2. HCV 2 Landscape-level ecosystems, ecosystem mosaics, and Intact Forest Landscapes

HCV 2 refers to large, landscape-level ecosystems or intact forest landscapes (IFL) that support viable populations of most naturally occurring species. The threshold size for HCV 2 for this screening exercise is >20,000 ha aligned with HCV National Toolkit for Indonesia (2008). In Lampung, IFL areas are found within Bukit Barisan Selatan National Park (BBSNP).

While neither Lampung Tengah nor Pesawaran contains formally designated IFL areas, several landscape features indicate that a precautionary approach should be warranted to further investigate potential HCV 2 presence:

- Lampung Tengah has extensive swamp and natural *gelam* (*Melaleuca leucadendra*) ecosystems exceeding 20,000 ha, giving them higher-probability HCV 2 status due to their size, continuity, and ecological roles.
- Pesawaran contains upland forest blocks (Register 20 and 21) that may potentially be part of a broader ecological mosaic in connection with the Tahura WAR landscape.

As a precautionary approach, the determination of HCV 2 probability was conducted using indicators such as ecosystem size, intactness, distance from human disturbance, habitat continuity, and landscape connectivity. Areas with large, relatively intact natural vegetation or key ecological functions (e.g., corridors or buffer zones) were classified as higher probability, while smaller or more modified areas that still support connectivity were classified as lower probability.

Key data Source: IFL map, Landcover data, Landform Map Indonesia, RTRW, Forest Area Map.

2.3. HCV 3 Ecosystems and Habitats

HCV 3 refers to ecosystems, habitats, or refugia that are rare, threatened, or hold unique ecological characteristics. Identification focuses on determining whether natural ecosystems – either intact or only slightly disturbed – are present within the study area. This screening follows the HCV National Toolkit for Indonesia (2008) and applies the precautionary principle when evaluating rarity and threat levels.

HCV 3 probability was assessed based on three main criteria:

- *Naturally rare ecosystems*. Ecosystems limited by unique geology, soil, hydrology, altitude, or climate were considered higher probability when these features remain within their natural range, while highly modified habitats were classified as lower probability.
- *Anthropogenically rare ecosystems*. Ecosystems historically widespread but now heavily reduced due to human activities were classified as higher probability. Ecosystems that remain regionally common but are too degraded to serve their ecological role were considered lower probability.
- *Threatened or endangered ecosystems*. Using RePPProT classifications and the Indonesian HCV Toolkit, ecosystems with remaining natural vegetation cover were considered higher probability. Areas where such ecosystems existed historically but have experienced substantial land-use change were classified as lower probability.

Key data source: Land cover MoF, RePPProT, FAO Soil Type, Karst Distribution, Landform map Indonesia, IBAs.

2.4. HCV 4 Ecosystem Services

HCV 4 refers to areas that provide critical ecosystem services where disruption would pose significant risks to communities, infrastructure, or other HCVs. These services include water catchment protection, erosion control, firebreak functions, and pollination:

- *Water catchment protection* is considered higher probability in wetlands with natural forest cover and in water catchment areas within protected or conservation forests at altitudes above 500 meters, while lower probability occurs in wetlands with shrub cover or water catchments in non-forest areas.
- *Erosion control* is considered as higher probability in steep slopes greater than 40% with forest cover and lower probability in slopes of 25–40% with forest cover.
- *Firebreak functions* are considered as higher probability in intact natural ecosystems such as rivers, lakes, and wetlands in forest areas, and lower probability in water sources and buffers located in non-forest areas.
- *Pollination services* are critical when crops such as durian or subsistence farming depend on forest habitats for pollinators.

Key data sources: Ramsar sites, MoF land cover data, Landform, watershed boundaries BPDAS, DEM SRTM.

2.5. HCV 5 Community Needs

HCV 5 refers to sites and resources that are fundamental for meeting the basic necessities of local communities or indigenous peoples, such as livelihoods, health, nutrition, and water. Ideally, these areas are identified through engagement with local communities, but in a screening context, information is gathered from government data and consultations with village and forest-farmer representatives.

The integration of GEDSI (Gender Equality, Disability, and Social Inclusion) principles within the data collection process ensures that variations in resource dependence are captured and that differing needs, constraints, and vulnerabilities among community groups are systematically considered. For

example, people living in remote areas and women residing near forest margins may rely more heavily on forest resources for non-timber forest products (NTFPs) or water. Indigenous groups may depend on specific rivers or forest areas for cultural or nutritional needs. Elders or people with disabilities may rely on closer, more accessible forest patches due to mobility constraints.

Overall, higher probability occurs when communities or groups depend heavily on natural resources for their basic needs (e.g., food, water, energy, income) and lack viable alternatives. Examples include indigenous hunter-gatherers present, firewood as the main energy source, fishing as the primary protein source, or reliance on rivers for drinking water. Meanwhile, lower probability occurs when alternative sources or substitutes are accessible, reducing reliance on natural resources. Examples include absence of indigenous groups, availability of alternative fuels, access to healthcare or markets, or government-provided water sources.

Key data sources: BPS data, local stakeholder interviews, and district-level FGDs with villages and farmers' representative.

2.6. HCV 6 Cultural Values

HCV 6 refers to areas with cultural importance for local or Indigenous communities, such as sacred sites, burial grounds, and places for traditional ceremonies. Indicators include the presence of customary practices, registered Indigenous tribes, or widely implemented cultural beliefs.

Although Lampung Tengah and Pesawaran are predominantly Muslim and no longer rely heavily on sacred areas, interviews with cultural representatives indicate some sites are still considered sacred. Using a precautionary approach, HCV 6 analysis is applied using the following criteria:

- For cultural or historical sites officially recognised at regional, national, or international level: Higher probability when sites are registered; lower probability when sites are identified but still under registration.
- For sites with recognised cultural or historical value without legal protection and/or any religious or sacred sites, burial grounds, or ceremonial areas: Higher probability when identified through desk research and stakeholder consultation; no lower probability defined.
- Plant or animal resources with totemic or ceremonial value. Higher probability when species are irreplaceable and mandatory for rituals; no lower probability defined.

Key data sources: Department of Culture and Education, Department of Tourism, UNESCO, BRWA, AMAN, stakeholder consultations.

2.7. High Carbon Stock (HCS)

The Indicative High Carbon Stock (HCS) maps for Lampung Tengah and Pesawaran were developed according to five main HCS classes:

- *High Density Forest (HDF):* High canopy, high biomass (>125 ton/ha)
- *Medium Density Forest (MDF):* Intermediate canopy (75–125 ton/ha)
- *Low Density Forest (LDF):* Early regeneration (<75 ton/ha)
- *Young Regenerating Forest (YRF):* Fast-growing young forest (35–75 ton/ha)
- *Scrub/Non-Forest:* Shrubs, grass, open areas (<35 ton/ha)

The Indicative High Carbon Stock (HCS) 2020 maps for Lampung Tengah and Pesawaran Districts were derived from the Indicative HCS Forest Map Dataset developed by Lang, Schindler, and Wegner (2021). This dataset integrates 10-m resolution Sentinel-2 optical imagery, GEDI LiDAR–derived canopy height

measurements, and deep-learning–based models to generate spatial layers of canopy height and above-ground carbon density, which are subsequently classified following the HCS Approach Toolkit Module 4. The dataset represents vegetation conditions between September 2020 and March 2021, providing a high-resolution spatial overview of carbon distribution, forest condition, and landscape degradation across the diverse landscapes of both districts.

A stratified random sampling approach was applied to validate the High Carbon Stock (HCS) classification derived from Lang et al. (2021). A total of 200 random sample points were generated, ensuring at least 30 samples per class to achieve stable accuracy estimates and reduce bias from uneven class distribution.

To evaluate whether vegetation greenness derived from remote sensing corresponds to the level of aboveground carbon represented by the HCS classes, we performed a statistical comparison between Normalised Difference Vegetation Index (NDVI) values and carbon classes obtained from the sample plots. The analysis used a one-way Analysis of Variance (ANOVA) to test whether mean NDVI differs significantly between the carbon strata. Prior to ANOVA, descriptive statistics (mean, standard deviation, minimum, and maximum NDVI) were calculated for each class to characterize the central tendency and variability within groups. This method follows common approaches in remote sensing and forest ecology, where NDVI is evaluated as an indicator of biomass, canopy density, or forest regeneration stage (Foody et al., 2003; Lu, 2005).

2.8. Threat and Priority Analysis

The threat analysis serves as an important basis for determining priority mitigation zones and sustainable landscape management strategies to maintain and enhance the remaining HCV and HCS in Lampung Tengah and Pesawaran. The study considers both anthropogenic and natural drivers of landscape change and analyses the potential to impact multiple HCVs, such as forest and land fires, landslides, flood, deforestation, and mining. Proximity to road and settlement is also considered to estimate potential threat in relation to human activities, such as wildlife hunting, agriculture encroachment or possibility of the infrastructure intersects with HCV/HCS probability areas. Threat level is classified using spatial indicators with higher-threat areas generally located close to access points, land-use activities, or sensitive ecological features.

1) *Road and settlement.* Areas located close to roads and settlements are considered more vulnerable because proximity increases human access, land-use pressure, and activities such as land conversion or resource extraction. Areas within two kilometres of roads or one kilometre of settlements are classified as high threat, while those beyond these distances are considered low threat. Proximity to roads and settlements was assessed using spatial layers from the Indonesian Topographic Map (Peta Rupa Bumi Indonesia – RBI).
2) *Fires.* Fire risk is evaluated using NASA FIRMS Hotspot Data (MODIS/VIIRS) from 2015 to 2025. The presence of hotspots indicates a high threat due to increased likelihood of fire and landscape disturbance.
3) *Mining*. Mining activity is assessed based on the presence of mining concessions, with any area located inside a concession categorized as high threat due to potential habitat loss and disturbance. Mining Business License (IUP) Spatial Data issued by Ministry of Energy and Mineral Resources (ESDM) (2020) is used for this analysis.
4) *Deforestation*. Areas experiencing forest cover loss indicate ongoing land-use change and ecological pressure. High threat where forest cover loss from 2020–2024 is detected; Low threat where no loss is observed. Forest Cover Change / Deforestation Data of Ministry of Environment and Forestry (KLHK) (2020-2024) is used for this analysis.

5) *Flood and Landslides*. Flood and landslide hazards are evaluated using national disaster risk maps (InaRISK Disaster Risk Map – BNPB, 2016). Areas classified as having high flood or high landslide hazard are considered high threat because such environmental instability can disrupt ecosystems. Areas mapped as moderate or low hazard fall into the low-threat category.

The identification of priority area combines the level of threat (higher and lower threat) with the probability of HCV presence (higher and lower probability). The prioritisation matrix can be seen below.

Table 1. Prioritisation matrix to identify HCV Management Priority Area

		Probability of HCV Presence	
		Lower Probability	**Higher Probability**
Threat level to HCV	**Higher Threat**	Priority: Medium (Lower Probability & High Threat)	Priority: High (High Probability & High Threat)
	Lower Threat	Priority: Low (Lower Probability & Low Threat)	Priority: Medium (High Probability & Low Threat)

3. Overview of screening landscape

3.1. Land Use and Topography

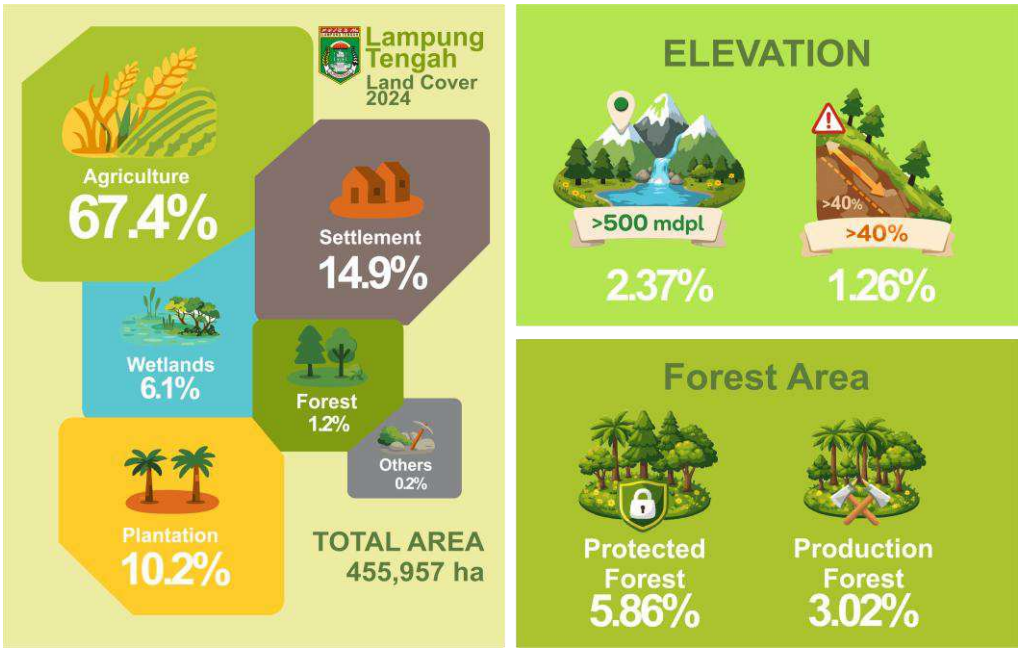


Figure 2. Landscape Overview of Lampung Tengah District

Lampung Tengah spans 28 subdistricts and features mostly lowland landscapes. The district is dominated by dryland agriculture but still retains important ecological elements relevant to HCV, including wetlands mainly on the eastern part; patches of forest and areas of steep terrain and high elevations, mainly in the western part of the district.

Plantation areas, mainly oil palm and rubber, are concentrated in the southern and western zones and occur adjacent to secondary dryland forest patches located in upland areas around Sumber Jaya, Padang Ratu, and Sendang Agung. Shrubland (under 'others' category) and shrub swamp (under 'wetlands' category) are mainly found in the northeastern area, indicating possible post-clearance or transitional land.

Lampung Tengah District contains several forest areas that form part of Indonesia's officially designated forest zone. These include:

- **Protected Forests:**
  - KPH Way Terusan Register 08 (Way Rumbia) on the east bordering WKNP.
  - KPH Way Waya Register 22 on the west[3].
- **Production Forest** within Register 47 Way Terusan, on the northeast.

While remnant natural forest mainly found around Reg 22; Reg 47 and Reg 08 Way Terusan include swamp ecosystems and natural *gelam* ecosystems, which contribute to local biodiversity and ecological functions.

[3] It is possible that a portion of KPH Way Waya Register 39 extends into Lampung Tengah. However, since the boundary of each register within the same unit (KPH) is unclear, and the majority of Register 39 lies within Tanggamus District, for the purposes of this report, references are limited to KPH Way Waya Register 22, while acknowledging that some areas may, in practice, overlap with Register 39.

Pesawaran comprises 11 sub-districts with a more heterogeneous land-cover pattern shaped by its coastal and hilly terrain. Agriculture still dominates the landscape, however, compared to Lampung Tengah, it retains a higher proportion of forest cover as well as more upland and steep-slope areas – key ecological features relevant for HCV. This is further strengthened by the mangrove ecosystem along the southern coast, which may align with RTE categories and form a complementary ecological zone for species diversity.

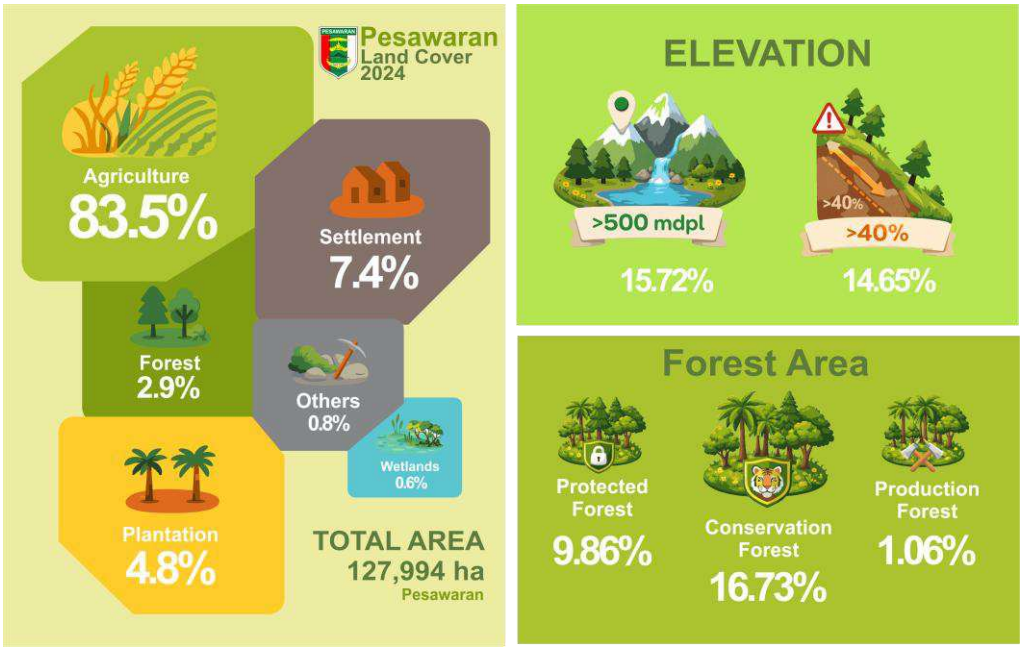


Figure 3. Landscape Overview of Pesawaran District

Plantation systems, including coconut, oil palm, and mixed agroforestry, are more prevalent in the northern upland areas bordering Pringsewu. Mangrove forests and fish-ponds are concentrated along the southern coastline, especially in Punduh Pidada and Padang Cermin.

Within Pesawaran, the formally designated forest areas include:

- **Conservation Forest** within KPHK Wan Abdul Rahman (WAR) around the centre.
- **Protected Forest** within KPH Pesawaran Register 21 on the west and Register 20 Punduh Pidada on the southwest.
- **Production Forest** within KPH Pesawaran Register 18 on the north.

Many of the higher-probability HCV areas in Pesawaran are influenced by the wider KPHK WAR landscape, as well as Register 20 and Register 21, which include remnant natural forest which contribute to local biodiversity and ecological functions.

3.2. Hydrology

Lampung Tengah is characterised by eastward-flowing river systems that drain from the western uplands toward the central and eastern lowland plains. Key rivers include Way Seputih, Way Pengubuan, Way Terusan, and Way Pegadungan, supported by tributaries such as Way Punggur and Way Raman. These form part of the Way Seputih – Way Sekampung watershed, with upland headwaters transitioning into agricultural lowland drainage zones.

Pesawaran has a more complex hydrological network shaped by mountainous terrain and coastal processes. Rivers such as Way Lima, Way Sekampung, and Way Ratai originate in the central highlands (around Gedong Tataan, Way Khilau, Kedondong) and flow toward the coast, discharging into Teluk

Lampung. Coastal and estuarine areas (e.g., Padang Cermin, Way Ratai, Punduh Pidada) exhibit tidal influence, supporting mangroves, brackish systems, and fishpond zones.

3.3. Soil

Both districts have high soil diversity shaped by alluvial and volcanic processes, supporting multiple land uses from intensive lowland farming to upland agroforestry. In Lampung Tengah, central and eastern lowlands (Terbanggi Besar, Seputih Mataram, Way Pengubuan) are dominated by moderately fertile Orthic Acrisols (Ao70-2/3b) that support intensive agriculture and plantations, while northwestern areas (Bandar Mataram and Bumi Nabung) contain Cambic Arenosols (Qc59-1ab) and Dystric Fluvisols (Jd9-2/3a) suitable for seasonal farming. Western and southern uplands (Selagai Lingga, Padang Ratu, Sendang Agung) are characterized by volcanic-derived Humic Andosols (Th17-2c), Humic Cambisols (Bh17-2bc), and Ferric Acrisols (Af55-3b) with high organic matter and good water retention, making them suitable for forests and agroforestry but vulnerable to erosion on steep slopes, alongside smaller pockets of fertile Nitosols (Nd54-3b) in Midland area (Kalirejo and Bangun Rejo) supporting mixed dryland agriculture.

In Pesawaran, Ferric Acrisols (Af55-3b and Af56-2a) dominate central and hilly zones (Way Lima, Gedong Tataan, and Teluk Pandan) and are mainly used for perennial crops and agroforestry with fertility management, while the surrounding uplands is dominated by Humic Andosols (Th17-2c) which support forest ecosystems and shade-grown plantations. More fertile Eutric Cambisols (Be116-2c) and Chromic Luvisols (Lc97-3b) and Ferric Acrisols occur in southern coastal areas and northern lowlands (Padang Cermin, Way Ratai, Punduh Pidada, Tegineneng and Negeri Katon), supporting agriculture and aquaculture and marking a transition from productive alluvial plains to more leached uplands. Overall, there is no specific unique soil type qualifying as HCV, but sustainable land and soil management is essential to prevent degradation, particularly in upland and steep areas (Acrisol zones) and optimised agricultural use in more fertile Cambisol and Luvisol areas.

3.4. Climate

Both districts have a tropical wet climate with consistently warm temperatures, high humidity, and substantial rainfall.

Lampung Tengah has annual mean temperatures range from about 21°C to 27.5°C. Cooler conditions prevail in the western uplands and warmer temperatures in the central and eastern lowlands. This variation reflects differences in elevation and land use, where upland areas are forested and lowlands are dominated by agriculture and settlements. Annual rainfall in Lampung Tengah averages between 2,000 mm and 2,692 mm, with the highest precipitation occurring in the western highlands due to orographic effects from the Bukit Barisan range.

Pesawaran has a slightly wider temperature range, from 18.8°C to 27.3°C. Cooler conditions prevail in the central mountainous areas, while warmer temperatures dominate the northern and coastal lowlands. Rainfall in Pesawaran is ranging from 1,955 mm to 3,000 mm annually, with the highest totals in the central highlands and lower amounts in northern lowlands. Coastal zones receive intermediate rainfall levels.

3.5. Socio Economic

Lampung Tengah's socio-economic landscape is dominated by intensive agriculture, with 95% of villages reliant on farming and plantation-based livelihoods, primarily food crops and large-scale commercial estates (sugarcane, pineapple, oil palm, rubber). This strong agriculture dependence—paired with dense population centres in Terbanggi Besar, Seputih Agung, and Gunung Sugih—creates sustained pressure on remaining natural habitats through land conversion, expansion of monoculture systems, and fragmentation of forest-adjacent areas. Although no villages lie within forest zones, 21

villages border forest areas, indicating potential edge pressures such as encroachment, increased human–wildlife interaction, and resource extraction. Limited reliance on forest products lowers direct forest dependency but does not reduce the risk of land-use expansion driven by livelihood needs, infrastructure development, and population concentration, all of which are relevant threats to HCVs linked to remaining ecological functions and landscape connectivity.

Pesawaran has a more diversified economy. Agriculture remains significant (88% of villages), but smallholder plantations, fisheries, and a rapidly growing nature-based tourism sector add diversity. The dominance of cocoa and mixed perennial crops, combined with settlements expanding around Gedong Tataan, Negeri Katon, and Kedondong, may pose potential pressures on upland forest blocks and coastal ecosystems through gradual agricultural expansion and increased demand for land. However, Pesawaran also has a strong social forestry presence including, 42 community groups across three forest registers, offering a structured mechanism for community-based forest protection but also increasing forest access, which requires careful governance to avoid overuse. Coastal tourism growth and the planned Teluk Pandan Special Economic Zone (KEK) bring economic opportunities but also elevate risks of habitat disturbance, waste generation, and coastal ecosystem degradation, particularly in mangrove, marine, and waterfall conservation zones. These dynamics make Pesawaran's socio-economic environment both an opportunity and a threat for maintaining HCVs in forested and coastal landscapes.

4. Screening Results

4.1. HCV 1-3 Province level

High-probability HCV 1, 2, and 3 areas across Lampung Province consistently align with remaining natural ecosystems—forested zones, swamps, mangroves, riparian habitats, and large intact forest blocks including IFL areas and primary landscape corridors. These zones also overlap with the ranges of key RTE species such as the Sumatran Elephant (*Elephas maximus sumatranus*), Sumatran Tiger (*Panthera tigris sumatrae*) and Sumatran Rhinoceros (*Dicerorhinus sumatrensis*) and include ecologically sensitive or rare ecosystems such as lowland rainforests, swamp forests, mangroves, limestone formations, and major wetland complexes.

High concentration of HCV 1, 2, and 3 with can be found around:

- ✓ *Primary and secondary lowland rainforest areas* that are located on the western side of Lampung Province, namely in Bukit Barisan Selatan National Park - BBSNP (Pesisir Barat and Lampung Barat), and on the eastern side around Way Kambas National Park - WKNP (Lampung Timur).
- ✓ *Wetland ecosystems and key riparian corridors* that are found in the northeastern part of Lampung, particularly along the Tulang Bawang and Way Seputih river basins, covering areas around Mesuji, Tulang Bawang, Tulang Bawang Barat, and Lampung Tengah.

In addition, HCV 1 and HCV 3, with high probability, also dominate the *highland regions* around Lampung Barat, Tanggamus, Pesawaran, and Lampung Selatan, as well as the western parts of Way Kanan, Lampung Utara, and Lampung Tengah.

Low-probability areas for all three HCV types are dominated by agricultural land uses, agroforestry systems, mixed cultivation, dryland farming, and small forest fragments which is found to be dominant around the western and southwestern area of Lampung Province, mainly around Pesisir Barat, Lampung Barat, Tanggamus, and Pesawaran. Patches of low probability of HCV areas are also identified around Way Kanan, Lampung Utara, Lampung Tengah, Pringsewu, Lampung Selatan, and Lampung Timur.

Lampung Province's HCV probability maps collectively indicate that the region has undergone extensive land-use change, leaving only a few concentrated areas with high biodiversity, intact ecosystems, and rare or sensitive habitats. These high-value zones—primarily remaining forests, wetlands, mangroves, limestone areas, and riparian corridors—serve as the last strongholds for threatened species and landscape-scale ecological functions. Meanwhile, the predominance of agricultural and settlement-dominated areas across the province highlights a fragmented landscape where ecological connectivity is limited.

Implications for future development:

Given this landscape dynamic, the following shall be considered for future development in Lampung:

1) *Prioritize protection* of remaining intact ecosystems, especially around national parks, large forest blocks, wetlands, and riparian corridors. However, creation of new protected area shall be accompanied with deeper and field-level HCV assessment to ensure the establishment of new or expanded protected areas does not create unintended risks to social HCVs.
2) *Maintain and restore ecological connectivity* to link fragmented habitats and support species movement and preserve landscape-scale ecosystem functions.

3) *Integrate HCV considerations* into spatial planning, including conducting field-level HCV assessments for future expansion of agriculture area and infrastructure development, and limiting expansion near high-probability HCV areas.

4) *Promote restoration* in degraded agricultural landscapes, including reforestation, riparian rehabilitation, and improved agroforestry.

5) *Strengthen collaborative management* with communities, local governments, and concession holders to safeguard high-value areas.

4.2. HCVs at Lampung Tengah and Pesawaran

The result of the study found that both Lampung Tengah and Pesawaran districts contain areas with potential HCV values. Both districts contain HCVs with higher probability across most categories, with the exception of HCV 2 in Pesawaran, which is classified only as lower probability.

The following table summarizes the probability level of different HCV categories in Lampung Tengah (LT) and Pesawaran (P), based on each district's key ecological features.

Table 2. Presence of HCVs with Higher (red) and Lower (yellow) Probability in Lampung Tengah and Pesawaran with Key Ecological Features

HCV Categories	Lampung Tengah	Pesawaran	Key Ecological Feature
HCV 1			Potential habitat and movement corridors for diverse species within: LT: Forests (higher) and non-forest (lower) within KPH Way Waya Reg 22; Swamp & natural *gelam* ecosystem, river & riparian around KPH Way Terusan Reg 47 (higher); Secondary swamp forest and mangrove area (higher), and non-forest area (lower) within KPH Way Terusan Reg 08 P: Forests (higher) and non-forest (lower) within KPH Pesawaran reg 20 & 21 and KPHK WAR; Mangrove area (higher)
HCV 2			LT: Swamp / wetland ecosystem >20,000 ha on the northeast area (higher); Large areas that are more natural and intact in Reg 22 (lower) P: Mangrove & upland forests in Reg 20 Punduh Pidada and Reg 21 Pesawaran (lower)
HCV 3			LT: Swamp / wetland ecosystem near Reg 47 and Reg 08 & Lowland rainforest ecoregion in Reg 22 (higher); Highly modified natural ecosystem in Reg 47 and Reg 22 (lower) P: KPHL Pesawaran and KPHK WAR forests (higher) and agroforestry within KPH (lower), Mangrove & coastal (higher)
HCV 4			LT: Forests and waterfalls within Reg 22, areas with steep slopes >40%, swamp and riparian area (higher); Non-forest > 500 masl around Reg 22, rivers and waterfalls outside the forest area (lower) P: Forests and waterfalls within Reg 20 Punduh Pidada, Reg 21 Pesawaran and KPHK WAR, areas with steep

			slopes >40%, mangrove and riparian area (higher); Non-forest > 500 masl, rivers and waterfalls outside the forest area (lower)
HCV 5	✓ ✓	✓ ✓	LT: Highland forests, springs, waterfall and lakes around the western part of the district (higher when it is within the forest area, and lower when it is outside the forest area); Swamps, river and rparian area (lower) P: Highland forests, springs, waterfall and lakes around the KPHK WAR and Reg 20 & 21 (higher when it is within the forest area, and lower when it is outside the forest area); Mangrove and coastal area (lower)
HCV 6	✓	✓	LT: Sacred Cave and its buffer P: Old forests and sacred tomb within KPHK WAR; Mesigit stone and its buffer

Note: LT = Lampung Tengah; P = Pesawaran

Implications for future development

These findings carry significant implications for donors, government, and private-sector organisations working in sustainable agriculture, as protecting and managing these areas aligns with NDPE frameworks and sustainable development goals. Given that the landscape shows high probability of HCV 1-6 presence, any future agricultural or development interventions in the area should proceed with a full, field-level HCV assessment to guide land-use decisions.

4.2.1. HCV 1 Species Diversity

Lampung Tengah and Pesawaran contain diverse fauna and flora, including several species classified as RTE. The distribution of these species is generally associated with areas that retain natural vegetation, forest cover, riparian systems, and other semi-natural habitats that support ecological continuity. Both districts include landscape features that support suitable environmental conditions for RTE species, reflecting their role as part of the broader ecological corridor in southern Lampung, and therefore HCV 1 with higher and lower probability is likely to be present. The key factor influencing these differences is forest cover availability, which determines ecological integrity and species' reliance on the landscape.

Biodiversity in both Lampung Tengah and Pesawaran is concentrated in remnant natural forests, upland ecosystems and mixed agroforestry landscapes, particularly within Register 22 Way Waya (KPH Way Waya), Register 20 Punduh Pidada, Register 21 Pesawaran, and the Tahura WAR landscape.

In addition:

- In Lampung Tengah:

  Secondary swamp forest in Register 08 further function as ecological buffers in the southeastern part of the district (WKNP). The overall swamp area around Reg 08 and 47, characterised by good vegetation cover and natural river networks, support habitats for waterbirds and semi-aquatic reptiles, and also serve as temporary stopover sites for migratory bird species.

- In Pesawaran:

  The southern coastline hosts extensive mangrove forests and coastal ecosystems – such as those in Padang Cermin, Punduh Pidada, and surrounding islands including Pahawang and

Legundi. These mangrove ecosystems serve as critical habitat for resident and migratory birds, coastal fauna, and aquatic species, and play an important role in sustaining the regions' overall biodiversity.

The table below provides an overview of selected key species and their estimated dependence on existing ecosystems within the two districts.

Table 3. List of species and justification of possible presence in Lampung Tengah and Pesawaran

Species **(scientific name; IUCN status)**	**District** where the species likely rely on the landscape for habitat or movement corridor	**Justification of HCV 1 presence**	**Source**
RTE Species			
Sumatran Elephant (*Elephas maximus sumatranus; CR*)	LT	Presence of suitable habitat, close proximity and/or connectivity with the known habitat range, i.e., WKNP and BBNP.	On habitat suitability: Rendana et al., 2023, Imron et al., 2023; Kadek et al., 2017; IUCN; Luskin et al., 2017; Wibisono et al., 2011; Pusparini et al., 2015; Nugraha et al., 2022. On likelihood of presence: IUCN; stakeholder consultation
Sumatran Tiger (*Panthera tigris sumatrae; CR*)	LT		
Sumatran Rhinoceros (*Dicerorhinus sumatrensis; CR*)	LT		
Malayan Tapir (*Tapirus indicus; EN*)	LT		
White-winged Duck (*Asarcornis scutulata; CR*)	LT		
Sumatran Ground-cuckoo (*Carpococcyx viridis; CR*)	LT		
Slow loris (*Nycticebus coucang; EN*)	LT		
Siamang (*Symphalangus syndactylus; EN*)	P	Reported presence in KPH Pesawaran and Tahura WAR	Stakeholder Consultation
Binturong *(Arctictis binturong; VU)*	P	Reported presence in Tahura WAR	Stakeholder Consultation
Pangolin (*Manis javanica; CR*)	LT, P	Presence of suitable habitat, e.g., reg 22 Way Waya, reg 20 and 21 Pesawaran	On habitat suitability: Nova, 2018; Tee et al., 2021; Hidayat et al., 2020 On likelihood of presence: IUCN; Stakeholder consultation; BirdLife's distribution map
Sun Bear (*Helarctos malayanus; VU*)	LT, P		
Helmeted Hornbill (*Rhinoplax vigil; CR*)	LT, P		
Rhinoceros hornbill (*Buceros rhinoceros; VU*)	LT, P		
Black Partridge (*Melanoperdix niger; VU*)	LT, P		
Non-RTE Species			

Javanese stork (*Leptoptilos javanicus; NT*)	LT	Breeding ground at natural *gelam* ecosystem	Stakeholder Consultation
Napu (*Tragulus Napu; LC)*	P	Reported presence in Tahura WAR	Stakeholder Consultation
Muntjac (Kijang) *(Muntiacus muntjak; LC)*	P	Reported presence in Tahura WAR	Stakeholder Consultation
Bajing kelapa (*Callosciurus notatus; LC*)	P	Reported presence in Pesawaran's mangrove area	Stakeholder Consultation
Cecadu pisang besar (*Macroglossus sobrinus*; *LC)*	P		
Lalai Kembang (Eonycteris spelaea*; LC)*	P		

Note: CR = Critically Endangered; EN = Endangered; VU = Vulnerable; NT = Near Threatened; LC = Least Concern

4.2.2. HCV 2 Landscape-level ecosystems, ecosystem mosaics, and Intact Forest Landscapes

In both Lampung Tengah and Pesawaran, no IFL remain, and neither district contains a continuous natural forest block large enough to meet the HCV 2 threshold. However, **Lampung Tengah** holds a >20,000 ha swamp–wetland landscape that functions as a large ecological unit and is therefore classified as HCV 2 with *higher probability*. Meanwhile, the southwestern region, where fragmented forest patches are likely to function as ecological corridors that support connectivity within the wider landscape is classified as HCV 2 with *lower probability*.

In **Pesawaran**, no continuous natural ecosystem block meets the >20,000 ha threshold required for HCV 2 designation. Upland forests, especially around Tahura WAR and KPH Pesawaran, may still form an interconnected ecological mosaic at the regional scale, therefore it is classified HCV 2 with *lower probability*. In addition, coastal and mangrove ecosystems in southern Pesawaran, including Padang Cermin, Punduh Pidada, and nearby small islands, provide supplementary habitat blocks that enhance the district's ecological integrity by supporting migratory birds, coastal fauna, and nursery functions for aquatic biodiversity. Due to the likelihood of this ecosystem contribute to the broader landscape mosaic, these areas are also classified as HCV 2 with *lower probability*.

4.2.3. HCV 3 Ecosystems and Habitats

In **Lampung Tengah**, areas with potential of HCV 3 are primarily located in lowland rainforest in the west around Register 22 and in swamp zones in the northeast and east near Register 47 and around Register 8. The forested ecosystems in the western part of the district, although fragmented, remain important as remnants of Sumatra's lowland forest. Similarly, the swamp zones in the east and northeast hold significant ecological functions within the broader lowland natural ecosystem. Both ecosystem types are considered rare due to extensive conversion that happened in southern Sumatra. As a result, the remaining forested ecosystem and swamp zones in Lampung Tengah are considered as *higher probability* category for HCV 3.

In **Pesawaran**, potentially rare and threatened ecosystems include hill dipterocarp forest remnants in Registers 20 and 21, mangrove and coastal ecosystems along the shoreline and small islands such as Pahawang and Legundi, and naturally restricted small-island ecosystems. These areas have experienced fragmentation and some conversion due to agriculture, aquaculture, tourism, and

settlements, leaving only limited patches of secondary forest and mangrove clusters. Given their rarity and ecological importance within the regional landscape, the remaining secondary forest and mangrove are considered as *higher probability* of HCV 3.

Agroforestry and secondary forest transition areas as well as agriculture areas found within Registers 47, 08, and 22 in Lampung Tengah, and around KPHK WAR, within Registers 20 and 21 in Pesawaran, are considered *lower probability* of HCV 3. These are highly modified ecosystems, however, due to its formal designation of national forest area, it is still possible that these ecosystems are restored through a natural process if it is not further converted.

4.2.4. HCV 4 Ecosystem Services

Both **Lampung Tengah** and **Pesawaran** contain ecosystems critical for hydrological stability, erosion control, fire prevention, and biodiversity support, and therefore are considered as having a *higher probability* of meeting HCV 4 criteria. Upland forests found in Lampung Tengah (Register 22) and Pesawaran (Registers 20 & 21, KPHK WAR) act as water catchment zones, regulating hydrology and reducing flood risks. Intact vegetation on areas with steep slopes greater than 40% prevent landslides and soil loss, maintaining slope stability and reducing sedimentation downstream. Furthermore, waterfalls and riparian corridors found in both districts maintains water quality and serves as natural firebreaks.

In addition, *higher probability* of HCV 4 is identified for swamp ecosystems located around Registers 47 and 8 in **Lampung Tengah** that serves as headwaters for major watersheds and function as natural firebreaks due to their high moisture content. This area serves as the headwaters of several major watersheds in the province, such as the Way Sekampung and Way Seputih watersheds, which are important hydrological systems for eastern area of Lampung Tengah.

Hydrologically, the watershed map and river network show that Lampung Tengah is traversed by several large rivers and major tributaries, including Way Sekampung, Way Seputih, Way Terusan, and Way Pegadungan, which form a natural riparian network. This riparian corridor functions as a barrier against riverbank erosion, a natural sediment filter, and a freshwater ecosystem corridor. The vegetation along the rivers generally consists of shrubs and secondary riparian trees, which still play an important role in maintaining water quality and riverbank stability.

Higher probability of HCV 4 is also identified in mangrove ecosystems in coastal **Pesawaran**, particularly in Padang Cermin, Marga Punduh, and Punduh Pidada. This ecosystem provides stormwater retention and tidal flood control, while also acting as moisture barriers that reduce fire spread.

Lower probability of HCV 4 is identified around the western part of the district where non-forested areas located above 500 meters above sea level (masl) function as water catchment zones and river basin areas (DAS) across the district that provide functions as natural firebreaks. In Pesawaran, lower probability areas occur in lowland and coastal zones with agroforestry and mixed agriculture. While these areas lack intact forest ecosystems, they still offer limited hydrological services, e.g., runoff regulation and infiltration.

4.2.5. HCV 5 Community Needs

In Lampung Tengah and Pesawaran, most households meet basic needs (food, fuel, water, materials) through markets, utilities, and government services rather than direct extraction from natural forests. Although naturally, HCV 5 would be considered low for this situation, further investigation indicates

that communities still access essential resources or derive livelihood benefits from natural ecosystems.

Forest community in both Lampung Tengah and Pesawaran still relies on natural water sources such as springs in Way-Waya Hills (KPH Way-Waya) Lampung Tengah and Tahura WAR of Pesawaran (KPHK WAR). Although alternative water sources may exist, using precautionary approach we determine that these natural springs shall be designated as *higher probability* of HCV 5 as their degradation could result in significant negative impacts on the community. Furthermore, discussion with representatives of Sendang Mulyo village, Sendang Agung sub-district (Lampung Tengah) near Register 22 and Bogorejo village, Gedong Tataan sub-districts (Pesawaran) near KPHK Tahura indicates the critical importance of natural spring, in which the farmer's group has an agreement with the forest farmers to protect it by planting *Gintung* Tree around the spring area to preserve its water quality.

Other indicators such as NTFPs (e.g. bamboo and rattan), protein sources, and additional income from tourism are considered as HCV 5 with *lower probability* due to the availability of alternatives sources of income and protein. Secondary data shows that rattan-based product is one of the livelihood sources in Pesawaran, which is potentially found in the remaining forest area of Tahura WAR. Fish as essential protein, is mostly provided through purchase, while wild-caught fishing remains as hobby and additional income. Tourism spots could potentially be the source of additional income for local communities, such as mangrove, waterfall, coastal area, beaches, and small islands. In Lampung Tengah, discussion with KPH Way Terusan indicated that riparian forest in Register 08 still provide NTFPs (rattan) for local communities, as well as water sources for sanitation.

In addition, the study identifies a *lower probability* of HCV 5 in the forest zones that have non-natural vegetation cover within the boundaries of KPH in both districts, as well as in tourism-related natural areas such as mangrove ecosystems and coastal zones in Pesawaran, and natural *gelam* ecosystem in the swamp areas of Lampung Tengah. These areas continue to support community livelihoods by providing alternative income opportunities, sources of NTFPs, and protein. Due to the availability of alternative sources, the likelihood of these areas qualifying as HCV 5 is considered lower.

4.2.6. HCV 6 Cultural Values

There are no nationally designated cultural heritage sites or UNESCO-recognized sites within Lampung Tengah and Pesawaran; the nearest UNESCO site is the Tropical Rainforest Heritage of Sumatra (TRHS) located in Lampung Barat. However, HCV 6 is still considered potentially present with higher probability in both Lampung Tengah and Pesawaran due to the existence of sites that hold recognized cultural, historical, and spiritual significance for local communities.

In **Lampung Tengah**, cultural practices persist but do not require specific sacred sites, with the exception of Gua Maria in Seputih Mataram subdistrict, a Catholic religious site with spiritual and tourism value. As a result, *higher probability* designation is assigned to areas around this specific site only.

On the other hand, in **Pesawaran**, interviews with KTH Cilimus indicate a prohibition on clearing old forests – *Hutan Tua Damar Kaca* and *Hutan Tua Wilayah Satu* – within Tahura WAR due to the presence of sacred tombs, including *Sukmo Ilang* located near the peak of Mount Pesawaran. Since the exact boundaries of these sites have not been identified, the study applies a precautionary approach and assigns a *higher probability* of HCV 6 across the remaining forest within Tahura WAR. Additionally, a sacred site known as *Batu Mesigit*, confirmed by *Penyimbang Adat* in Pekon Ampai (Marga Punduh), is also considered HCV 6 with *higher probability*.

4.3. High Carbon Stock (HCS)

Non-forest and low-carbon categories represent the majority of the landscape in Lampung Tengah and Pesawaran, according to vegetation conditions between September 2020 and March 2021. However, HCS-based land cover stratification in Pesawaran shows a landscape where forest and regenerating vegetation occupy a considerably larger share of the territory compared to Lampung Tengah. In total, all HCS forest classes combined (HDF + MDF + LDF + YRF) cover approximately 12,098 ha, equivalent to only about 2.7% of the total area of Lampung Tengah. Meanwhile, the same HCS forest strata account for approximately 18,550 ha, equivalent to about 14.5% of the total area of Pesawaran, indicating the presence of more extensive forest and regrowth patches than in Lampung Tengah.

Table 4. Area per HCS Vegetation Class in Lampung Tengah and Pesawaran

HCS Vegetation Class	Lampung Tengah		Pesawaran		Main Distribution
	Area (Ha)	% of district's area	Area (Ha)	% of district's area	
High Density Forest (HDF)	965	0.2	251	0.2	LT: Western area within KPH Way Waya (mainly Selagai Lingga) P: Uplands area (Punduh Pidada, Gedong Tataan, Kedondong, Way Lima and Teluk Pandan)
Medium Density Forest (MDF)	3,947	0.9	3,936	3.1	LT: Western and southwestern uplands bordering Pesawaran and Lampung Barat (Selagai Lingga, Pubian and Sendang Agung) P: As above, with additional MDF identified in Padang Cermin, Way Ratai, Marga Punduh and around small islands and coastal forests, including Pahawang, Kelagian, Tegal, and Maitara island groups
Low Density Forest (LDF)	767	0.2	1,302	1.0	LT: Selagai Lingga, Pubian, Sendang Agung, and transitional zones toward higher elevations P: All subdistricts, except Negeri Katon and Tigeneneng (small YRF is identified)
Young Regenerating Forest (YRF)	6,419	1.4	13,062	10.2	
Other land-use (shrub, open land, plantation and urban area)	443,859	97.3	109,444	85.5	LT: Across the district P: Across the district
Total Area	455,957	100.0	127,994	100.0	

Note: LT = Lampung Tengah, P = Pesawaran

Implication for future interventions:

Overall, the Indicative HCS map of Lampung Tengah and Pesawaran demonstrates the region is dominated by low to medium carbon stocks, with only a few fragmented remnants of higher-carbon forest. The limited MDF and HDF patches hold important conservation value, while the widespread YRF-LDF mosaics present opportunities for landscape restoration and canopy enhancement.

5. Threats and Priority Area

5.1. Subunit Designation

Subunits are defined as areas that require heightened attention during development planning. Their designations are determined by the location of the potential HCV areas and the specific types of threats present, which therefore require different approaches for management prioritisation. The subunit framework was developed using inputs gathered during consultations with district and provincial stakeholders. A key consideration is that potential HCV areas located outside the forest boundary often experience higher levels of human disturbance due to the absence of a formal management authority.

Across both Lampung Tengah and Pesawaran, the spatial analysis shows that threats to HCV and HCS areas are widespread and multidimensional, driven by a combination of human activities and natural hazards. Several threat categories appear consistently across the two districts, creating overlapping pressure on forests, biodiversity, hydrological systems, and community-managed landscapes.

Different threat categories are used in the analysis of HCV area prioritisation, including proximity to roads, distance from settlements, deforestation, forest and land fire, mining, landslides, and floods. However, proximity to roads and distance from settlements are only considered relevant threats when the identified potential HCV lies within formally designated forest areas.

This is because outside forest zones, roads and settlements are naturally widespread. Using these indicators in non-forest areas would label nearly the entire landscape as high-threat. This would distort the analysis by overstating the actual level of human-induced pressure on these areas. Consequently, this would undermine the intention of the prioritisation exercise, which is to accurately identify locations where management interventions are most urgently needed.

5.1.1. Lampung Tengah

Below is the map showing the different subunits in Lampung Tengah, developed based on the screening analysis, the indicative integrated HCV–HCS area, and inputs from stakeholders.

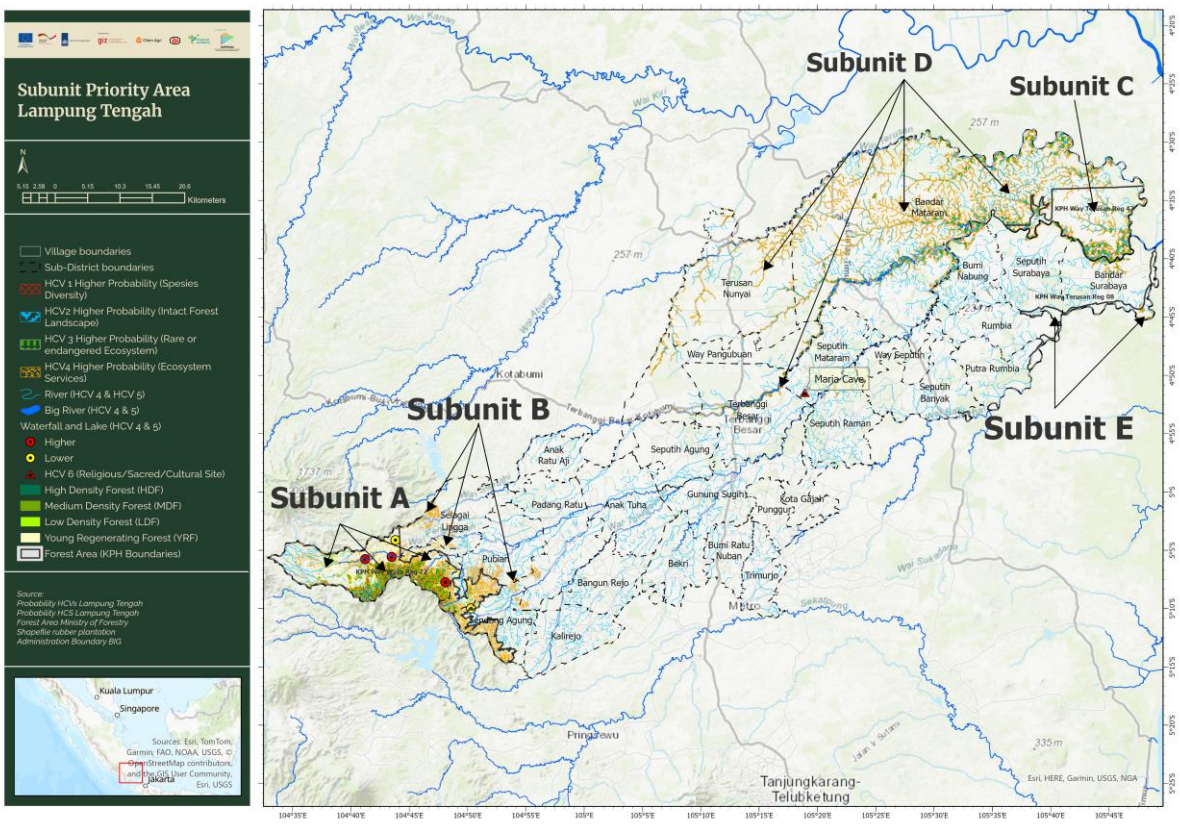


Figure 4. Subunit Priority Area of Lampung Tengah

The table below presents the subunit areas that fall under medium to high priority for HCV 1–5 management in Lampung Tengah.

Table 5. Subunit Designation in Lampung Tengah, Key HCV/HCS signals and Its Dominant Threats

Subunit *	Description of Subunit	Key HCV Signals	HCS Forest Class	Dominant Threat
A	*KPH Way Waya Register 22*	**1 2 3 4 5**	HDF MDF YRF	**D, L, FR, M, R, S**
B	Steep slopes area outside KPH Way Waya	**3 4**	YRF	**L, FR, M**
C	*KPH Way Terusan Register 47*	**1 2 3 4 5**	YRF	**FL, FR, R, S**
D	Swamp area outside Reg 47	**1 2 3 4 5**	-	**FL, FR**
E	*KPH Way Terusan Register 08*	**1 2 3 4 5**	-	**FL, FR, R, S**

Note:

- ***Subunit*** in italic indicates area within forest area (KPH) boundary
- ***Key HCV Signal*** Colour Code: *Red* = High probability of HCV presence, *Yellow* = Low probability of HCV presence
- ***HCS Forest Class***: *HDF* = High Density Forest, *MDF* = Medium Density Forest, *LDF* = Low Density Forest, *YRF* = Young Regenerating Forest

- ***Dominant Threat***: *L* = Landslide, *D* = Deforestation, *FL* = Flood, *FR* = Fire, *M* = Mining, *R* = Road, *S* = Settlement

6) Threat within subunit A – KPH Way Waya Register 22

Deforestation has occurred within the forest block of KPH Way Waya, making it a dominant threat for forested parts of the subunit. The presence of non-forest patches indicates active agricultural activities and agroforestry systems, reflecting historical expansion – further supported by the proximity of these areas to roads and settlements. Nearby mining operations introduce additional risks to remaining natural forest remnants. The subunit is also vulnerable to land fires, and areas with steep slopes are prone to landslides.

7) Threats within subunit B – Steep slopes area outside KPH Way Waya

The area is classified as dryland agriculture based on the MoF land cover map and is increasingly pressured by the transition from perennial crops to seasonal agricultural systems that typically have shallower root structures and lower water-retention capacity, resulting in higher susceptibility to erosion and landslides. This land-use shift also heightens the risk of land fires. In addition, mining activities within and around the subunit contribute further threats through land disturbance and potential degradation of remaining natural vegetation and soil stability. The fact that this subunit lies outside the KPH boundary further heightens the risk of degradation due to the absence of a formal management authority.

8) Threats around KPH Way Terusan Register 47, including subunit C (within KPH) and D (outside KPH)

These subunits are connected by swamp and river network, Seputih river basin. The threats identified in this area at high risk are floods, land fires, settlement expansion, and road development. Particularly for flood, it aligns with the mapped distribution of flood-prone zones and dense settlement networks. Areas outside the KPH boundaries are designated as a separate subunit due to the heightened risk of degradation in the absence of a formal management authority.

9) Threats within subunit E – KPH Way Terusan Register 08

Flooding is significant because the area contains riparian forest and small mangrove patches that are highly sensitive to hydrological changes. Road networks and expanding settlements increase human access, intensifying pressure from agricultural encroachment, pollution, and other disturbances, including fires.

The forested riparian area in Register 08 is considered a priority due to strong pressure from potential agricultural expansion and pollution from adjacent farmland. This small riparian forest patch represents one of the few remaining natural ecosystems in the landscape and therefore requires strengthened protection.

Interviews with KPH Way Terusan indicate that the surrounding landscape has been designated as a food-security area, which may heighten the risk of encroachment into the riparian zone as farmers face limited cultivation land. These subunits also hold ecological importance due to their direct boundary with Way Kambas National Park (WKNP) and the presence of small mangrove areas that support biodiversity and provide natural flood and erosion regulation.

5.1.2. Pesawaran

Below is the map showing the different subunits in Pesawaran, developed based on the screening analysis, the indicative integrated HCV–HCS area, and inputs from stakeholders.

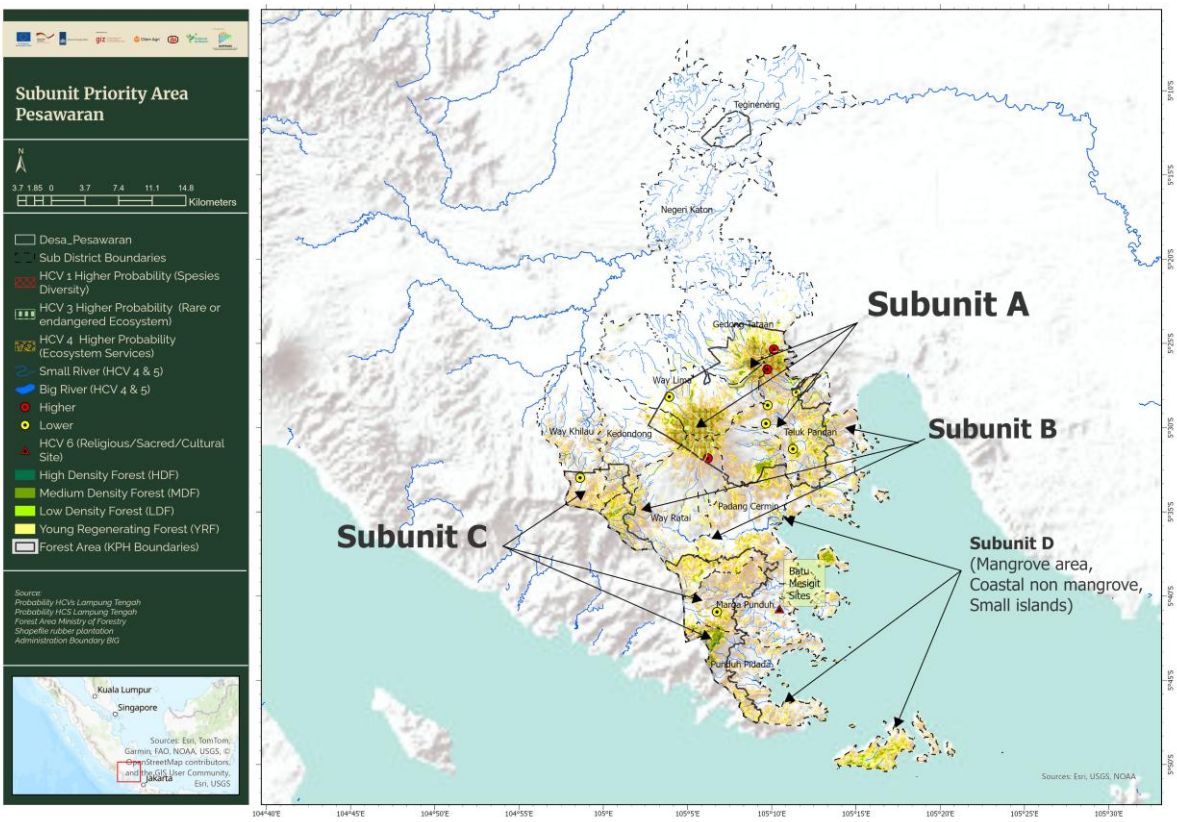


Figure 5. Subunit Priority Area of Pesawaran

Table 6. Subunit Designation in Lampung Tengah, Key HCV/HCS signals and Its Dominant Threats

Subunit	Description of Subunit	Key HCV Signals	HCS Forest Class	Dominant Threat
A	*KPHK WAR*	**1 2 3 4 5**	HDF MDF LDF YRF	**L, D, S, R**
B	Steep Slope Areas (Padang Cermin, Teluk Pandan, Way Ratai, Kedondong) outside KPH	**4**	YRF	**L, R, S, FR, M**
C	*KPH Pesawaran Reg 20 & 21*	**1 3 4 5**	HDF MDF LDF YRF	**L, D, S, M, R**
D	Mangrove (Teluk Pandan, Padang Cermin, Marga Punduh, Punduh Pidada), coastal and small islands	**1 3 4 5 6**	YRF	**S, R, FR, M, FL**

Note:

- ***Subunit*** in italic indicates area within forest area (KPH) boundary.
- ***Key HCV Signal*** Colour Code: *Red* = High probability of HCV presence, *Yellow* = Low probability of HCV presence
- ***HCS Forest Class***: *HDF* = High Density Forest, *MDF* = Medium Density Forest, *LDF* = Low Density Forest, *YRF* = Young Regenerating Forest
- ***Dominant Threat***: *L* = Landslide, *D* = Deforestation, *FL* = Flood, *FR* = Fire, *M* = Mining, *R* = Road, *S* = Settlement

1) **Threat within Subunit A – KPHK Tahura Wan Abdul Rahman (WAR)**

Deforestation has occurred within the forest block of KPHK Tahura, making it a dominant threat for forested parts of the subunit. The presence of non-forest patches indicates active agricultural activities and agroforestry systems, reflecting historical expansion – further supported by the proximity of these areas to roads and settlements.

2) **Threat within Subunit B – steep slopes outside KPH**

This area is dominated with mixed dryland agriculture on the land cover map of MoF with variety of crop types from deep-rooted trees to seasonal agriculture. The high threat in this area is landslide, land fires, and mining activities which could add pressure to the remaining natural ecosystems and soil stability. The fact that this subunit lies outside the KPH boundary further heightens the risk of degradation due to the absence of a formal management authority.

3) **Threat within Subunit C – KPHL Pesawaran Reg 20 & 21**

This area is predominantly covered with non-natural forest, where conversion to agricultural land has been established although remnant natural forest blocks remain in smaller patches. It is designated as protected forest, with portions classified as dryland agriculture and the majority as mixed dryland agriculture according to the Ministry of Forestry (MoF) land cover map. The dominant threat is deforestation, as the area is under significant pressure for further conversion to agricultural land. In addition, mining activities also add further threats through land disturbances and potential degradation of remaining natural vegetation and soil stability.

4) **Threat within Subunit D – Mangrove, Coastal, and Small Islands**

Land fires pose a significant risk particularly in coastal and mangrove ecosystems where fire can degrade vegetation structure, alter hydrological functions, and reduce habitat quality. Flooding, whether seasonal or intensified by land-use change may further disrupt ecosystem stability and accelerate erosion. Mining activities present additional pressure through land clearing, sedimentation, and water pollution which can adversely affect mangrove systems, coastal habitats, and small island ecosystems.

5.2. Priority Area of Lampung Tengah

5.2.1. HCV 1

High probability of HCV 1 in relation to *habitats for waterbirds, semi-aquatic reptiles, and migratory* birds is identified around KPH Way Terusan Reg 47 and 08. These areas potentially provide important wetland or swamp ecosystems used by waterbirds and semi-aquatic fauna, and they face significant pressures such as agriculture pressures, fires, hydrological changes, and human access. Due to high probability of HCV 1 and high threats, these areas are considered as ***high priority*** areas for HCV 1 management.

Low to high probability of HCV 1 in relation to *suitable habitat for RTE species and potential contribution to the southern Lampung ecological corridor* is identified around KPH Way Waya Reg 22 and Way Terusan Reg 08. This reflects variable but notable potential for supporting RTE species and maintaining broader landscape connectivity. These areas also experience high levels of human disturbance, including deforestation and agricultural expansion, underscoring the need for targeted management.

Within KPH Way Waya Reg 22, remnants of natural forest (classified as high-probability HCV 1) are particularly important to protect. These patches are surrounded by areas that have already

transitioned into agroforestry systems, indicating significant ongoing degradation pressure. For this reason, the remaining natural forest in Reg 22 is considered a ***high-priority*** area for HCV 1 management. Similarly, portions of Way Terusan Reg 08 that still contain secondary swamp forest and mangrove are also designated as ***high priority***, given their ecological importance as buffer zones for WKNP and the threats they face.

By contrast, areas already degraded into agroforestry around Reg 22, as well as open areas or dryland agriculture within Reg 08 (classified as low-probability HCV 1) are identified as ***medium priority*** for management intervention.

Table 7. Lampung Tengah HCV 1 Priority Area

Description	Sub-Unit			
	A **KPH Way Waya Reg 22**	**C** **KPH Way Terusan Reg 47**	**D** **Swamp Area outside Reg 47**	**E** **Way Terusan Reg 08**
Habitats for waterbirds and semi-aquatic reptiles, and temporary stopover sites for migratory bird species.	N/A	High probability & high threat	High probability & high threat	High probability & high threat
Suitable habitat for RTE species that may form part of the southern Lampung ecological corridor.	Low to High probability & high threat	N/A	N/A	Low to High probability & high threat

The following table presents our suggested actions for HCV 1 priority areas in Lampung Tengah.

Table 8. Suggested Actions for Lampung Tengah HCV 1 Priority Areas

Suggested Actions	Sub-Unit			
	A **KPH Way Waya Reg 22**	**C** **KPH Way Terusan Reg 47**	**D** **Swamp Area outside Reg 47**	**E** **Way Terusan Reg 08**
Strengthen KPH institution to empower forest patrol to prevent deforestation.	✓	✓		
Engagement with forest communities, raising awareness on the importance of forest preservation.	✓			
Regular stakeholder engagement with the private sectors to ensure that Good Agricultural Practices (GAP) is implemented especially near swamp area.		✓	✓	✓
Socialisation of protected and endangered wildlife species, especially those with CR status, and the dissemination of applicable laws and regulations related to wildlife protection.	✓			
Establish species database by collaboration with academia, NGOs, to do species inventory.	✓	✓	✓	
Strengthen the implementation of Social Forestry by enhancing regular engagement with forest communities and supporting the planting of economically valuable NTFP species.	✓ Applicable to non-forested			

	area within the KPH			
Regular community engagement to raise awareness on good agricultural practices (GAP) in the agricultural lands near HCV area.	✓ (As above)			✓

5.2.2. HCV 2

High probability of HCV 2 in relation to *area larger than 20,000 ha* is identified around KPH Way Terusan Reg 47 and 08, where ecosystems are dominated by extensive swamp areas. These landscapes retain patches of natural vegetation, including *gelam* ecosystem within Register 47 and mangrove and secondary swamp forests within Register 08. The region is also connected to a broader swamp system stretching from Bandar Mataram and Bandar Surabaya to Terbanggi Besar, spanning ten subdistricts. These interconnected areas face significant risks from flooding and land fires, as well as potential expansion of roads, settlements, and agriculture, all of which could disrupt their functions in ecological connectivity. As a result, this area is considered a ***high priority*** for HCV 2 management.

Low probability of HCV 2 in relation to *areas < 20,000 ha but retain potential ecological connectivity as corridor linked to the IFL in BBSNP* is identified around KPH Way Waya Reg 22. However, they retain potential ecological connectivity if strengthened through agroforestry systems to function as corridor linked this smaller forest patch to the IFL in BBSNP. As these small patches of natural forest face a high risk of deforestation, this area is considered as ***medium priority*** for HCV 2 management.

Table 9. Lampung Tengah HCV 2 Priority Area

Description	Sub-Unit			
	A KPH Way Waya Reg 22	**C KPH Way Terusan Reg 47**	**D Swamp Area outside Reg 47**	**E Way Terusan Reg 08**
Swamp / wetland ecosystem >20,000 ha on the northeast area of Lampung Tengah	N/A	High probability & high threat	High probability & high threat	High probability & high threat
Areas < 20,000 ha but retain potential ecological connectivity as corridor linked to the IFL in BBSNP.	Low probability & high threat	N/A	N/A	N/A

The following table presents our suggested actions for HCV 2 priority areas in Lampung Tengah.

Table 10. Suggested Actions for Lampung Tengah HCV 2 Priority Areas

Suggested Actions	Sub-Unit			
	A KPH Way Waya Reg 22	**C KPH Way Terusan Reg 47**	**D Swamp Area outside Reg 47**	**E Way Terusan Reg 08**
Develop policies/regulations to protect and preserve natural swamp areas, especially natural swamp areas (Melaleuca).		✓	✓	
Socialisation and collaboration with private sectors and smallholders in the area to implement GAP especially in plots adjacent to HCV areas.			✓	
Collaboration with multi stakeholders (KPH Institutions, National Park, Forest	✓			

Communities, NGOs, and Government) to restore ecological corridors connecting the remaining forest patch to BBSNP.

5.2.3. HCV 3

Both types of ecosystems in its natural form are still found within all three KPH registers in Lampung Tengah and considered as high probability of HCV 3 and ***high priority*** for management due to the following considerations:

1) The remaining patch of natural forest within KPH Way Waya Reg 22 poses high level of threat from deforestation and is prone to landslides.
2) Natural *gelam* ecosystem within secondary swamp forest of KPH Way Terusan Register 47 poses high-level threat of potential agricultural expansion and consistently exposed to flood and land fires.
3) Swamp network covering Bandar Mataram, Terusan Nunyai, Bandar Surabaya, Seputih Mataram, and Bumi Nabung (outside KPH Way Terusan Reg 47) is considered as anthropogenically rare, due to the extent of the ecosystem has been greatly reduced by human activities. It poses risk of extensive landscape alteration if not managed properly.
4) The small patch of riparian forest in KPH Way Terusan Register 08 represents one of the remaining natural ecosystems in the area. Interviews with KPH Way Terusan indicate that the surrounding landscape has been designated as a food security area, which may increase the risk of agricultural encroachment into the riparian zone, particularly as farmers face limited land availability for cultivation.

Highly modified ecosystem within these subunits (that is classified as low probability of HCV 3) is considered as ***medium priority***, including:

1) Within Reg 22, areas that are dominated by dryland agriculture, mosaic of agroforestry and secondary vegetation.
2) Parts of swamp and riparian areas that are no longer in their natural form within and around Reg 47, 08 and 22.

Table 11. Lampung Tengah HCV 3 Priority Area

Description	Sub-Unit			
	A KPH Way Waya Reg 22	**C KPH Way Terusan Reg 47**	**D Swamp Area outside Reg 47**	**E Way Terusan Reg 08**
Forest ecosystem around western area of Lampung Tengah that is anthropogenically rare due to historical conversions.	Low to high probability & high threat			
Swamp and riparian ecosystem on the northeastern area of Lampung Tengah, that is naturally and anthropogenically rare.		Low to high probability & high threat	Low to high probability & high threat	Low to high probability & high threat

The following table presents our suggested actions for HCV 3 priority areas in Lampung Tengah.

Table 12. Suggested Actions for Lampung Tengah HCV 3 Priority Areas

Suggested Actions	Sub-Unit			
	A KPH Way Waya Reg 22	C KPH Way Terusan Reg 47	D Swamp Area outside Reg 47	E Way Terusan Reg 08
Develop policies/regulation to limit agricultural expansion within the forest buffer zones and buffer zone of riparian forest, particularly in Reg 08.	✓			✓
Conduct socialisation and raise awareness to the surrounding villages on the importance of swamps in supporting local ecosystems		✓		✓
Provide agroforestry training to local communities who own agricultural land inside and near KPH area	✓	✓	✓	

5.2.4. HCV 4

High priority for HCV 4 management is identified in these areas:

1) Remaining patches of forest within Reg 22 (high probability of HCV 4) that provide function as effective-water catchment zones and support ecological function of Seputih river (Way Seputih). Maintaining intact vegetation in this area is critical to reduce sedimentation risks downstream, particularly for communities in Pubian and Selagai Lingga.
2) Steep slopes area within and outside this Reg 22 forest area. Disturbance such as vegetation loss in this area could cause landslides and erosion. The steep slopes areas outside Reg 22 also identified within the high risk of landslides and land fires.
3) Wetlands and riparian ecosystems within and outside Reg 47 that are that forms Seputih river basin, while important in the provision of water, flood preventions, and pollination services, are at high risk of floods, land fires, settlement expansion, and road development.
4) Forested riparian area within Reg 08 is considered priority due to its high level of threat from potential agricultural expansion, and pollution from the adjacent farming lands.

Non-forested areas within Register 22 that lie above 500 masl still retain important water-catchment functions. However, because these areas are classified as low-probability HCV 4, they are considered ***medium priority*** for HCV 4 management.

Table 13. Lampung Tengah HCV 4 Priority Area

Description	Sub-Unit				
	A KPH Way Waya Reg 22	B Steep slopes area outside KPH Way Waya	C KPH Way Terusan Reg 47	D Swamp Area outside Reg 47	E Way Terusan Reg 08
Ecosystems around Way Waya Hills and wetlands around northeastern area of Lampung Tengah, that is important for the provision of water, flood preventions, and pollination services.	Low to high probability & high threat		High probability & high threat	High probability & high threat	High probability & high threat

Steep slopes areas >40% important for the prevention of erosion and sedimentation.	High probability & high threat	High probability & high threat			
Natural firebreak's function provided by waterfalls, rivers and/or riparian area.	High probability & high threat	High probability & high threat	High probability & high threat	High probability & high threat	High probability & high threat

The following table presents our suggested actions for HCV 4 priority areas in Lampung Tengah.

Table 14. Suggested Actions for Lampung Tengah HCV 4 Priority Areas

Suggested Actions	Sub-Unit				
	A KPH Way Waya Reg 22	**B** Steep slopes area outside KPH Way Waya	**C** KPH Way Terusan Reg 47	**D** Swamp Area outside Reg 47	**E** Way Terusan Reg 08
Forming a fire-conscious community as a participatory approach to prevent forest/land fires			✓	✓	
Enforce policy/regulation at village level for river preservation	✓	✓			✓
Regular monitoring using remote sensing to monitor changes in land cover, riparian vegetation, and compliance with buffer zone regulations	✓	✓	✓	✓	✓
Conduct awareness campaigns and establish early warning systems to improve community readiness and response to flood events			✓	✓	✓
Rehabilitate degraded lands and maintain permanent vegetation cover with deep root trees to reduce surface runoff and soil erosion	✓	✓	✓		✓
Promote and awareness raising in agricultural and plantation activities within the watershed to minimize fertilizer and pesticide runoff	✓ Applicable to non-forested area within the KPH	✓			
Collaboration with external stakeholders to promote and develop natural tourism sites while maintaining the preservation and prevent excess pollution	✓				
Develop policies and regulations to control the types of commodities cultivated in areas with high risk of landslide, prioritizing those with deep root systems that help maintain soil stability and water absorption	✓				

5.2.5. HCV 5

High priority for HCV 5 management is identified in the forest and water-catchment areas within Reg 22 that serve as important sources of water for surrounding communities. This area is considered as highest priority, especially because the forest block contains a spring that is still actively used by local residents, particularly those in Sendang Mulyo Village, as highlighted during stakeholder consultations. These forest blocks face a high risk of deforestation, which could lead to declining water quality and increase the likelihood of landslides, ultimately resulting in greater sedimentation.

Medium priority for HCV 5 management is identified around the wetlands and riparian zones. The forested riparian area in Register 08 is considered a priority due to the presence of NTFP resources – particularly rattan – that continue to support local livelihoods. This area faces a high risk of conversion from potential agricultural expansion, especially for food-security plots. The river networks within these subunits provide essential water resources for sanitation and also support local communities through fisheries, which remain an important protein source. Although alternative protein sources are increasingly available, the rivers may still host endemic fish species such as *jelabat*. Water quality in this area is threatened by surrounding farming activities, which contribute to sedimentation and may further degrade the ecological integrity of these riparian systems.

Table 15. Lampung Tengah HCV 5 Priority Area

Description	Sub-Unit			
	A KPH Way Waya Reg 22	**C KPH Way Terusan Reg 47**	**D Swamp Area outside Reg 47**	**E Way Terusan Reg 08**
Forest as water provision and associated waterfalls, NTFPs, and items to support livelihood of local communities (e,g. tourism).	Low to high probability & high threat			
Wetlands and riparian forest for NTFP products, and rivers as sources of protein alternatives.		Low probability & high threat	Low probability & high threat	Low probability & high threat

The following table presents our suggested actions for HCV 5 priority areas in Lampung Tengah.

Table 16. Suggested Actions for Lampung Tengah HCV 5 Priority Areas

Suggested Actions	Sub-Unit			
	A KPH Way Waya Reg 22	**C KPH Way Terusan Reg 47**	**D Swamp Area outside Reg 47**	**E Way Terusan Reg 08**
Collaboration with NGO and relevant departments from the government to conduct regular monitoring in river water quality	✓			✓
Periodically assess household income sources, livelihood dependency on forest resources, and changes in local poverty levels	✓			✓
Develop and support sustainable livelihood programs such as agroforestry, community-based ecotourism, or non-timber forest product enterprises to reduce dependence on forest resources	✓ Applicable to non-forested area within the KPH	✓	✓	

5.2.6. HCV 6

In general, there is no high priority area identified for HCV 6 as the indicative site (religious site of Maria Cave) is already registered in the government's official database, so the potential threat is considered as low because there is policy in place to maintain and preserve the area. Further maintenance of the cave would be suggested to prevent deterioration.

5.3. Priority Area of Pesawaran

5.3.1. HCV 1

Our analysis identifies two categories of HCV 1 that require critical management prioritisation in Pesawaran, including:

1) Suitable habitat for RTE species that may serve as the last viable habitat
2) habitats for waterbirds, semi-aquatic reptiles, and migratory bird species.

Low to high probability of suitable habitat for RTE species that may serve as the last viable habitat is identified in the remaining natural forest of KPHK Tahura WAR particularly in the peak of Mt Pesawaran and Mt Betung, and KPHL Pesawaran Reg 20 and 21. These areas still have remnant natural forest that critical for biodiversity conservation but exposed to significant and overlapping threats such as deforestation and landslides which could risk to habitat fragmentation and reduced ecosystem integrity. In KPHL Pesawaran, forest patches functioning as ecological corridors are increasingly threatened by the potential expansion of agricultural land, deforestation, land fires, landslides, and mining activities in Kedondong, Marga Punduh, and Punduh Pidada sub-districts. Due to high probability of HCV 1 and high threats, these areas are considered as ***high priority*** areas for HCV 1 management

Whereas the majority of forest area within KPH boundaries have been degraded and converted as agricultural land, with land-use status designated as production forest. The current priority is to maintain and optimise the remaining ecological functions, particularly those related to non-timber forest products. The risk of further agricultural expansion will likely continue if the livelihoods of local communities surrounding the forest do not adequately meet their basic needs, which is aligned to the detection of deforestation occurrence in KPHK Tahura. Due to low probability of HCV 1 and high threats, these areas are considered as ***medium priority*** areas for HCV 1 management.

Low to high probability of habitats for waterbirds, semi-aquatic reptiles, and migratory birds is identified in mangrove and coastal area of Pesawaran particularly across Padang Cermin, Teluk Pandan, Marga Punduh, and the outer island clusters such as Legundi-Pahawang. These coastal and island environments are critical stopover points and feeding grounds for migratory birds. These areas are exposed to high risk of settlements developments, proximity with roads which could increase pollution, land fires, floods, and mining activity. Fire and flood hazards reduce vegetation structure needed by migratory species, while mining in Pahawang introduces additional pressure on coastal ecological processes. Due to high probability of HCV 1 and high threats, these areas are considered as ***high priority*** areas for HCV 1 management.

Table 17. Pesawaran HCV 1 Priority Area

Description	Sub-Unit			
	A **KPHK Tahura Wan Abdul Rahman (WAR)**	**B** **Steep slopes outside KPH**	**C** **KPHL Pesawaran Reg 20 & 21**	**D** **Mangrove, coastal, and small islands**
Suitable habitat for RTE species that may serve as the last viable habitat	Low to High probability & high threat	N/A	Low to High probability & high threat	N/A
Habitats for waterbirds and semi-aquatic reptiles, and temporary stopover sites for migratory bird species.	N/A	N/A	N/A	Low to High probability & high threat

The following table presents our suggested actions for the priority areas in Pesawaran.

Table 18. Suggested Actions for Pesawaran HCV 1 Priority Areas

Suggested Actions	Sub-Unit			
	A **KPHK WAR**	**B** **Steep slopes outside forest area**	**C** **KPHL Pesawaran Reg 20 & 21**	**D** **Mangrove, coastal, and small islands**
Strengthen KPH institution to empower forest patrol to prevent deforestation.	✓		✓	
Collaboration with academia or NGO to conduct survey on habitat quality e.g. forage plants or habitat condition	✓			
Raise awareness on the importance of RTE species, engage with local communities to monitor illegal encroachment.	✓		✓	✓
Regular monitoring of community plantation to ensure implementation of good agricultural practices.	✓ Applicable to non-forested area within the KPH		✓	
Engage with mining companies and relevant ministry to regularly monitor air and water quality around mining operation area	✓		✓	✓
Issue a local regulation (*Perda)* to enforce stricter penalties for illegal mining and develop a participatory monitoring system supported by a confidential and transparent whistle-blower reporting mechanism.	✓	✓	✓	✓
Built ecological corridor linking KPHK Tahura and KPHL Pesawaran, with economically valuable tree species.	✓		✓	
Engage with local communities to define and determine the preferred tree species for building ecological corridor linking KPHK Tahura and KPHL Pesawaran	✓ (As above)		✓	

5.3.2. HCV 2

Our analysis identifies two categories of HCV 2 that require critical management prioritisation in Pesawaran, including areas smaller than 20,000 ha but retain potential connectivity to form an ecological mosaic at the regional scale.

Low probability of HCV 2 is identified in the KPHK Tahura WAR particularly in Mt Betung and Mt Pesawaran. The mountain slopes are facing high risk of landslides, proximity to road and settlements further add to risk of human disturbances. Due to the low probability and high threat, the slopes of Mount Betung and the overall Mount Pesawaran are considered as ***medium priority*** for HCV 2 management. Whereas the peak of Mt Betung is considered as minimal to no threat, as it is the area is relatively distant from roads and settlements and shows limited exposure to other threats. Furthermore, its conservation is supported by existing regulations and management policies that restrict land conversion and illegal encroachment, contributing to its comparatively stable ecological condition. Therefore, due to the low probability and no threat, the peak of Mt Betung is considered as ***low priority*** for HCV 2 management.

Table 19. Pesawaran HCV 2 Priority Area

Description	Sub-Unit			
	A KPHK WAR	**B Steep slopes outside forest area**	**C KPHL Pesawaran Reg 20 & 21**	**D Mangrove, coastal, and small islands**
Areas < 20,000 ha but retain potential connectivity to form an ecological mosaic at the regional scale	Low probability & low to high threat	N/A	N/A	N/A

The following table presents our suggested actions for the priority areas in Pesawaran.

Table 20. Suggested Actions for Pesawaran HCV 2 Priority Areas

Suggested Actions	Sub-Unit			
	A KPHK WAR	**B Steep slopes outside forest area**	**C KPHL Pesawaran Reg 20 & 21**	**D Mangrove, coastal, and small islands**
Socialisation and engagement with community around Mt Betung to plant deep rooted trees instead of food crops.	✓			
Socialisation and implementation of Good Agricultural Practices in the area that are already converted as agricultural land	✓			
Establish connectivity to the forest areas in KPHK Tahura and KPHL Pesawaran by planting deep rooted trees that economically viable.	✓			

5.3.3. HCV 3

The following table summarises the probability of potential HCV 3 across different subunits in Pesawaran and its threat levels. Each row corresponds to a specific value, while the columns represent the subunits where that value may occur.

Table 21. Pesawaran HCV 3 Priority Area

Description	Sub-Unit			
	A KPHK WAR	**B Steep slopes outside forest area**	**C KPHL Pesawaran Reg 20 & 21**	**D Mangrove, coastal, and small islands**
Potentially rare and threatened ecosystems include hill dipterocarp forest remnants	Low to high probability & low to high threat	N/A	Low to high probability & high threat	N/A

Mangrove and coastal ecosystems along the shoreline and small islands	N/A	N/A	N/A	Low to high probability & high threat

Our analysis identifies two categories of HCV 3 that require critical management prioritisation in Pesawaran, including hill dipterocarp forest remnants as potentially rare and threatened ecosystems and mangrove and coastal ecosystems along the shoreline and small islands.

Low to high probability of HCV 3 is identified in the KPHK Tahura WAR and KPHL Pesawaran, potentially serve as ecological importance and exposure to significant and overlapping threats i.e. deforestation, landslides, and confirmed illegal encroachment, requiring strengthened monitoring. In KPHL Pesawaran, the additional threat is mining activities within the area increasing the risk of continued degradation. Due to the high probability and high threat, the remaining natural forest remnants of these subunits are considered as ***high priority*** for HCV 3 management.

Mangrove and coastal ecosystems have undergone extensive fragmentation and conversion from agriculture, aquaculture, tourism, and settlements, leaving only limited mangrove patches. These areas are also vulnerable to land fires and mining impacts. Despite existing government rehabilitation programs, intensified and collaborative management is necessary, justifying their high priority status. Due to the high probability and high threat, patches of mangrove forest and coastal ecosystems are considered as ***high priority*** for HCV 3 management.

Highly modified ecosystem within these subunits (that is classified as low probability of HCV 3) is considered as ***medium priority***, including areas in KPHL Pesawaran Reg 20 & 21 and KPHK Tahura WAR, that are dominated by mixed dryland agriculture, mosaic of agroforestry and secondary vegetation.

The following table presents our suggested actions for the priority areas in Pesawaran.

Table 22. Suggested Actions for Pesawaran HCV 3 Priority Areas

Suggested Actions	Sub-Unit			
	A KPHK WAR	**B Steep slopes outside forest area**	**C KPHL Pesawaran Reg 20 & 21**	**D Mangrove, coastal, and small islands**
Conduct periodic monitoring of environmental indicators (e.g., land cover, water quality, biodiversity) and social impacts from mining activities to ensure compliance with environmental regulations and mitigation measures	✓		✓	
Promote sustainable aquaculture practices compatible with mangrove conservation, such as integrated mangrove–fish farming systems	✓		✓	
Conduct spatial studies and zoning adjustments to clearly differentiate mangrove conservation areas from fisheries cultivation areas				✓
Develop policies/regulation to limit agricultural expansion within the buffer zone of riparian forest and forest buffer zones	✓		✓	
Provide GAP training for local communities who have agricultural land adjacent to natural ecosystems	✓		✓	
Provide agroforestry training and regular awareness raising on the importance of forest conservation and forest management	✓		✓	

5.3.4. HCV 4

The following table summarises the probability of potential HCV 4 across different subunits in Pesawaran and its threat levels. Each row corresponds to a specific value, while the columns represent the subunits where that value may occur.

Table 23. Pesawaran HCV 4 Priority Area

Description	Sub-Unit			
	A KPHK WAR	**B Steep slopes outside forest area**	**C KPHL Pesawaran Reg 20 & 21**	**D Mangrove, coastal, and small islands**
Forest area for flood prevention, water provision, natural firebreaks, pollinator service, and prevention of erosion and sedimentation	Low to high probability & high threat	N/A	Low to high probability & high threat	N/A
Important areas for the prevention of erosion and sedimentation (Steep slopes > 40%)	N/A	Low to high probability & high threat	N/A	Low to high probability & high threat

Low to high probability of HCV 4 is identified in the KPHK Tahura WAR and KPHL Pesawaran. The remaining patch of forest provides function as effective-water catchment zones, natural firebreaks, pollinator, and prevention of erosion and sedimentation when upstream forests are degraded, their hydrological function as water regulators is disrupted, which can lead to natural disasters. The forests in this subunit are surrounded by hilly terrain, making them highly sensitive to disturbance; therefore, maintaining intact vegetation is critical to reducing sedimentation risks downstream. Due to the high probability and high threat, the remnant natural forest in Mt Pesawaran, mountain slopes of Mt Betung, Reg 20 & Reg 21, and hilly areas with steep slopes more than 40% within KPH boundaries are considered as ***high priority*** for HCV 4 management.

Non-forested area within KPH boundaries (KPHK & KPHL) are dominated as agroforestry areas with deep rooted trees which is facing significant pressure of land conversion from perennial to seasonal crops, which could reduce the soil capacity of retaining water. As these threats degrade water retention capacity, downstream communities particularly along coastal and lowland areas of Marga Punduh and Punduh Pidada face heightened flood risk. In addition, mining operation could also polluted river water and resulted in pollution and sedimentation. Due to the low probability and high threat, these areas are considered as ***medium priority*** for HCV 4 management.

Low to high probability of HCV 4 for prevention of erosion and sedimentation is identified in the steep slopes higher than 40% outside KPH boundaries. These sites potentially remain exposed to significant risks from landslides and deforestation. Steep slopes in these areas have, in some cases, been converted to agricultural use, increasing erosion risks. Erosion from these upland regions directly contributes to declining water quality, river siltation, and sediment deposition in downstream estuaries and coastal habitats. Therefore, due to the high probability and high threat, this area is considered as ***high priority*** for HCV 4 management.

In coastal sub-districts, such as Padang Cermin and Punduh Pidada, the combination of land fires and mining operations significantly increases the risk of habitat degradation, landscape fragmentation, and ecological instability. Therefore, due to the high probability and high threat, this area is considered as ***high priority*** for HCV 4 management.

The following table presents our suggested actions for the priority areas in Pesawaran.

Table 24. Suggested Actions for Pesawaran HCV 4 Priority Areas

Suggested Actions	Sub-Unit			
	A KPHK WAR	**B Steep slopes outside forest area**	**C KPHL Pesawaran Reg 20 & 21**	**D Mangrove, coastal, and small islands**
Forming a fire-conscious community as a participatory approach to prevent forest/land fires	✓	✓	✓	✓
Rehabilitate degraded lands and maintain permanent vegetation cover with deep root trees to reduce surface runoff and soil erosion	✓	✓	✓	✓
Conduct reforestation or vegetation restoration in eroded or degraded riparian zones	✓	✓	✓	
Track sediment loads and erosion rates, particularly in areas with high land conversion or agricultural activity	✓ Particularly in rivers and watersheds	✓	✓	✓
Develop policies and regulations to control the types of commodities cultivated in high flood-risk areas, prioritizing those with deep root systems that help maintain soil stability and water absorption				✓
Promote and awareness raising in agricultural and plantation activities within the watershed to minimize fertilizer and pesticide runoff	✓	✓	✓	
Collaboration with external stakeholders to promote and develop natural tourism sites while maintaining the preservation and prevent excess pollution	✓		✓	

5.3.5. HCV 5

Low to high probability area of HCV 5 as the sources of water, NTFPs, and items to support income of local communities such as tourism is identified in the remnant of natural forest in KPHK Tahura WAR and KPHL Pesawaran. These areas face significant deforestation risks; notably, KPH Pesawaran Register 20 is also vulnerable to landslides and mining activities. Rivers and springs within these subunits are prioritized due to declining water quality caused by nearby agricultural activities. Although local communities have taken initiatives to protect water sources by planting *gintung* trees and committing to water conservation, stronger support through formal policies and water management regulations from the government and KPH is necessary. Therefore, due to the high probability and high threats, these areas are considered as ***high priority*** for HCV 5 management.

Mangrove ecosystems serve as fish breeding grounds and provide supplementary income for local communities. Although not considered a primary livelihood source, the area faces increasing pressure from mining activities, land fires, and sedimentation, which may further degrade its ecological function. Due to the low probability and high threats, these areas are considered as ***medium priority*** for HCV 5 management.

Table 25. Pesawaran HCV 5 Priority Area

Description	Sub-Unit			
	A KPHK WAR	B Steep slopes outside forest area	C KPHL Pesawaran Reg 20 & 21	D Mangrove, coastal, and small islands
Forest as water provision and associated waterfalls, NTFPs, and items to support livelihood of local communities (e,g. tourism, additional protein sources)	Low to high probability & high threat	N/A	Low to high probability & high threat	N/A
Mangrove and coastal ecosystems to as one of income sources for local communities	N/A	N/A	N/A	Low probability & high threat

The following table presents our suggested actions for the priority areas in Pesawaran.

Table 26. Suggested Actions for Pesawaran HCV 5 Priority Areas

Suggested Actions	Sub-Unit			
	A KPHK WAR	B Steep slopes outside forest area	C KPHL Pesawaran Reg 20 & 21	D Mangrove, coastal, and small islands
Collaboration with NGO to conduct regular monitoring in river water quality	✓		✓	
Periodically assess household income sources, livelihood dependency on forest resources, and changes in local poverty levels	✓		✓	
Establish formal regulation to protect spring water and its usage for local communities	✓			
Develop and support sustainable livelihood programs such as agroforestry, community-based ecotourism, or non-timber forest product enterprises to reduce dependence on forest resources	✓	✓	✓	✓
Collaboration with Department of Tourism to develop sustainable tourism	✓	✓	✓	✓

5.3.6. HCV 6

High probability of sites with recognised cultural, historical, and spiritual importance to local communities is potentially found at the peak of Mt Betung, where a sacred tomb is believed to exist and *Old Forest Damar Kaca & Old Forest Wilayah Satu* in the Tahura WAR area. Local communities visit this site where they are in need help or blessings. The threat is considered low, due to the lower risk of encroachment considering the significance importance by the locals, and also lower risk to natural hazard such as landslides. Therefore, due to the high probability and low threat, the area is considered as **medium priority** for HCV 6 management.

Table 27. Pesawaran HCV 6 Priority Area

Description	Subunit A KPHK WAR
Sites with recognised cultural, historical, and spiritual importance to local communities	High probability & low threat

The following table presents our suggested actions for this priority area in Pesawaran.

Table 28. Suggested Actions for Pesawaran HCV 6 Priority Areas

Suggested Actions	Subunit A KPHK WAR
Conduct further research in the cultural value areas involving local communities and tribe leaders to deepen and document the traditional knowledge	✓

5.4. Priority Subdistricts Based on HCV High-Probability and Indicative HCS

The following section highlights subdistricts considered critical because they contain large extent of HCV high-probability areas and Indicative HCS compared to other subdistricts. These areas represent the most significant opportunities for conservation impact and require priority attention in spatial planning and management actions.

5.4.1. Lampung Tengah

Within **Subunits A and B** of Lampung Tengah – located in the western part of the district and characterised by secondary forest, high elevation, and steep terrain – *Selagai Lingga* is identified as the highest management priority. This is due to its extensive indication of high carbon stock (both HDF and MDF) and high-probability presence of multiple HCVs (HCV 1, 3, 4, and 5). *Pubian* is identified as the second priority, while *Sendang Agung* is identified as third priority within these subunits.

In the eastern part of Lampung Tengah, covering **Subunits C, D, and E**, which are dominated by wetlands, swamp ecosystems, and riparian landscapes, *Bandar Mataram* is considered the top management priority due to the extensive area identified as high-probability HCV 1-4. *Bandar Surabaya, Bumi Nabung, Terbanggi Besar,* and *Terusan Nyunyai* are considered second-priority, while *Way Pangubuan, Seputih Mataram, Seputih Raman,* and *Seputih Surabaya* are considered third-priority, given their substantial but comparatively smaller areas of high-probability HCVs.

Table 29. Subdistricts in Lampung Tengah and Their Respective Areas (in Hectares) Identified as High-Probability HCV and Indicative HCS

Subdistrict in Lampung Tengah	HDF	MDF	LDF	YRF	HCV1 High	HCV2 High	HCV3 High	HCV4 High	HCV5 High	Threat
Anak Ratu Aji	-	-	-	14	-	-	-	0	-	FL, FR
Anak Tuha	-	-	-	6	-	-	-	-	-	FL, FR, M
Bandar Mataram	-	0	1	14	20,887	20,887	20,887	20,887	-	FL, FR
Bandar Surabaya	-	-	-	0	785	646	785	762	116	FL, FR, M
Bangun Rejo	-	-	-	25	-	-	-	7	-	FL
Banyumas	-	-	-	-	-	-	-	-	-	M
Bekri	-	-	-	0	-	-	-	4	-	FL, FR
Bumi Nabung	-	0	0	0	1,056	1,056	1,056	1,056	-	FL, FR
Bumi Ratu Nuban	-	-	-	0	-	-	-	-	-	FL, FR
Gunung Sugih	-	-	-	17	-	-	-	-	-	FL, FR
Kalirejo	-	-	-	26	-	-	-	-	-	FL, M
Kota Gajah	-	-	-	1	-	-	-	-	-	FL, FR
Padang Ratu	-	-	-	57	-	-	-	149	-	FL, FR, M
Pubian	13	404	156	1,089	299	-	299	1,643	300	L, D, FL, FR

Subdistrict in Lampung Tengah	HDF	MDF	LDF	YRF	HCV1 High	HCV2 High	HCV3 High	HCV4 High	HCV5 High	Threat
Punggur	-	-	-	1	-	-	-	-	-	FL, FR
Putra Rumbia	-	-	-	1	40	25	40	40	14	FL, FR
Rumbia	-	-	-	4	10	10	10	10	-	FL, FR
Selagai Lingga	952	3,510	566	4,012	5,168	-	5,168	6,447	5,169	L, D, FL, FR, M
Sendang Agung	-	32	44	1,084	45	-	45	1,064	45	FL, FR, M
Seputih Agung	-	-	-	7	-	-	-	-	-	FL, FR
Seputih Banyak	-	-	-	11	-	-	-	-	-	FL, FR
Seputih Mataram	-	-	-	10	322	322	322	322	-	FL, FR
Seputih Raman	-	-	-	5	128	128	128	128	-	FL, FR
Seputih Surabaya	-	-	-	0	284	284	284	284	-	FL, FR
Terbanggi Besar	-	-	-	12	922	922	922	922	-	FL, FR
Terusan Nunyai	-	-	0	2	1,910	1,910	1,910	1,910	-	FL, FR
Trimurjo	-	-	-	1	-	-	-	-	-	FL
Way Pangubuan	-	0	0	14	810	810	810	810	-	FL, FR
Way Seputih	-	-	-	6	-	-	-	-	-	FL, FR
Grand Total	**965**	**3,947**	**767**	**6,419**	**32,666**	**27,001**	**32,666**	**36,447**	**5,645**	

Note:

- Red highlighted indicates first priority for HCV/HCS Management
- Orange highlighted indicates second priority for HCV/HCS Management
- Yellow highlighted indicates third priority for HCV/HCS Management

Management recommendations for these areas are provided in Section 5.2.

5.4.2. Pesawaran

In Pesawaran, *Teluk Pandan* is considered the highest priority, primarily due to the large area identified as High Probability HCV – particularly HCV 1 and HCV 4 – and the extensive presence of forest with relatively high carbon stock (HDF and MDF). Teluk Pandan falls under Subunits A and B.

Punduh Pidada and *Padang Cermin*, including their coastal areas and small islands, are identified as the second-priority areas due to the substantial extent of HCV 4. These locations are addressed under Subunit D for both districts, with Padang Cermin also included in Subunit B.

The third-priority areas comprise *Gedong Tataan*, *Kedondong*, *Marga Punduh, Way Lima*, and *Way Ratai*. Gedong Tataan, Kedondong, and Way Lima are included in Subunit A; Way Ratai is included in Subunits A, B, and C; and Marga Punduh is included in Subunit C.

Table 30. Subdistricts in Pesawaran and Their Respective Areas (in Hectares) Identified as High-Probability HCV and Indicative HCS

Subdistrict in Pesawaran	HDF	MDF	LDF	YRF	HCV1 High	HCV2 High	HCV3 High	HCV4 High	HCV5 High	Threat
Gedong Tataan	53	489	124	1,514	605	-	605	1,504	605	L, FL, M
Kedondong	23	431	86	1,001	486	-	275	1,470	275	L, FL, FR, M
Marga Punduh	0	70	50	1,152	309	-	309	2,434	109	L, FL, M
Negeri Katon	-	-	-	45	-	-	-	5	-	FL, FR, M
Padang Cermin	3	323	174	2,232	389	-	389	3,098	108	L, FL, FR
Punduh Pidada	92	487	221	1,542	403	-	410	3,659	307	L, D, FL, M
Tegineneng	-	-	-	6	-	-	-	2	-	FL, FR, M

Subdistrict in Pesawaran	HDF	MDF	LDF	YRF	HCV1 High	HCV2 High	HCV3 High	HCV4 High	HCV5 High	Threat
Teluk Pandan	63	1,213	358	2,876	1,492	-	664	4,709	431	L, D, FL, M
Way Khilau	-	8	15	577	18	-	18	1,177	18	L, D, FL, FR, M
Way Lima	16	679	94	312	676	-	491	1,069	491	L, D, FL, FR, M
Way Ratai	1	237	180	1,804	134	-	134	2,090	134	L, FL, FR, M
Grand Total	**251**	**3,936**	**1,302**	**13,062**	**4,512**	**-**	**3,294**	**21,216**	**2,478**	

Note:

- Red highlighted indicates first priority for HCV/HCS Management
- Orange highlighted indicates second priority for HCV/HCS Management
- Yellow highlighted indicates third priority for HCV/HCS Management

The corresponding management recommendations for these subunits are provided in Section 5.3.

6. Conclusion

6.1. HCV/HCS Integrated Screening Result

The following maps present the Indicative High Carbon Stock (HCS) areas integrated with High Conservation Value (HCV) high-probability areas across Lampung Tengah and Pesawaran. This integrated spatial analysis highlights zones where significant ecological values overlap with remaining natural vegetation, providing a clearer picture of priority areas for conservation, landscape connectivity, and sustainable land-use planning. The maps serve as a foundation for identifying management priorities and guiding discussions with local stakeholders on protection and intervention strategies.

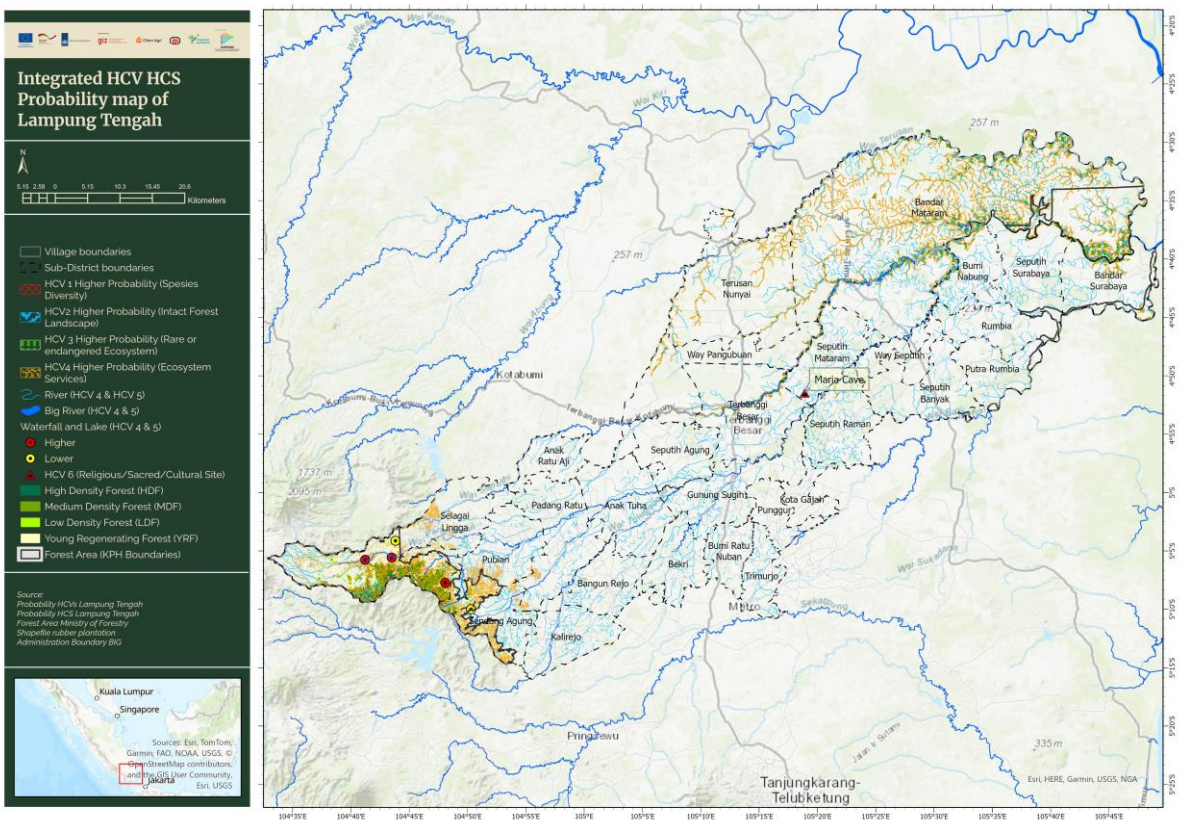


Figure 6. Indicative HCS map integrated with HCV high probability area of Lampung Tengah

The HCV screening in Lampung Tengah identified extensive areas with high probability of HCV 1, 3 and 4 (32,666 ha for HCV 1 and 3, 35,447 ha for HCV 4) indicating biodiversity importance and critical environmental services concentrated in the western and northeastern area of the district. Potential landscape-level ecological function (high probability of HCV 2) is concentrated in the northwestern area dominated with wetland and riparian ecosystems. Presence of high probability of HCV 5 is identified in relation to community's dependency to water sources from the forested area in the west. The low-probability areas in the northeast indicate the presence of ecosystem relied upon by local communities, although mostly alternatives are available.

When integrated with HCS consideration, the critical areas are expected to cluster in the western uplands of Lampung Tengah (mainly in Selagai Lingga), where an estimate of 965 ha of area are still intact (high density forest) and large medium-density forests and young regenerating forests coincide with connectivity and watershed functions.

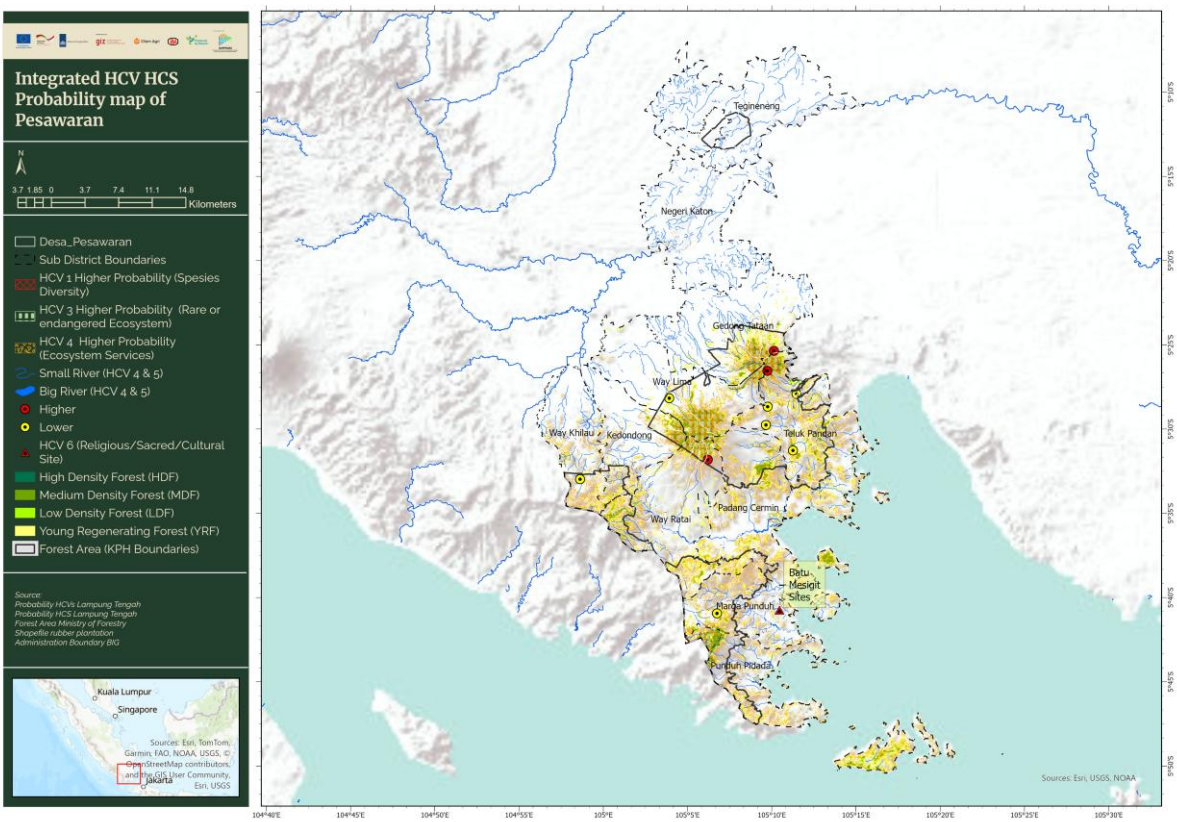


Figure 7. Indicative HCS classification map integrated with HCV high probability area of Pesawaran

Pesawaran's HCV probability profile is strongly shaped by ecosystem-service functions, with HCV 4 emerging as the most significant high-probability value at 21,216 ha (16.6% of the district). Its dominance highlights the district's reliance on watershed protection, slope stability, and flood mitigation, making these landscapes core conservation priorities. HCV 1 and HCV 3 contain smaller high-probability cores (4,512 ha and 3,294 ha, respectively) but are surrounded by extensive low-probability areas, indicating that biodiversity and rare ecosystems are widespread yet fragmented. HCV 5 contributes 2,478 ha of high-probability areas, pointing to localized livelihood values that require community-based and participatory management, rather than broad zoning alone.

From the HCS forest classification, Young Regenerating Forest (13,062 ha) dominates the landscape, although Low to High Density Forest (a combined 5,489 ha) remains present within the formally designated forest area and across the small islands. These remaining forest HCS classes show substantial overlap with HCV areas, reinforcing their ecological and socio-environmental importance.

However, within Pesawaran, the forest patches are highly fragmented, creating clear opportunities for restoration interventions, particularly through corridor establishment and enhancement. Strengthening connectivity between these fragmented HCV/HCS forest blocks would not only accelerate natural regeneration, but also support wildlife movement and further strengthen key values such as HCV 1 (biodiversity), HCV 3 (rare ecosystems), and HCV 4 (ecosystem services).

The following tables present the estimated probability area of HCV-HCS in Lampung Tengah and Pesawaran District.

Table 31. Summary of total probability HCV area of Lampung Tengah

HCV	High Probability area (ha)	Low probability area (ha)	Total HCV Probability Area (ha)
HCV 1	32,666	20,363	53,030
HCV 2	27,001	5,535	32,536
HCV 3	32,666	19,285	51,952
HCV 4	36,447	7,157	43,604
HCV 5	5,645	34,759	40,405

Table 32. Summary of total probability HCV area of Pesawaran

HCV	High Probability area (ha)	Low probability area (ha)	Total HCV Probability Area (ha)
HCV 1	4,512	26,464	30,976
HCV 2	-	2,473	2,473
HCV 3	3,294	25,423	28,717
HCV 4	21,216	7,949	29,165
HCV 5	2,478	16,909	19,388

Table 33. Summary of Indicative HCS area of Lampung Tengah and Pesawaran

HCS Vegetation Class	Lampung Tengah		Pesawaran	
	Area (Ha)	% of district's area	Area (Ha)	% of district's area
High Density Forest (HDF)	965	0.2	251	0.2
Medium Density Forest (MDF)	3,947	0.9	3,936	3.1
Low Density Forest (LDF)	767	0.2	1,302	1.0
Young Regenerating Forest (YRF)	6,419	1.4	13,062	10.2
Other land-use (shrub, open land, plantation and urban area)	443,859	97.3	109,444	85.5
Total Area	455,957	100.0	127,994	100.0

6.2. Recommendation

This section summarises suggested actions for maintaining and enhancing HCV/HCS high-probability areas in Lampung Tengah and Pesawaran. These priorities reflect the urgent actions needed to protect remaining natural ecosystems, maintain ecological connectivity, and reduce pressures from land-use change, fire, and other threats.

6.2.1. Strengthening Governance and Institutional Capacity of KPH in Forest Protection

Across both districts, a priority given to improving the capacity of KPH institutions to prevent deforestation to the remaining forest area. This includes empowering forest patrols, enforcing regulations on land-use expansion, and developing local policies to protect critical ecosystems such as river buffers, riparian forests, swamps, and spring water sources. For non-forested KPH areas, the study suggests implementation of Social Forestry through regular engagement and support for planting economically valuable NTFPs in suitable areas.

Interviews conducted separately with KPH representatives across Lampung Tengah and Pesawaran consistently highlighted the same challenge: the available human resources and operational capacity are insufficient to effectively manage and monitor the extensive areas under their jurisdiction. For example, some KPH units have only around eight forest rangers responsible for monitoring areas of approximately 20,000 hectares, while operational budgets for regular and comprehensive field monitoring are also limited. This capacity gap can constrain the KPH's ability to prevent and respond to encroachment, illegal activities, forest degradation, and other land-use pressures. Therefore, strengthening the institutional capacity of KPH should be an important consideration for the Government, including through adequate staffing, technical capacity, operational funding, equipment, and stronger collaboration with communities and other relevant stakeholders to support effective long-term forest management and protection.

6.2.2. Biodiversity Protection and Ecological Connectivity

Suggested actions emphasize conserving critical habitats and maintaining connectivity between forest patches within KPHK Tahura WAR in Pesawaran, potential connectivity from KPH Way-Waya to Bukit Barisan Selatan National Park, and KPH Way Terusan to Way Kambas National Park. Recommended efforts include: establishing species databases, conducting habitat quality surveys, raising awareness of RTE (Rare, Threatened, Endangered) species, and restoring ecological corridors. As highlighted during interviews with KPH units in Lampung Tengah and Pesawaran, a key challenge related to biodiversity across all KPHs is the limited availability of reliable biodiversity data. There is currently no systematic or formal monitoring in place to regularly document species presence, distribution, and population trends, particularly for Rare, Threatened, and Endangered (RTE) species.

In addition, development related to road, settlement, and agricultural expansion that could fragment swamp ecosystems, particularly along Bandar Mataram to Terbanggi Besar, shall be accompanied with HCV considerations to maintain Southern Lampung ecological corridor functions.

6.2.3. Safeguarding Wetlands, Swamps, Riparian and Mangrove Ecosystems

Actions shall focus on regulating land use in buffer zones, rehabilitating degraded riparian zones; promoting sustainable aquaculture compatible with mangrove conservation; and adjusting zoning to separate mangrove conservation areas from fisheries.

Priority swamp ecosystem identified in Lampung Tengah (>20,000 ha) shall be supported with buffer zones along waterways tied to Way Seputih, and management of agricultural runoff and pollution affecting rivers and riparian ecosystems.

In addition, strengthening forest buffer zones and river riparian areas should go beyond restricting agricultural expansion to also limiting physical developments, including housing and other structures near riverbanks, as observed in current conditions. These efforts can be facilitated by Bappeda (Regional Development Planning Agency), in coordination with the Agriculture Agency, Plantation Agency, and Public Works Agency, as emphasized during consultations with Bappeda Pesawaran.

In relation to mangroves, it is important to recognise that responsibilities for coastal and marine areas are distributed across different levels and sectors of government. Under Law (UU) No. 23/2014 on Local Government, the provincial government has authority over marine space up to 12 nautical miles from the coastline, while the Central Government is responsible for marine space beyond 12 nautical miles and areas of national strategic importance. This means that provincial governments have an important role in managing mangrove areas located within their respective coastal and marine jurisdictions, although responsibility for mangrove protection and management is not limited to the provincial level.

Mangrove management also cuts across administrative and sectoral boundaries, as mangrove ecosystems may occur both within and outside forest areas and directly interface with coastal and marine areas. Government Regulation (PP) No. 27/2025 on the Protection and Management of Mangrove Ecosystems provides for management at the national, provincial and district/city levels, according to their respective authorities, and requires coordination between relevant levels of government. Responsibilities also involve different sectoral institutions, including forestry (Dinas Kehutanan) and marine and fisheries (Dinas Kelautan dan Perikanan) authorities. This makes coordination and collaboration among government institutions particularly important to ensure that mangrove conservation is integrated into planning and management, while also recognising the economic and livelihood pressures faced by local communities, including the conversion of mangrove areas for aquaculture such as shrimp and fish ponds.

6.2.4. Sustainable Production through Forest Conservation and Good Agricultural Practices

Promoting Good Agricultural Practices (GAP) essential in agricultural areas adjacent to HCV zones. In alignment with the *Strategic Plan*[4] of the Lampung Provincial Plantation Agency (Dinas Perkebunan) 2025-2029, which prioritises increasing the production of plantation commodities, the adoption of GAP, and appropriate soil and water conservation measures should be strengthened as part of the production strategy. HCV-HCS should be incorporated into plantation expansion planning to help identify and avoid areas with important conservation values, to maintain land productivity and ensured that the increased production does not result in environmental cost and declining productivity in the future.

Actions may also include agroforestry training for existing plantation area, limiting agricultural expansion into forests and its buffer zones, rehabilitating degraded lands, restoring riparian vegetation, and managing erosion and sedimentation through deep-rooted vegetation. Special attention should also be given to swamp conservation, mangrove zoning, and steep-slope management.

6.2.5. Community Engagement and Social Forestry

Local communities play a critical role in HCV stewardship. The recommended actions promote active participation through forest fire prevention groups, fire extinguisher equipment procurement, awareness programs on biodiversity and ecosystem importance, involvement in illegal encroachment monitoring, and regular engagement to support Social Forestry implementation.

In the context of forest fire prevention groups, local villagers reported limited access to fire-fighting equipment, particularly fire extinguishers, at the community level. Basic fire-fighting equipment should be made readily available at the grassroots level to enable communities to respond quickly as a first line of defence against small fires before they spread. In addition, clear and visible fire-response signs should be installed in identified hotspot areas, providing step-by-step guidance on what to do

[4] *Rencana Strategis Dinas Perkebunan Provinsi Lampung 2025-2029*

when a fire is detected, including how to report the incident, safely respond using available equipment, and contact the relevant authorities. In regards to the relevant authority, natural disaster prevention falls under the Regional Disaster Management Agency (BPBD), while fire suppression is managed by the Fire Department (*Damkar*). Considering the consultation result with Bappeda, these initiatives could be facilitated by Bappeda with BPBD as the implementing body.

In the context of biodiversity awareness, based on the IEC campaigns conducted in Lampung Tengah and Pesawaran, communities generally have limited awareness of protected species, partly because they are not familiar with which animals are legally protected or why they are important to the ecosystem, how to respond safely when encountering wild animals, and what are the legal consequences associated with the hunting, capture, trade, or possession of RTE species. To address this gap, awareness-raising activities should be complemented by the installation of clear and informative warning signs at key locations, particularly near important habitats, forest access points, and areas with potential human–wildlife interactions.

In addition, for areas vulnerable to illegal hunting and wildlife poaching, conservation interventions should be complemented by livelihood improvement programmes (see 6.2.7).

6.2.6. Water, Pollution, and Disaster Risk Management

Several recommendations address water quality monitoring, especially in river systems and areas impacted by mining. Enhancing early warning systems for floods, tracking land-cover changes via remote sensing, and reducing agricultural pollution are critical for maintaining hydrological stability and minimizing disaster risks. Swamp protection policies also play an important role in maintaining ecological functions.

Consultations with Bappeda Pesawaran further highlight that the effectiveness of these measures is closely linked to governance challenges in the mining sector. As mining operations fall outside district authority and the District Mining Office has been dissolved, stronger coordination with provincial and central governments is needed to prevent uncontrolled expansion and environmental degradation. At the same time, the district government's role in oversight and monitoring should be reinforced within the existing framework.

The consequences of this regulatory gap are already visible in areas such as Bukit Bunut in Way Ratai, which has been almost entirely converted into mining sites. This illustrates how extractive activities can expand rapidly in the absence of effective local oversight, ultimately threatening ecosystem stability, particularly in relation to water systems.

6.2.7. Livelihood Diversification and Sustainable Economic Development

To reduce pressure on forests, the strategy encourages sustainable livelihood programs such as agroforestry enterprises, NTFP development, and community-based ecotourism. These are supported by regular assessments of household income sources and partnerships with relevant government agencies, including tourism departments. In mangrove and coastal areas, sustainable aquaculture is also promoted.

In addition, in many forest-bordering villages, illegal hunting is often linked to underlying socioeconomic factors, including poverty and limited income opportunities. Consequently, strategies to reduce poaching should be integrated with measures that strengthen local livelihoods and enhance economic resilience. Such measures may include sustainable agriculture development, diversification of household income sources, capacity building for sustainable agricultural enterprises, and improved access to markets for environmentally responsible products.

Outside the forest area, economic development efforts shall focus on alignment of interventions with district and provincial spatial planning to reduce degradation risks and guide land-use decisions. In

this context, all interventions should be aligned with the IAD framework to ensure consistency and avoid overlap, while recognizing that land rehabilitation authority lies at the provincial level under the Forestry Department. In addition, coordination with the Public Works Agency is essential, given its authority over spatial planning framework such as RTRW and RTLH, as emphasized during consultations with Bappeda Pesawaran.

During discussions with Bappeda of Lampung Province, it was further highlighted that synchronization with IAD plans remains important. However, currently only Pesawaran District has a completed IAD, while the IAD for Lampung Tengah District is still under development. It was also noted that integrating HCV–HCS indicative areas into the Regional Spatial Plan (RTRW) may face limitations due to its long-term planning horizon (20 years), with the current plan in effect until 2043. In this regards, these findings can serve as supplementary references for regional development.

6.2.8. Restoration Priorities

Rehabilitate degraded lands, steep slopes, and riparian buffers with deep-rooted, soil-stabilising vegetation, and restore natural cover within priority ecological corridors to improve connectivity. This recommendation was consulted with Lampung Province Forestry Department that expressed their support and suggested the development of proposal that includes details on corridor planning, width, and plant species. Further study is needed to identify and prioritise restoration areas based on hydrological function, biodiversity value, and landscape-scale connectivity, ensuring that interventions strengthen ecosystem resilience and long-term habitat viability. Well-designed restoration corridors can enhance slope stability, improve watershed performance, and support species movement. Therefore, priority locations for corridor-based restoration should be refined through field verification and spatial analysis to determine the most effective and socially appropriate intervention zones.

6.3. How the HCV-HCS Screening Supports Climate-Resilient and Sustainable Agricultural Development

The HCV-HCS screening studies in Lampung Tengah and Pesawaran were undertaken as part of the Sustainable Agriculture for Forest Ecosystems (SAFE) project[5]. The studies aim to provide spatial information on areas of potential HCV and HCS and its importance in providing environmental and socio-economic functions for the community and its livelihood.

Agriculture and land-use economic sectors are highly dependent on natural resources and can be vulnerable to climate-related impacts. Climate-related impacts, including flooding, landslides, drought and fires, can affect agricultural productivity, damage productive assets and increase the risk of income loss for farming households. Against this background, the HCV-HCS screening provides an opportunity to identify ecosystems and landscape features that contribute to climate resilience, including forests, riparian areas, wetlands, mangroves, steep slopes and ecological corridors. The findings can help inform practical measures to maintain, restore and integrate these areas into agricultural and landscape management.

The recommendations from the HCV-HCS screening were developed with consideration of the development priorities identified by the Government of Lampung. Among the priorities identified in Lampung Provincial Plantation Agency Strategic Plan (Renstra) 2025–2026 are increasing agricultural productivity through intensification and extensification of agriculture; strengthening the competitiveness of plantation commodities; management of land fires and reducing climate-related impact to crops; and improving overall agriculture business through development of commodities based on production centres, strengthening institutional arrangements and partnerships, and improving plantation agribusiness performance.

6.3.1. Productive and Competitive Plantations

Increasing productivity through **intensification** is broadly consistent with the objective of increasing production within existing agricultural areas while reducing pressure to expand into natural ecosystems. Measures such as crop rejuvenation (replanting), integrated pest management, improved agricultural practices and the appropriate use of technology can contribute to increasing productivity without requiring additional land conversion.

Where **extensification** or expansion of plantation areas is considered in the strategic plan, the HCV-HCS screening can provide an additional source of spatial information to support responsible land-use planning. Areas identified as having potential HCV or HCS significance should be considered alongside applicable spatial plans, environmental requirements and other relevant information before decisions on land-use change or plantation expansion are made.

This is particularly relevant for Lampung's priority plantation commodities. Of the seven priority commodities identified by the province – oil palm, rubber, robusta coffee, cocoa, pepper, coconut and sugarcane – **oil palm, rubber, coffee and cocoa** are relevant to the **EU Deforestation Regulation** (EUDR). While plantation expansion into HCV-HCS areas may lead to both direct and indirect impacts on the environment and human well-being, the expansion of oil palm, rubber, coffee, and cocoa plantations into forest areas would result in direct consequences under the EUDR. As the regulation

[5] SAFE (Sustainable Agriculture for Forest Ecosystems) project is implemented by GIZ Indonesia and co-funded by the European Union, the German Federal Ministry for Economic Cooperation and Development (BMZ), and the Ministry of Foreign Affairs of the Netherlands. In Indonesia, the SAFE programme is implemented in partnership with the Ministry of National Development Planning (BAPPENAS), specifically the Department of Food and Agriculture.

prohibits the placement of commodities linked to deforestation on the EU market, such expansion could immediately affect market access and the livelihoods of producers associated with such expansion.

Beyond supply-chain considerations, the screening can also support broader spatial planning discussions by highlighting areas where agricultural development may need to be balanced with the protection of biodiversity, ecosystem services and climate-resilience functions.

6.3.2. Sustainable Agriculture and Climate Resilience

Sustainable agriculture development requires maintaining the ecological functions that support agricultural production and local livelihoods over the long term. This is consistent with the principles of Law No. 22/2019 on Sustainable Agricultural Cultivation Systems, which emphasises the sustainable management of biological resources and the need to ensure that agricultural resources remain available for future generations.

In agricultural areas adjacent to HCV areas, **Good Agricultural Practices (GAP)** should complement conservation measures. Depending on the local context, these may include agroforestry, maintaining appropriate buffer zones, rehabilitation of degraded land, restoration of riparian vegetation, erosion and sediment control, and measures to reduce pressure on wetlands, mangroves and steep slopes.

The HCV-HCS screening provides a basis for identifying areas where conservation, restoration and improved land management can contribute to climate resilience. The threat analysis undertaken through the screening can help identify priority areas for mitigation and landscape management. In particular, **areas exposed to flooding, landslides and fire** may require additional attention where these risks could affect both ecosystems and agricultural productivity.

The Agricultural Disaster Control and Management Program has been integrated into the 2025-2029 Lampung Provincial Plantation Agency Strategic Plan. The program encompasses provincial-level initiatives aimed at addressing the impacts of climate change on the food crop, horticulture, and plantation sectors, as well as preventing and responding to land fires and other disturbances that may affect agricultural production and plantation operations.

The screening indicates that both Lampung Tengah and Pesawaran contain ecosystems that contribute to hydrological regulation, erosion control, fire prevention and biodiversity conservation. These include highland forests, steep slopes, riparian areas, wetlands and mangrove ecosystems. The findings indicate a high probability of HCV 4 in several of these areas, reflecting their potential importance for maintaining critical ecosystem services. This includes, among others:

- Swamp system stretches from Bandar Mataram and Bandar Surabaya to Terbanggi Besar, Lampung Tengah. These interconnected areas face significant risks from flooding and land fires, as well as potential expansion of roads, settlements, and agriculture, all of which could disrupt their functions in ecological connectivity.
- Mangrove ecosystems in coastal Pesawaran, particularly in Padang Cermin, Marga Punduh, and Punduh Pidada that provides stormwater retention and tidal flood control, while also acting as moisture barriers that reduce fire spread.
- Steep slopes, high-elevation areas and riparian ecosystems found across both districts provide important ecosystem services for flood regulation and landslide prevention. These areas should therefore be conserved, with deep-rooted vegetation maintained or restored where appropriate to help stabilise soils and slopes.

6.3.3. Agriculture Development that Benefit Local Communities around Areas of Conservation Importance

Sustainable plantation development that delivers tangible benefits to local communities has been prioritised by the Provincial Government of Lampung through agendas such as developing commodities based on designated production centres (*sentra produksi*), strengthening plantation institutions and business partnerships, and improving the performance of plantation agribusiness. Ultimately, reducing dependence on activities that may place additional pressure on forests and other areas of conservation importance will require efforts to improve household incomes and strengthen sustainable livelihood opportunities for local communities.

The study identifies areas of high conservation importance, including areas with high concentration of HCV 1, and areas surrounding Taman Nasional Bukit Barisan Selatan (TNBBS) and Taman Nasional Way Kambas (TNWK), where illegal poaching of RTE species remains a concern. Given that limited livelihood opportunities can contribute to pressure on natural resources, these areas should be prioritised for livelihood improvement initiatives alongside strengthened conservation and law enforcement efforts.

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