LAND USE CHANGE AND

DEFORESTATION ANALYSIS REPORT

Prepared for Malaysian Sustainable Palm Oil (MSPO)

Prepared by GEOSPATIAL AI SDN BHD (A subsidiary of UZMA BERHAD)

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1. EXECUTIVE SUMARY

The purpose of this report is to review and analyse the land use change of a group of smallholders located in Pahang and Johor in Malaysia. The objective of this analysis are (i) to identify high-risk deforestation zones; and (ii) to analyse historical and current satellite imagery to detect deforestation trends after 31 Dec 2020.

As provided in the shapefile, the total number of plots requiring analysis is 73 plots with total area of 232.89 ha. The total area of these plots are different from the reviewer's calculation which is 220.20 ha. The difference is due to the 24 plots that have a discrepancy of more than 0.05 ha between the reported area and the area calculated by reviewer (See Table 2).

All plots were assessed for potential deforestation beyond the cut-off date of 31 December 2020. The assessment confirmed that none of the plots exhibited deforestation after this date. Specifically, 70 plots were already established as oil palm plantations prior to the cut-off, while the remaining 3 plots were not classified as forest areas as of 31 December 2020. Based on this, the group of smallholders is considered compliant with the deforestation-free requirement beyond the cut-off date.

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2.   STATEMENT OF CONFIDENTIALITY

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3.   INTRODUCTION

3.1   Background

In response to growing global concern over deforestation and its impact on climate change, biodiversity, and human rights, the European Union adopted the EU Deforestation Regulation (EUDR) in June 2023. This regulation aims to ensure that certain key commodities placed on the EU market or exported from it are deforestation-free and produced legally.

The EUDR applies to commodities such as oil palm, soy, cocoa, coffee, cattle, wood, and rubber, along with a wide range of their derived products. From 30 December 2024, operators and traders will be required to conduct strict due diligence, including verifying that products were not produced on land subject to deforestation after 31 December 2020 and are fully traceable to the plot of land of origin.

This regulation reflects the EU's commitment to reduce its contribution to global deforestation and forest degradation, particularly those linked to agricultural expansion. As such, it imposes significant responsibilities on producers, processors, and exporters in producing countries, requiring greater transparency, traceability, and legal compliance throughout supply chains.

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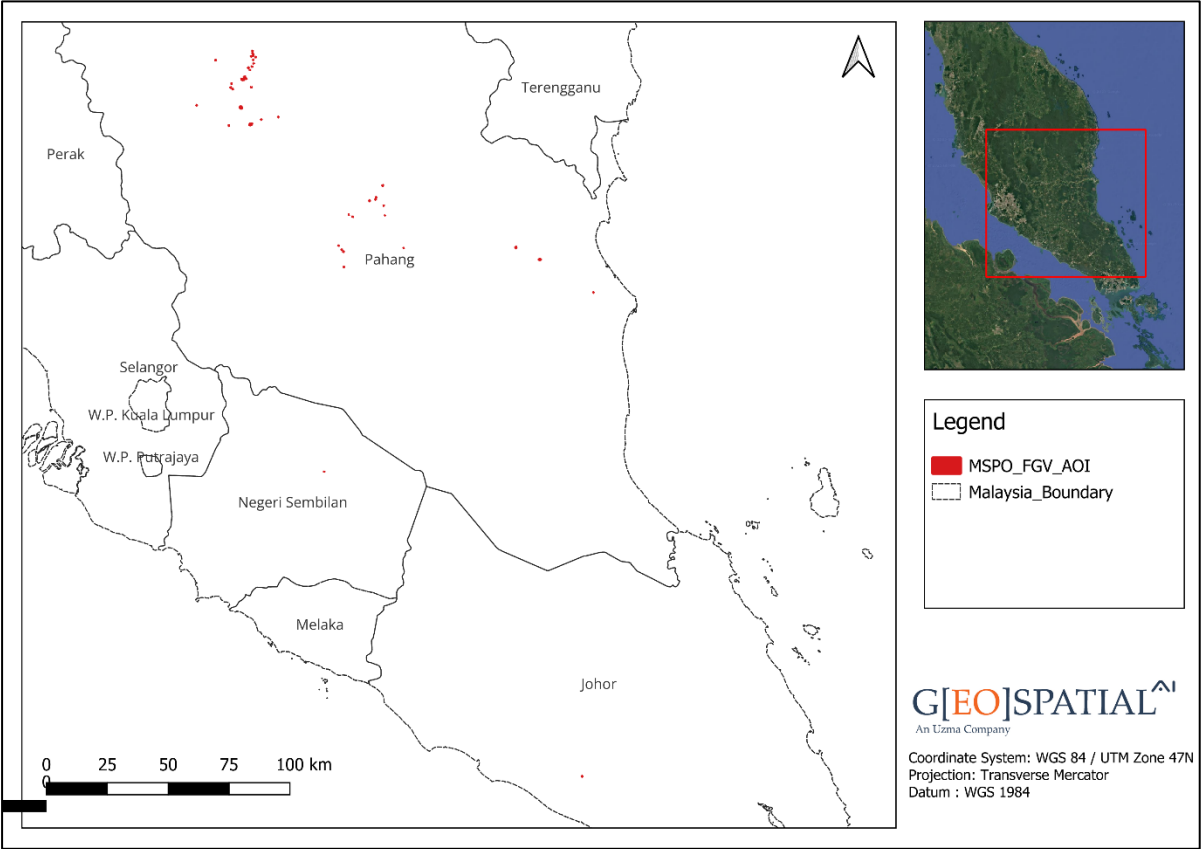
Figure 1: Location of MSPO Plots

4. PROPOSED METHODOLOGY

This forest cover and deforestation analysis was conducted using unsupervised and supervised classification of satellite imagery extracted from multiple sources. The aim was to identify and map changes in forest cover across the study area over a defined time period.

4.1 Spatial Data Assessment

The assessment of the spatial data and document was done by ensuring the completeness of the spatial data provided by the smallholder group. The following steps were performed to assess the boundary polygon.

a) Spatial and attribute data assessment

  i. The format for the boundary data is shapefile package data (*.shp, *.dbf, *.shx, *.sbx, *.sbn, *.prj, and *.cpg and .xml for metadata).

  ii. Verification of spatial data was done from the geometric aspect where the first and last coordinates are the same based on correct spatial information of Datum and Projection.

  iii. Individual polygon present information on location, length, and size of the area of interest.

  iv. The attribute should contain a name of dedicated owner of landholding and size of the area.

  v. Geometrical calculations were conducted on each of the boundary shapefile and compared with the area provided in order to verify the total area (ha) and exact location of smallholder's management unit.

b) Topology checking

  i. Topology checking was performed based on "one feature one identity" to ensure there is no redundant or multiple attributes for each feature

  ii. Relational compliance with topology rules such as nodes at intersections, overshoots, undershoots, slivers etc and with correlation between one item and another feature.

4.2 Data Sources

Several data sources were utilized to enhance the accuracy and reliability of the analysis. All images were transformed to local coordinate system (based on spatial data provided) that is Universal Transverse Mercator projection, WGS 1984 (UTM zone 47N) datum map projection system.

i.   Sentinel-2A Satellite Imagery

Source of archived optical satellite imagery for selected reference years (e.g., 2019). Used to verify historical land cover conditions prior to the designated cut-off date. Provides high-resolution, time-stamped visual data suitable for detecting land cover changes.

ii.   UzmaSAT-1 Satellite Imagery

Source of current and latest satellite imagery. Used to verify and monitor the most recent land use conditions. Offers up-to-date optical data to support land status validation.

iii.   SBTN Natural Lands Map (2020)

Used to identify areas classified as natural forests in Malaysia. Supports baseline assessments aligned with Science Based Targets for Nature (SBTN) frameworks and international sustainability standards.

iv.   Google Earth

Source of historical optical imagery for selected reference years. Used to visually verify past land cover conditions through accessible, time-stamped data, particularly where higher-resolution imagery is beneficial.

v.   Esri Satellite Imagery

Used to access high-resolution basemaps and recent satellite imagery. Supports visual verification of land cover conditions, particularly for areas lacking accessible archived datasets.

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4.3   Land Cover Classification

a) Object-Based Classification

    i.   Object-Based Image Analysis (OBIA) was applied using multiple bands to create objects and then classify them.

    ii.   Object-based image classification groups pixels into representative shapes and sizes and this process known as multi-resolution segmentation or segment mean shift.

    iii.   Multiresolution segmentation produces homogenous image objects by grouping pixels. It generates objects with different scales in an image simultaneously. These objects are more meaningful because they represent features in the image.

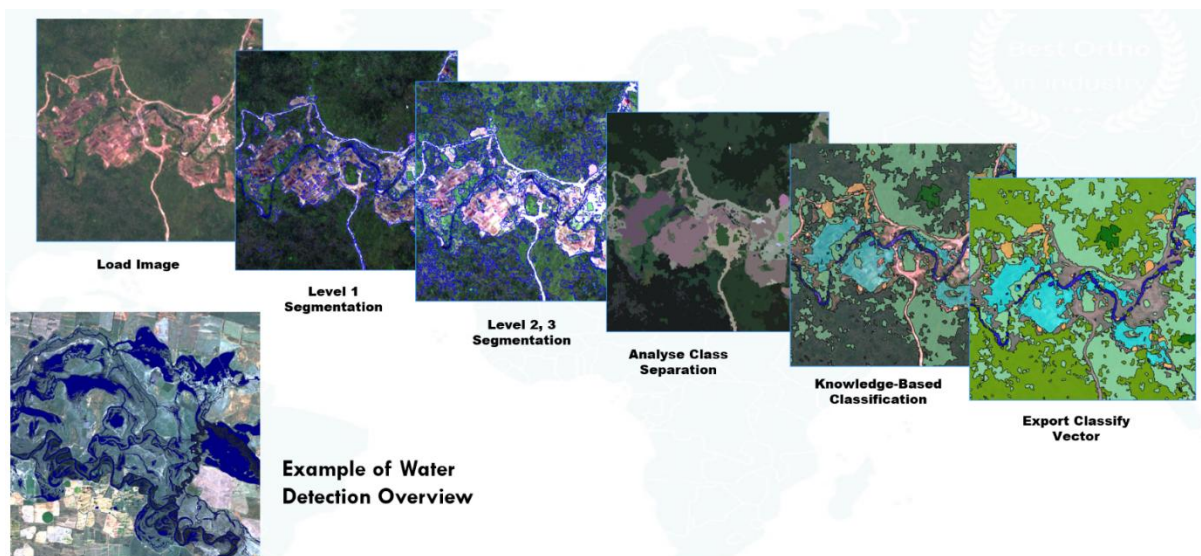   iv.   The boundary shapefile of separate landholdings should be used to clip the various land cover classes within the management unit.

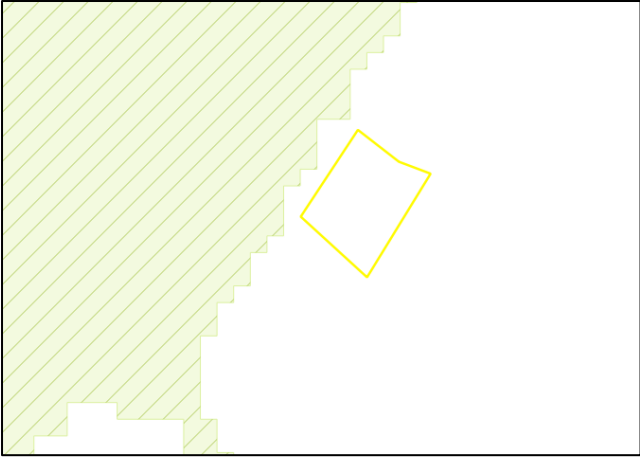**Figure 2: Concept of Image Extraction**

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5. FINDINGS AND ANALYSIS

Initial findings indicate that 70 plots were already planted with oil palm prior to the cut-off date of 31 December 2020, while 3 plots require further analysis for potential deforestation. Subsequent assessment using high-resolution satellite imagery and the 2020 Malaysia Natural Lands dataset confirmed that none of the plots were located within natural forest areas as of 2020. Therefore, no deforestation has occurred after the cut-off date of 31 December 2020.

Table 1: Plots requiring further analysis

No.	Name	Before and Close to 31 Dec 2020 (Cut-off date)	Ater 31 Dec 2020	Remark
1	Tan Eh Tat (4.402251, 101.922214)	September 2019 (Sentinel 2a- False Colour)	31 August 2022 (Maxar, Esri)	Based on Sentinel-2A imagery from September 2019, the area within the plot was found to be less vegetated compared to the surrounding forested areas. This observation is further supported by the Malaysia Natural Forest 2020 dataset obtained from Global Forest Watch (GFW), which does not classify the area as natural forest. Although land clearance within the plot is evident in 2022 imagery, it is not considered deforestation.

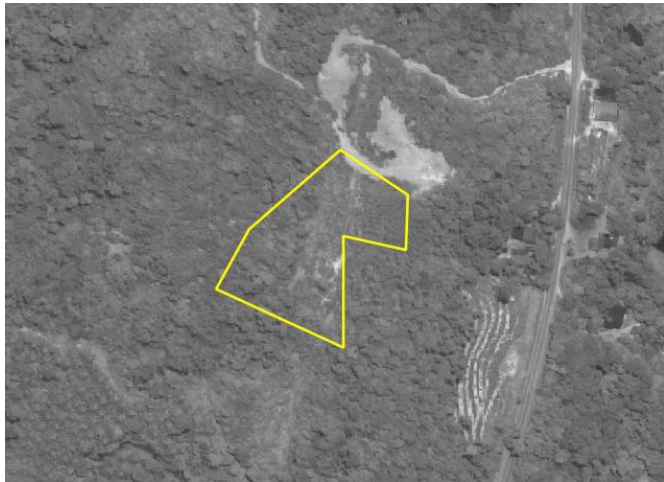| No	Name	Before and Close to 31 Dec 2020 (Cut-off date)	Ater 31 Dec 2020	Remark
		SBTN Natural Land 2020	13 July 2025 (UzmaSat-1)	The most recent satellite image from UzmaSAT-1 confirms that the area has since been planted with oil palm.

No	Name	Before and Close to 31 Dec 2020 (Cut-off date)	Ater 31 Dec 2020	Remark
2	AHMAD SANI B ABD RAHMAN (4.334251, 102.032538)	October 2016 (Airbus, Google Earth)	31 August 2022 (Maxar, Esri)	Based on Google Earth imagery from October 2016, the area within the plot was covered by forest. However, Sentinel-2A imagery from September 2019 shows that the area had already been cleared by that time. Therefore, the plot is not considered to be subjected to deforestation after the cut-off date of 31 December 2020. In 2022, oil palm planting activities commenced, and the most recent imagery from UzmaSAT-1 confirms that the area is currently planted with oil palm.

No	Name	Before and Close to 31 Dec 2020 (Cut-off date)	Ater 31 Dec 2020	Remark
		September 2019 (Sentinel 2a- True Colour)	11 July 2025 (UzmaSat-1)	

No	Name	Before and Close to 31 Dec 2020 (Cut-off date)	Ater 31 Dec 2020	Remark
3	Shamsuddin (4.422431, 102.061022)	11 July 2019 (Worldview-1)	31 August 2022 (Maxar, Esri)	Based on WorldView-1 satellite imagery dated July 2019, the area within the plot was observed to be a degraded forest. This observation is further supported by the Malaysia Natural Forest 2020 dataset from Global Forest Watch (GFW), which does not classify the area as natural forest. By 2022, the area was partially cleared.

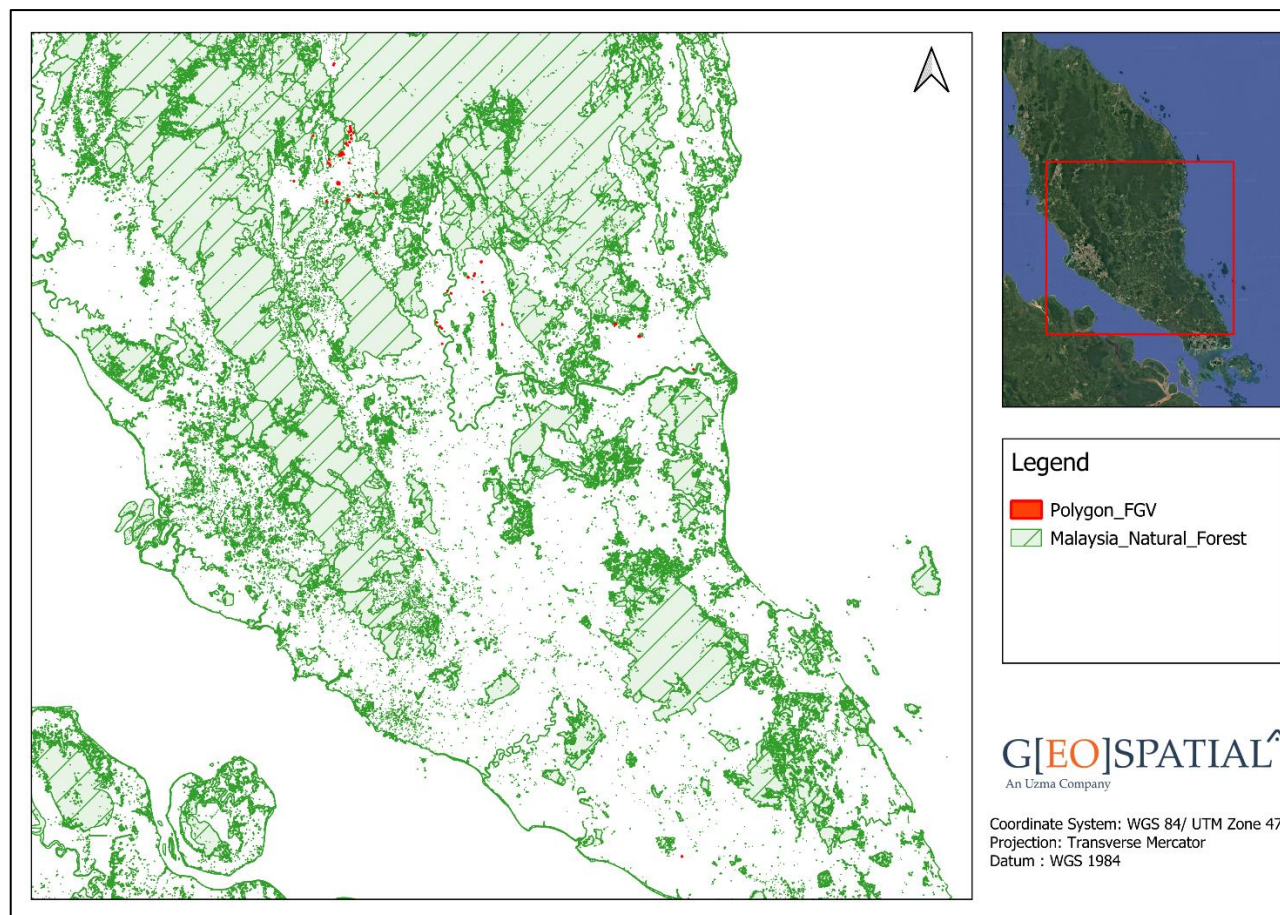| No	Name	Before and Close to 31 Dec 2020 (Cut-off date)	Ater 31 Dec 2020	Remark
		SHAMSUDIN BIN MAT ZAHID SBTN Natural Land 2020		

Figure 3: Overview of Natural Forest Area 2020 and FGV Plots map

6.   CONCLUSION

1. This report is aimed at analysing the land use change and deforestation after cut-off date 31st December 2020 for MSPO.

2. The reviewer has analysed 73 separate landholdings as provided.

3. A total of 24 plots show discrepancies greater than 0.05 hectares between the reported area and the area calculated by the reviewer, which exceeds our normal standard practice.

4. Initial assessment identified that 70 plots were already established with oil palm before the cut-off date of 31 December 2020, while 3 plots required further analysis for potential deforestation.

5. Follow-up verification using high-resolution satellite imagery and the 2020 Malaysia Natural Lands dataset confirmed that none of the plots were located within natural forest areas as of 2020. As a result, no deforestation was found to have occurred after the cut-off date of 31 December 2020.

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Table 2: List of Plots

	Name Of Farmer	License No	Total Area Reported (ha)	Total Area Calculated by Reviewer (ha)	Remarks
1	Mamat B Musa	758539001022	3.26	2.05	Discrepancies in area reported by smallholder and calculated by reviewer
2	Jusoh Bin Dagang	751119001010	4.51	0.18	Discrepancies in area reported by smallholder and calculated by reviewer
3	Uitm Cawangan Pahang	429595001000	21.55	0.12	Discrepancies in area reported by smallholder and calculated by reviewer
4	Jusoh B Dagang	751119001010	1.21	3.79	Discrepancies in area reported by smallholder and calculated by reviewer
5	Ahmad Nazlan Bin Idris	468302001022	1.23	0.06	Discrepancies in area reported by smallholder and calculated by reviewer
6	Mohamed B Abdullah	816219001022	8.46	1.31	Discrepancies in area reported by smallholder and calculated by reviewer
7	Mohamad Hishamuddin Bin Mohd Nasir	418594101000	0.81	5.52	Discrepancies in area reported by smallholder and calculated by reviewer
8	Jalaludin Bin Lat	203878101000	2.92	2.95	
9	Musthapa Bin Aman	771301001022	1.29	1.30	
10	Mahendran A/L Sri Ramolo @ Jaganathan	822593001022	1.86	1.88	
11	Perniagaan Haw & Anak Anak	819255001022	0.49	0.49	
12	Nor Fadilah Binti Abdullah	853812001010	0.93	0.94	
13	Jusoh B Dagang	751119001010	1.07	1.08	
14	Abd Jabal Bin Ibrahim	753040001022	2.01	2.02	
15	Ali Hanapiah B Abd Rahman	749375001022	1.48	1.50	
16	Mat Lisa Bin Mat Lia	757299001022	2.15	2.17	
17	Yusof Bin Hashim	749353001022	0.46	0.47	
18	Wan Ruslan Bin Wan Yaakob	747283001022	2.04	2.06	
19	Mohd Yunos Bin Abidin	747291001010	1.72	0.12	Discrepancies in area reported by smallholder and calculated by reviewer
20	Suhaimi Bin Abd Rahman	753309001010	1.31	1.32	
21	Perniagaan Haw & Anak Anak	819255001022	2.45	2.47	
22	Jusoh B Dagang	751119001010	1.30	1.31	
23	Jusoh B Dagang	751119001010	1.00	1.01	
24	Jusoh B Dagang	751119001010	2.61	2.63	
25	Sky Enterprise Sdn Bhd	203809801000	22.92	23.13	Discrepancies in area reported by smallholder and calculated by reviewer
26	Ong Whee Sen	592658301000	3.39	8.57	Discrepancies in area reported by smallholder and calculated by reviewer
27	Ong Whee Tiong	592658301000	3.39	8.57	Discrepancies in area reported by smallholder and calculated by reviewer

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	Name Of Farmer	License No	Total Area Reported (ha)	Total Area Calculated by Reviewer (ha)	Remarks
28	Perniagaan Haw & Anak Anak	819255001022	2.50	2.53	
29	Othman B Jusoh	201248001000	1.99	2.01	
30	Tan Kian Siong	751960001022	2.78	2.80	
31	Tan Hap @ Tan Hup	832826001010	8.88	3.63	Discrepancies in area reported by smallholder and calculated by reviewer
32	Tan Soon @ Tan Yu	832826001010	9.75	3.96	Discrepancies in area reported by smallholder and calculated by reviewer
33	Thanapalan A/L Rangasamy	748569001022	8.50	8.58	Discrepancies in area reported by smallholder and calculated by reviewer
34	Ong Lay Leong	592658301000	1.64	8.26	Discrepancies in area reported by smallholder and calculated by reviewer
35	Sky Enterprise Sdn Bhd	203809801000	4.78	4.82	
36	Dato Hj. Mohd Kamari Bin Hj. Alias	778703001022	2.58	2.61	
37	Ahmad Sani B Abd Rahman	749394001022	0.98	0.99	
38	Lokman Hakim Bin Arifin	804726001022	1.91	1.93	
39	Md Piah Bin Udin	749351001022	0.96	0.97	
40	Sky Enterprise Sdn Bhd	203809801000	1.09	1.09	
41	Sky Enterprise Sdn Bhd	203809801000	1.80	1.80	
42	Md Piah Bin Udin	749351001022	1.32	1.33	
43	Yusof Bin Hashim	749353001022	2.23	1.26	Discrepancies in area reported by smallholder and calculated by reviewer
44	Yusof Bin Hashim	749353001022	0.64	0.65	
45	Sky Enterprise Sdn Bhd	203809801000	6.07	6.13	Discrepancies in area reported by smallholder and calculated by reviewer
46	Than Hai @ Tan Huat	832826001010	9.31	3.82	Discrepancies in area reported by smallholder and calculated by reviewer
47	Dato Hj. Mohd Kamari Bin Hj. Alias	778703001022	1.64	1.66	
48	Dato Hj. Mohd Kamari Bin Hj. Alias	778703001022	1.68	1.70	
49	Tan Eh Tat	810393001022	3.06	3.08	
50	Shamsudin Bin Mat Zahid	748548001022	0.81	0.82	
51	Shamsudin Bin Mat Zahid	748548001022	0.46	0.26	Discrepancies in area reported by smallholder and calculated by reviewer
52	Mat Noh Bin Yaakob	749377001022	3.29	3.32	
53	Mat Noh Bin Yaakob	749377001022	2.50	2.52	
54	Perniagaan Haw & Anak Anak	819255001022	2.34	2.37	
55	Ong Lay Leong	592658301000	1.70	8.57	Discrepancies in area reported by smallholder and calculated by reviewer
56	Ali Hanapiah B Abd Rahman	749375001022	1.45	1.62	Discrepancies in area reported by smallholder and calculated by reviewer
57	Ahmad Sani B Abd Rahman	749394001022	1.90	1.90	
58	Ong Whee Sen	592658301000	3.27	8.26	Discrepancies in area reported by smallholder and calculated by reviewer

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	Name Of Farmer	License No	Total Area Reported (ha)	Total Area Calculated by Reviewer (ha)	Remarks
59	Ong Whee Tiong	592658301000	3.27	8.26	Discrepancies in area reported by smallholder and calculated by reviewer
60	Shamsudin Bin Mat Zahid	748548001022	1.05	1.06	
61	Md Piah Bin Udin	749351001022	1.28	1.30	
62	Borhan Bin Mostapar	428811201000	2.25	2.27	
63	Ahmad Sani B Abd Rahman	749394001022	0.53	0.53	
64	Dato Hj. Mohd Kamari Bin Hj. Alias	778703001022	1.62	1.64	
65	Shamsudin Bin Mat Zahid	748548001022	1.39	1.40	
66	Dato Hj. Mohd Kamari Bin Hj. Alias	778703001022	1.66	1.68	
67	Dato Hj. Mohd Kamari Bin Hj. Alias	778703001022	1.62	1.66	
68	Lee Kian Heng	535225101000	18.70	18.17	Discrepancies in area reported by smallholder and calculated by reviewer
69	Perniagaan Haw & Anak Anak	819255001022	0.09	0.09	
70	Azman Bin Dollah	562820501000	2.44	2.46	
71	Hamizaki Bin Abdul Halim	525403801000	1.31	1.32	
72	Rozita Binti Suriff	363747001008	3.24	3.27	
73	Karip Bin Mohd Salleh	885717001005	0.81	0.82	

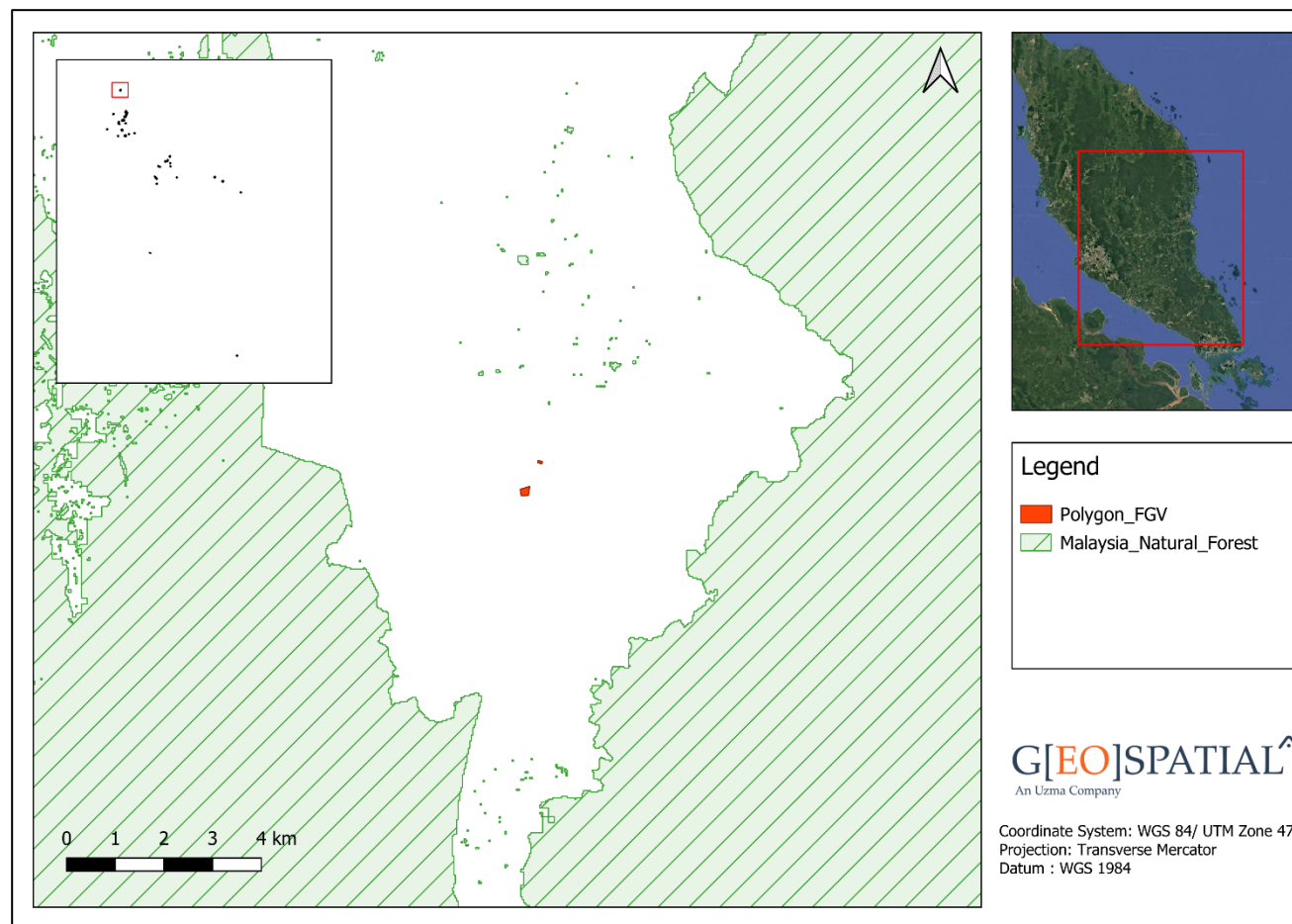I. **FOREST AREA 2020 MAP (A)**

Figure 4: Forest Area 2020 and FGV Plots map (A)

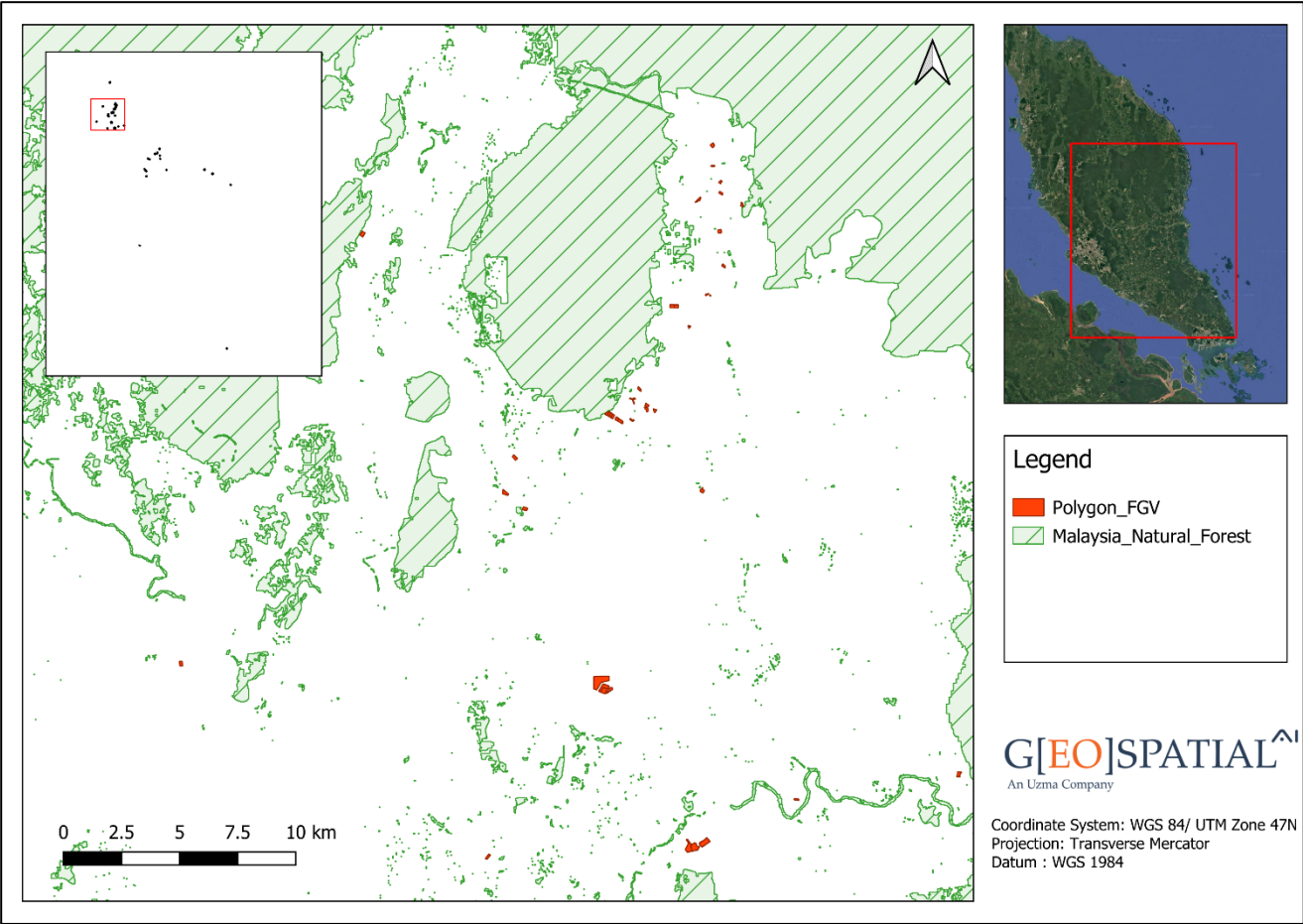II.   FOREST AREA 2020 MAP (B)

Figure 5: Forest Area 2020 and FGV Plots map (B)

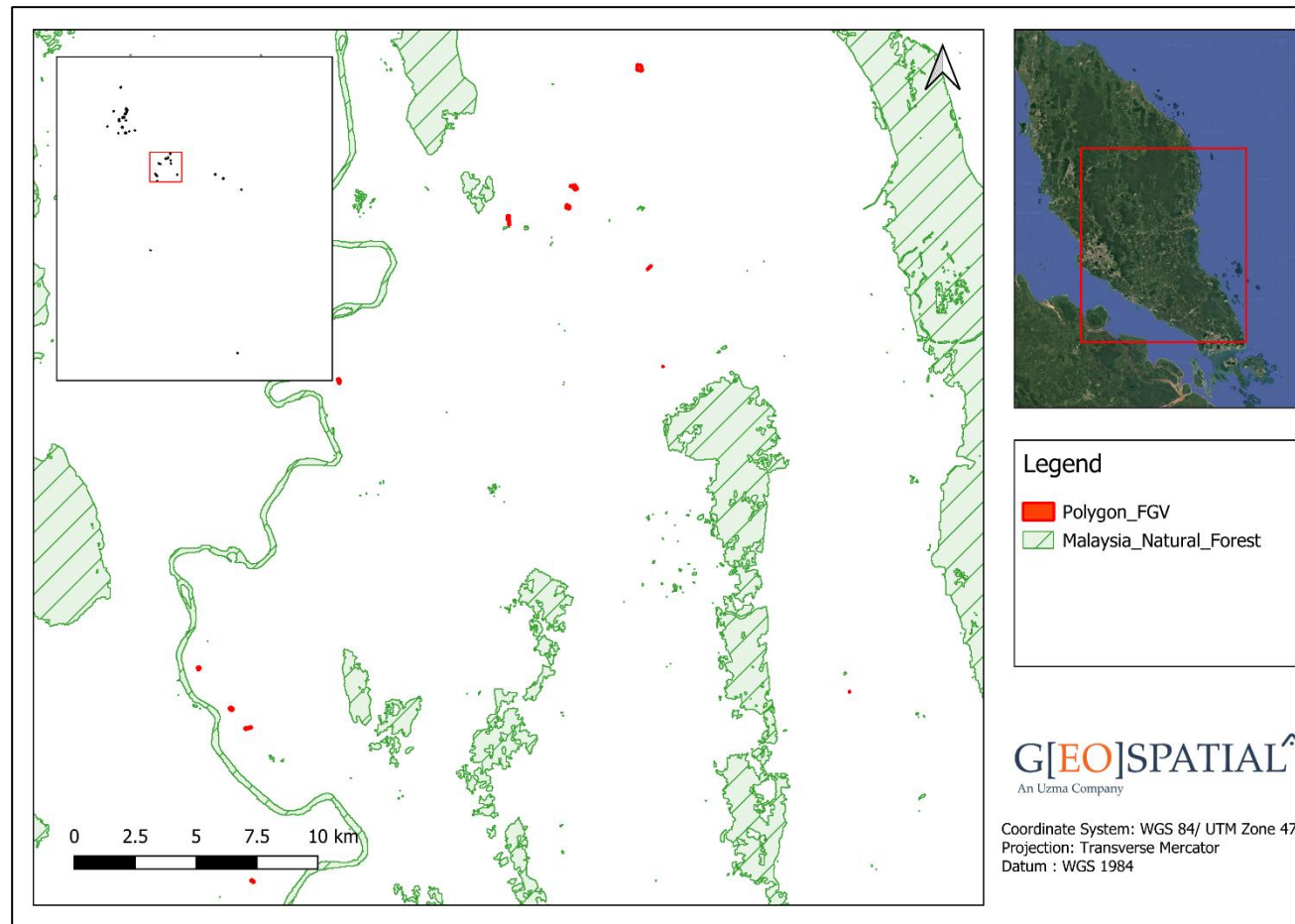### III.   FOREST AREA 2020 MAP (C)

Figure 6: Forest Area 2020 and FGV Plots map (C)
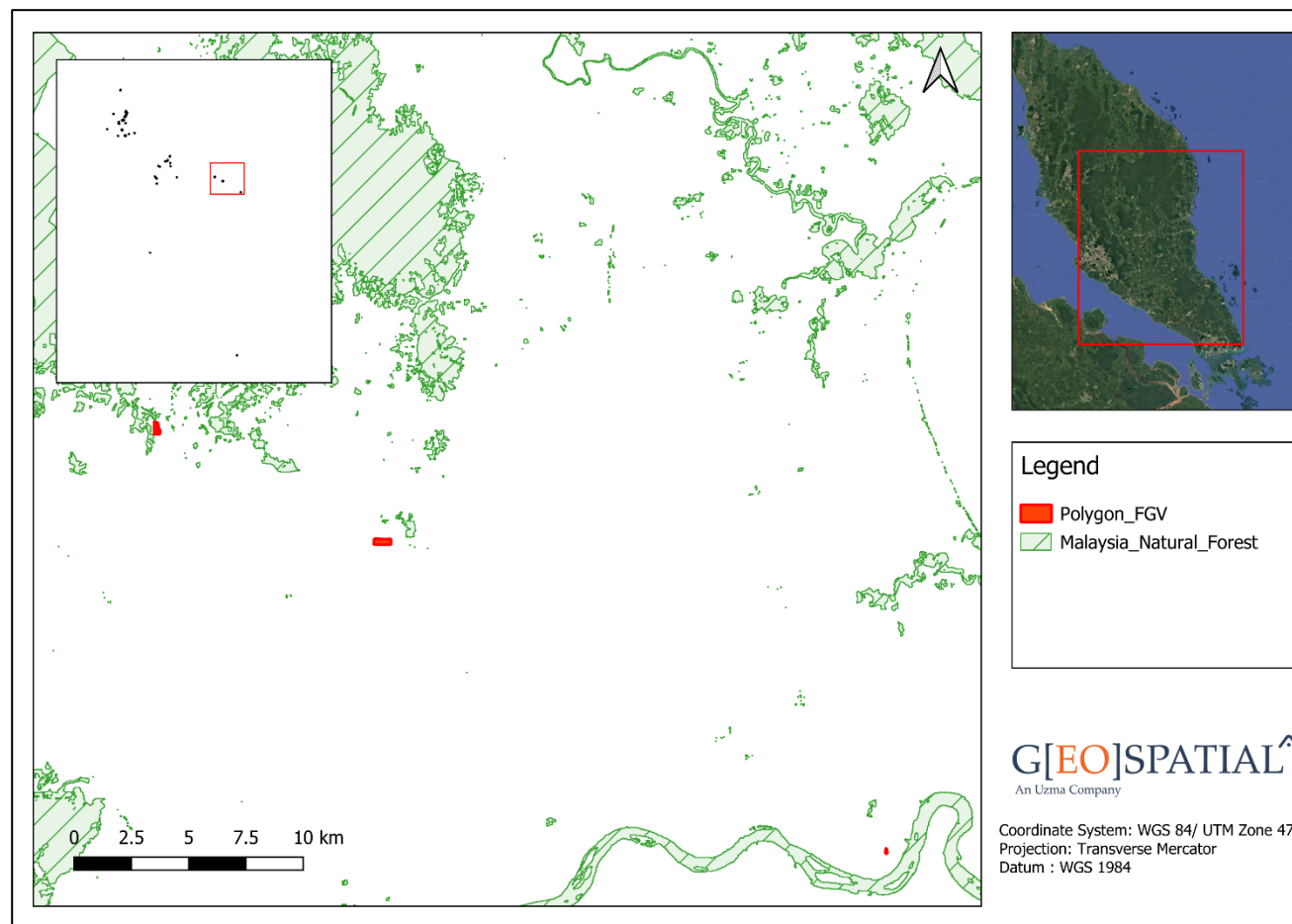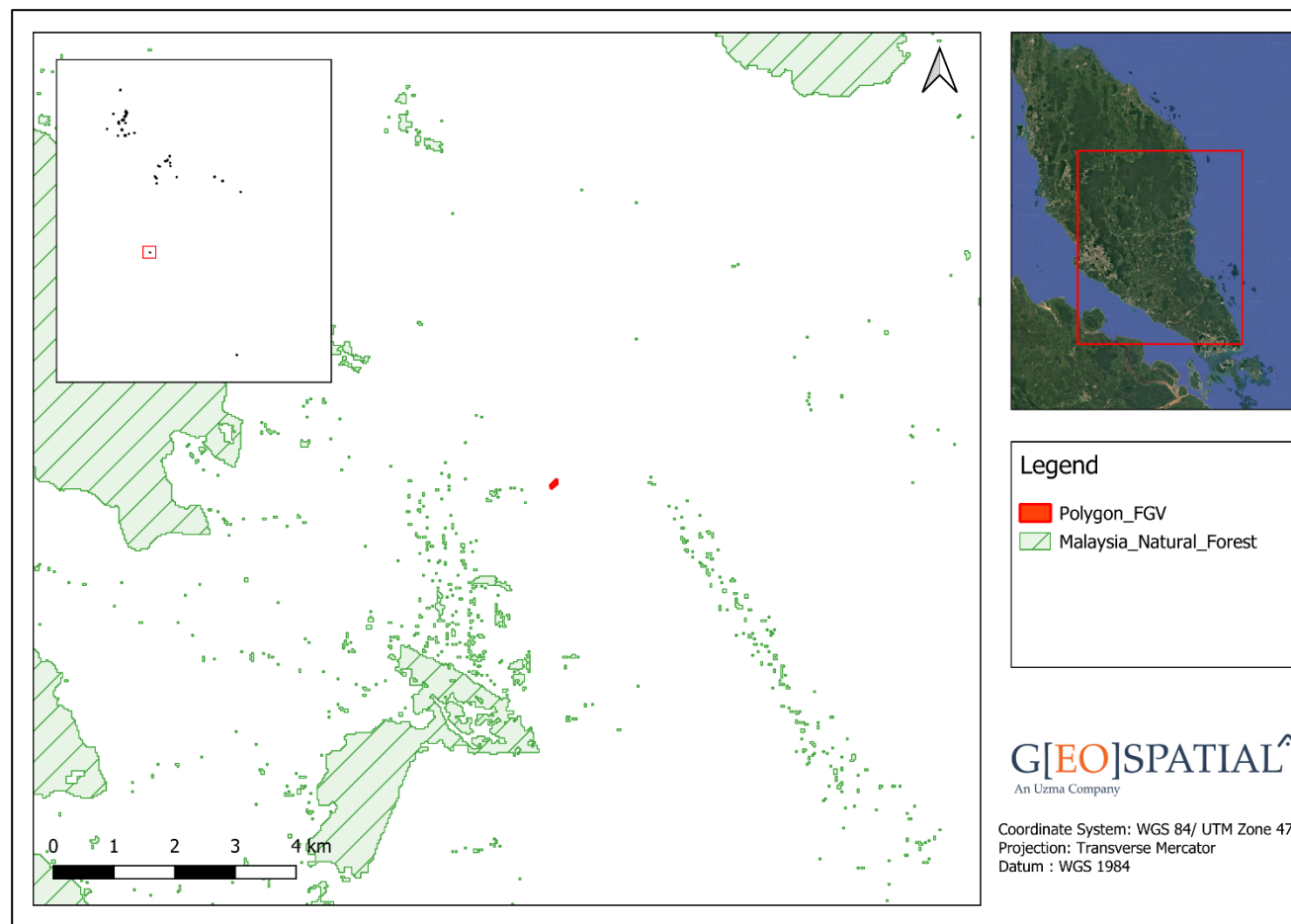
I. FOREST AREA 2020 MAP (D)

Figure 7: Forest Area 2020 and FGV Plots map (ADD)

I. FOREST AREA 2020 MAP (E)

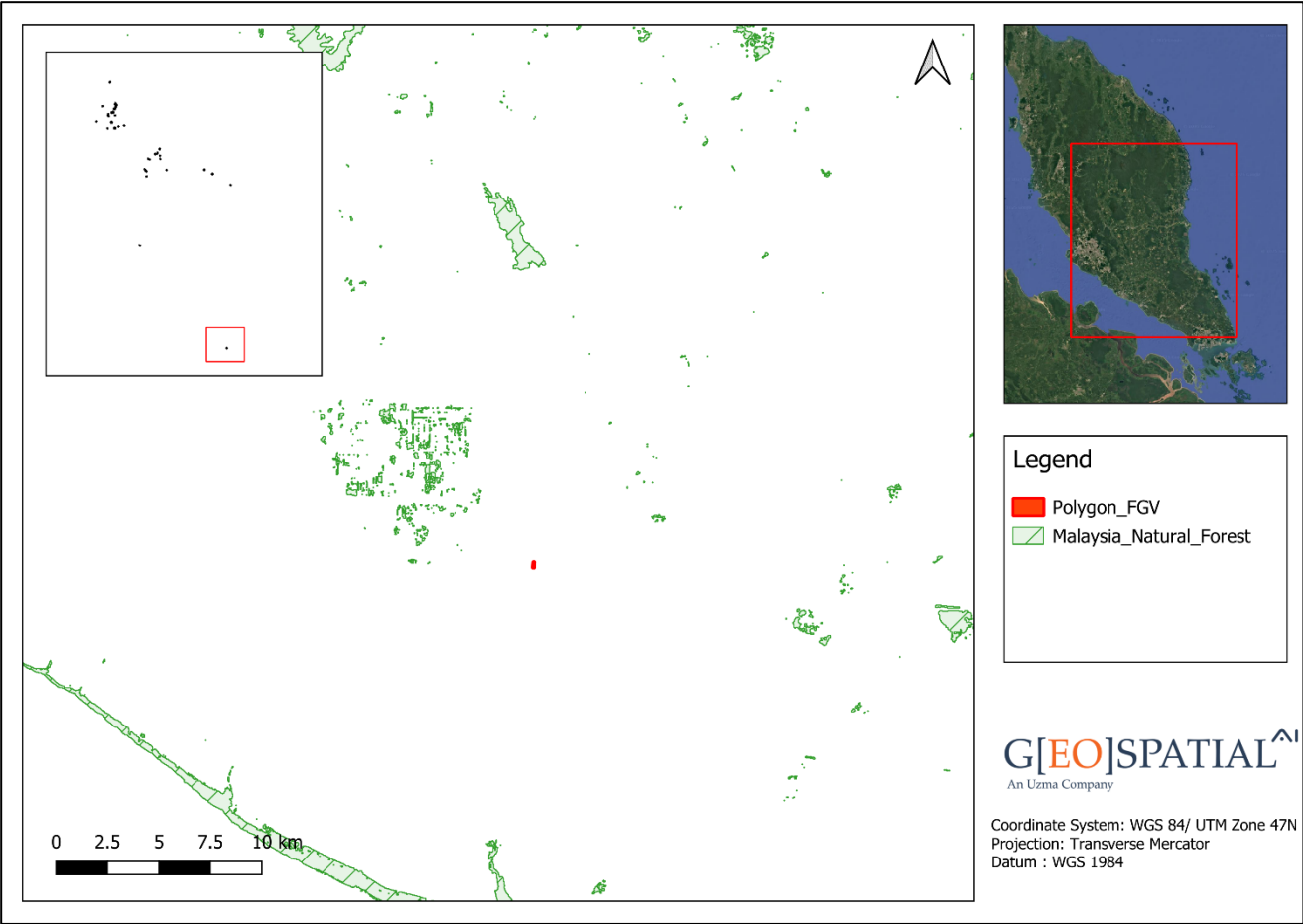**Figure 8: Forest Area 2020 and FGV Plots map (E)**

II.   FOREST AREA 2020 MAP (F)

Figure 9: Forest Area 2020 and FGV Plots map (F)