State of Nature Conservation in Malaysia 2025, 679–685
doi: 10.62613/sonc2025.v3anc01

CHAPTER 1

State of the Malaysian rainforest 2025: Conversion outlook and emerging trends

ADAM FARHAN

Abstract: While Malaysia has committed to maintain at least 50% of its forest cover, there remains opacity regarding the actual extent of forests earmarked for conversion. This chapter, which focuses on predicting forest conversion ex-ante, refines and updates the findings of RimbaWatch's *State of Malaysian Rainforest* 2023 and 2024 studies, accounting for the most recently-available spatial forest cover dataset from the Joint Research Centre Tropical Moist Forest hub—an updated concession dataset accounting for recently-document threats, and re-calculation of threatened forests within concessions reflecting the updated forest cover dataset. Adopting FAO's definition of Naturally Regenerating Forest, the findings of this study estimates that about 3.65 million ha of undisturbed and degraded forest remain within known concession and are potentially at risk of conversion. Industrial timber plantation accounts for 2.59 million ha or 78% of all identified forest threats. The study further estimates that this forest conversion could release approximately 519.7 million MgC of carbon.

INTRODUCTION

At the Rio Earth Summit in 1992, Malaysia pledged to ensure that at least 50% of its land area would remain under forest cover. In the ensuing years, the Government and its representatives have made multiple verbal and written commitments reiterating this target, which has been enshrined in a number of policy and planning frameworks. This includes the 12th Malaysia Plan, the 4th National Physical Plan, and the 2021 Malaysia Forestry Policy (Endot *et al.* 2024).

While the Government of Malaysia publishes statistics on the remaining extent of forest cover, which in 2024 was 54.58%, these figures are not reinforced by publicly available geospatial data, or maps in general, illustrating which areas are counted as forest cover (Bernama 2024). Furthermore, while existing forest cover is reported, there is no transparent reporting on the extent of forest cover that has been earmarked, gazetted, or approved for conversion, which would impact the Government's alignment to the target. Interpretation of this target is further muddied by the absence of explicit guidance on which definition of forest applies to the 50% commitment, creating uncertainty on whether industrial plantations, cleared land and other land uses are counted.

The Government of Malaysia's performance on maintaining this target had not been independently verified until RimbaWatch published the *State of the Malaysian Rainforest 2023* study, which found that forest cover in Malaysia was estimated to decrease to 47% in the future. A second installment in the series, the *State of the Malaysian Rainforest 2024* study, adopted more accurate georeferencing methodologies, updated the extent of concessions to reflect state-published data and referred to three spatial forest cover baselines. The 2024 study found the extent of forests earmarked for conversion would cause Malaysia's forest cover to drop below 50% in the future in all three baselines, with the post-conversion forest cover ranging between 40% – 49% depending on the spatial dataset.

RimbaWatch, 35-10 Boulevard, Mid Valley City, 59200 Kuala Lumpur, Malaysia.
***Corresponding author: adam@rimbawatch.com**

The purpose of this chapter, which focuses on predicting conversion *ex-ante*, is to refine and update the findings of the *State of the Malaysian Rainforest 2024* study, taking into account:

- Most recently-available spatial forest cover datasets (Vancutsem *et al.* 2024);
- Addition of updated concession dataset, accounting for recently-documented threats;
- Re-calculation of threatened forests within concessions reflecting Vancutsem *et al.* (2024).

METHODOLOGY

This chapter is based on the following assumptions and definitions:

1. This chapter defines '**forests**' by adopting the FAO's FRA 2025 'Naturally Regenerating Forest' definition: "***Forest predominantly composed of trees established through natural regeneration***", including "i) forests for which it is not possible to distinguish whether planted or naturally regenerated; ii) forests with a mix of naturally regenerated tree species and planted/seeded trees, and where the naturally regenerated trees are expected to constitute the major part of the growing stock at stand maturity; iii) Includes coppice from trees originally established through natural regeneration and iv) Includes naturally regenerated trees of introduced species."
2. This chapter adopts the Vancutsem *et al*. (2024) forest cover dataset from the EU's Tropical Moist Forest (TMF) cover tool, developed to support the implementation of the EU Deforestation Regulation (EUDR). Sub-forest cover classifications, such as the extent of undisturbed, degraded and non-forest areas, are adopted from this dataset. The dataset, which identifies and classifies tree cover outside of non-natural forest uses, is adopted as it reflects 'Naturally Regenerating Forest' criteria (EU Science Hub 2025).
3. All areas within concession boundaries which meet the Vancutsem *et al.* (2024) criteria for undisturbed and degraded forest are assumed to be under threat from conversion, as data on areas set aside for conservation, and other non-conversion uses are not known.
4. Concessions are defined as "any areas which have been earmarked for conversion to non-forest uses, as demonstrated by spatially defined plans as published in state Forest Management plans, approved Environmental Impact Assessments (EIAs), and others".
5. It must be noted that due to continued limitations in data availability, the findings of this report must be taken as estimates produced within the confines of the methodology adopted.

The calculation methodologies from the *State of the Malaysian Rainforest 2024* report were adopted for this chapter. Where possible, concession boundaries were imported directly from existing datasets. If unavailable, maps were digitised to convert them from 2D images into shapefiles. To digitise maps of concessions, the maps were georeferenced on Google Earth Pro while referencing forest reserve boundaries, geographical features (i.e., rivers), or other other features (i.e., boundaries of monoculture plantations). Once digitised, concessions were then traced at less than a 100 km resolution for maps at State level, 50 km resolution for district level, and 20 km for individual concessions. The maps were traced following the outer boundary of the concession, as a .1 point line. It must be noted that the accuracy of concession boundaries are dependent on the resolution of the image used, and the data presented here is an estimate only.

The calculations for this chapter were conducted on ArcGIS Pro 2.9. This methodology may be applicable with other Geographic Information Systems (GIS) such as QGIS, however the details below are based solely on calculations performed with ArcGIS Pro.

Upon downloading the relevant data, the "Extract by Mask" raster tool and "Mosaic to New Raster" tool were applied to isolate and merge the data within Malaysia's administrative boundaries. This process generated a comprehensive layer representing the state of forests

within Malaysian territory, categorised as "Undisturbed", "Degraded", and "Other" (Vancutsem *et al.* 2024). To integrate the concession boundaries data obtained from RimbaWatch into the analysis, the Keyhole Markup Language (KML) format of the concession boundaries (see Appendix II) was converted into a layer file using the tool available in ArcGIS Pro. Further, classification of the polygons and lines in the concession dataset was conducted based on their respective attributes, such as timber plantations, palm oil areas, and settlements, utilising the reclassify tool. This step enabled the differentiation of different types of concessions within the dataset. Subsequently, the forest classification layer was overlaid onto the RimbaWatch dataset using the "Extract by Mask" tool. In this operation, the forest classification data served as the input data, and the RimbaWatch dataset functioned as the boundary, yielding forest classification information within the defined concession boundaries. The attribute tables from the new layers provide data for the number of cells for each type of forest cover.

The layer properties of the raster data, available for each layer, provide the necessary information for this calculation. Specifically, the Raster Spatial Reference and Extent provided the necessary values for cell length (x) and cell width, which were instrumental in calculating the size of each cell. The cell length was squared to determine the cell size in square meters (m^2), and this value was then converted to hectares (ha) by dividing it by 10,000. The formula for calculating the cell size (ha) is as follows:

$$\text{Cell size (ha)} = \frac{x^2}{10{,}000}$$

After obtaining the cell size, the attribute table of each layer was processed to extract pertinent information related to relevant values and the corresponding number of pixels for each row. The total area for each row in the attribute table was then determined by multiplying the number of cells by the previously calculated hectare value:

$$\text{Total area (ha)} = \text{Number of cells} \times \text{Cell size (ha)}$$

Finally, the total value in a given area is determined by multiplying the total area (ha) by the corresponding value specific to that region.

Considerations for the interpretation of data

The data presented in the following section must be interpreted with the following considerations in mind:

1. The concession data collected cannot be guaranteed to contain comprehensive coverage of all forest-risk activities, due to limited transparency of environmental and spatial data by the Department of Environment, State Forestry Departments, and other relevant agencies.
2. Due to this opacity, there is limited access to planting or forest management plans, and the data presented here is agnostic as to concession-level conservation exclusion zones.
3. The quality of georeferencing depends on the quality and granularity of original source maps, therefore some concession boundaries are indicative.
4. The Vancutsem *et al.* (2024) dataset is adopted due to its policy relevance; being used as a base layer for the Tropical Moist Forest Tool (TMF) developed by the EU Joint Research Centre (JRC) with the intention to support EUDR implementation (CIRAD, 2024). However, there is academic debate over its accuracy in classifying, for example, abandoned rubber plantations as natural forest cover, leading to either inflated or under-estimates of natural forest cover (Sheil *et al.* 2025).

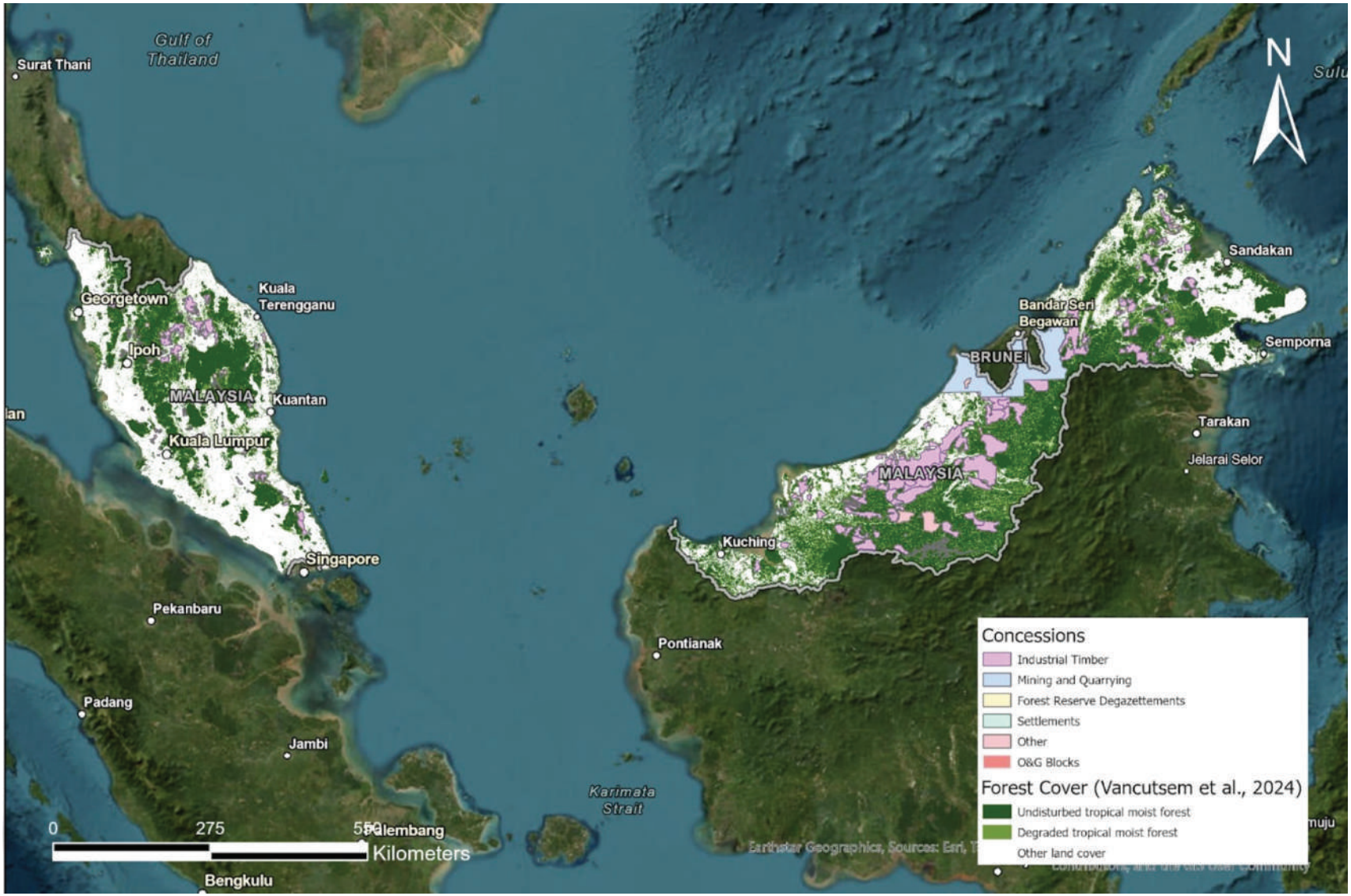

Figure I. Overview of concessions analysed in this chapter

RESULTS

The Vancutsem *et al*. (2024) dataset identifies 2,206,046 ha of remaining undisturbed forest and 1,444,752 ha of degraded forest within concessions, resulting in a combined 3,650,798 ha of forests earmarked for conversion in known concessions (Figure 1). There is a combined 2,588,964 ha of forests earmarked for conversion in industrial timber plantation (ITP) concessions. Within these concessions, 1,499,039 ha of threatened forests are classified as undisturbed, while 1,089,925 ha are classified as degraded. Therefore, 58% of remaining forests in known ITP concessions are undisturbed forests. ITPs consist of 78% of all threats to forests. The breakdown of forest areas for other economic activities is outlined in Table 1. The predicted forest conversion by State is presented in Table 2.

Table 1. Area of forest under threat based on economic activities.

Activity	Forest under threat (ha)
Industrial Timber Plantations	2,588,964
Oil Palm	28,644
Mining and Quarrying	14,731
Settlements (incl. Hydropower and other reservoirs)	181,415
Forest Reserve Degazettements	2,580
Other (incl. Verified real estate listings)	72,390

Table 2. Predicted forest conversion by State.

State	Forest under threat (ha)
Johor	28,644
Kedah	14,731
Kelantan	181,415
Negeri Sembilan	2,580
Pahang	72,390
Perak	33,393
Sabah	405,178
Sarawak	2,803,425
Selangor	6,935
Terengganu	17,126

Assuming that 100% aboveground biomass and 21.3% of soil carbon is vulnerable to release during conversion events (Noon *et al*. 2022), 519,691,344 Mg C is expected to be released from the conversion of known concessions, which is roughly equal to the annual emissions of Pakistan at current levels (EDGAR 2025). Proposals for the commercialisation of onshore oil and gas (O&G) resources have been revived in recent years. The two onshore O&G blocks with active exploration activities in Sarawak overlap with 765,016 ha of forests, posing significant emerging risks to communities and ecological integrity forests through conversion, soil, water and air pollution. However, this figure is not included in the final figure for threatened forest due to insufficient information on the extent of planned conversion within these O&G blocks.

DISCUSSION

These findings reflect those of the two previous *State of the Malaysian Rainforest* studies in 2023 and 2024, which is that ITPs will be the top future driver of forest conversion in Malaysia. The official position of the Peninsular Malaysia (FPD 2022), Sarawak (FDS 2022), and Sabah (Anjumin 2022) authorities are that ITPs, which are referred to officially as "*ladang hutan*", or other variations of the term, seems to be a method of rehabilitating degraded forests which reduces pressure on natural forests (Anjumin 2022). For example,

the Forest Plantation Development claims, "*The Programme supports rehabilitation of degraded forests, encroached forests, unproductive state lands, and poorly stocked forest areas*" (FPD 2022).

The findings above demonstrate that nearly 1.5 million ha of industrial plantation concessions are located in forests classified as undisturbed, which contradicts this official rationale. Further, ITPs are the primary threat to the conversion of natural forest, rather than a method of reducing pressure on them.

While the National Land Council placed a moratorium on new '*ladang hutan*' development in 2021, this moratorium: 1) only applies to new ITP zoning, and therefore has no impact on land already zoned, namely the 2.58 million hectares identified in this study; and 2) only applies to Peninsular Malaysia and does not cover Sabah and Sarawak, where the majority of the 2.58 million hectares are located.

Beyond ITPs, this data illustrates that threats to forests are varied and overlap. For example, there is 526,249.7 ha of overlap between ITPs and oil palm in Sarawak, which can be attributed to the fact that the Sarawak Forestry Department permits the planting of up to 20% of the timber plantation concessions with oil palm for one cycle. Further, oil palm concessions overlap with other emerging threats, such as coal, oil and gas production, and proposed settlements. Further, the extent that these overlapping contestations degrade habitat connectivity remains understudied and omitted from land planning decisions. While it is possible, for example, to model Tiger Habitat Quality using Sentinel-2 imagery and the InVEST model (Louis *et al.* 2023), there is a need to study how different concession types impact the distribution of a wider range of indicator species, and for this data to be incorporated into forest zoning and decision-making.

WAY FORWARD

These findings illustrate the urgent need to improve Malaysian forest governance, and underlying legislation and political attitudes towards the rainforest, the species which call it home, and their stewards.

1. An immediate moratorium on all forest degradation and conversion in ITP concessions across Malaysia.
2. Malaysia must adjust all forestry targets to reflect the definition of 'Naturally Regenerating Forest' from the FAO (FRA 2025).
3. In both policy documents and upcoming environmental legislation (i.e., the Climate Change Act), Malaysia must legislate the target to maintain natural forest cover above a certain minimum percentage of land cover, which should be set at Malaysia's current and existing natural forest cover.
4. All relevant development and planning frameworks, from State Structure Plans to the Environmental Quality Act 1974, should be amended to reflect the target in point 2 above.
5. The relevant agencies should spearhead constitutional amendments to reflect the right of Malaysians to a clean environment, and of its Indigenous communities to legal ownership of their Traditional Territories.

REFERENCES

Anjumin, E. 2022, July 7. Tree plantations way forward in forestry. *New Straits Times*. https://www.nst.com.my/news/nation/2022/07/811532/tree-plantations-way-forward-forestry

Bernama. 2024, May 11. Malaysia Reiterates Commitment to Maintain 50 pct Forest Cover. *Bernama*. https://bernama.com/en/news.php?id=2296618

CIRAD. 2024. A map of the world's forest to support the EU Regulation on deforestation-free supply chains. https://www.cirad.fr/en/cirad-news/news/2024/deforestation-reference-map-for-the-european-union

EDGAR - Emissions Database for Global Atmospheric Research. 2025. GHG emissions of all world countries. https://edgar.jrc.ec.europa.eu/report_2025

Endot, M.R., Nor, N.L., Rahim, M.K.A. 2024. Restoration, reclamation and rehabilitation of degraded forest areas in Peninsular Malaysia: Issues, challenges and way forward. *20th Malaysian Forestry Conference 2024* (MFC-20), 28th - 30th October 2024, Sabah International Convention Centre (SICC), Kota Kinabalu. Kota Kinabalu: Sabah Forestry Department.

EU Science Hub. 2025. Tropical Moist Forests product - Resources. https://forobs.jrc.ec.europa.eu/TMF

FAO. 2025. *Global Forest Resources Assessment - FRA 2025 - Terms and Definition*. Rome: Food and Agriculture Organization of the United Nations. https://openknowledge.fao.org/server/api/core/bitstreams/a6e225da-4a31-4e06-818d-ca3aeadfd635/content

Forest Plantation Development. 2022. Background/History. https://www.fpd.com.my/backgroundhistory

Forest Department Sarawak. 2022. Issues and Challenges https://forestry.sarawak.gov.my/page-0-245-1010-tid.html

JRC-TMF. 2024. Tropical Moist Forests product - Data Access. https://forobs.jrc.ec.europa.eu/TMF/data

Noon, M.L., Goldstein, A., Ledezma, J.C., Roehrdanz, P.R., Cook-Patton, S.C., Spawn-Lee. S.A., Wright, T.M. *et al.* 2021. Mapping the irrecoverable carbon in Earth's ecosystems. *Nature Sustainability* 5: 37–46.

RimbaWatch. 2023. State of the Malaysian Rainforest 2023. https://borneoproject.org/state-of-the-malaysian-rainforest-report/

RimbaWatch. 2024. State of the Malaysian Rainforest 2024. https://9b2d2d75-7adf-4ea5-8c47-1b96d3a7eaf6.filesusr.com/ugd/a4715a_ad144495d1fa46bf857166bda8e2e8a9.pdf

Sheil, D., Descals, A., Meijaard, E. and Gaveau, D. 2025. Rubber planting and deforestation. *Nature* 644: E20–E22.

APPENDIX

The list of concession datasets adopted for this chapter can be viewed and downloaded in the link below:

https://docs.google.com/spreadsheets/d/1OAjUDPJEshyzJ5P5QmIZ27i-lFILYp2Rg9qGJUj7-Wo/

The list of non-concession datasets adopted can be viewed and downloaded in the link below:

https://docs.google.com/spreadsheets/d/1AY-o1lka-2shgTwqszr2C6xH4ikRuIBjuDnYlD5bn9M/

This excludes linear infrastructure and environmental impact assessments (EIAs) for projects not approved by the Department of Environment as of 1 August 2025.