Japan Fund for Prosperous and Resilient Asia and the Pacific (JFPR)

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Development of New Statistical Resources and Building Capacity

in New Data Sources and Technologies.

Documentation for Physical Timber Asset Accounts for Thailand for the Accounting period 2015-2019

Contents

Introduction

This documentation report outlines the data sources and methodologies used to compile the Kingdom of Thailand's Physical Asset Accounts for Timber Resources consistent with the System of Environmental Economic Accounting (SEEA) framework.

The SEEA framework[1] integrates economic and environmental data and provides a comprehensive view of the relationships between the economy and the environment. It provides a methodology to analyse the flows, stocks and changes in flows and stocks of environmental assets, and their value. The SEEA framework follows a similar accounting structure as the System of National Accounts (SNA). The framework uses concepts, definitions and classifications consistent with the SNA to facilitate the integration of environmental and economic statistics.

This account was undertaken as part of the Asian Development Bank-Japan Fund for Poverty Reduction (JFPR) TA 6856 project, titled "Development of New Statistical Resources and Building Capacity in New Data Sources and Technologies," which aims to support ADB Developing Member Countries (DMCs), including Thailand, in compiling environmental satellite accounts, which have been identified as a priority and a starting point for future initiatives in developing ecosystem accounts.

Covering the accounting period of 2015–2019, this document provides detailed insights into the data sources, methodologies, assumptions and challenges encountered during the and recommendations for future improvements.

Environmental Asset Accounting

The System of Environmental Economic Accounting (SEEA) defines environmental assets as the naturally occurring living and non-living components of the Earth that together make up its bio-physical environment. These assets provide benefits to humanity, either directly or indirectly. Examples of environmental assets include forests, water bodies, minerals, soil, and biodiversity. The SEEA provides comprehensive guidance on the measurement and accounting of these essential resources.

Environmental asset accounting is a method used to systematically measure and report the value of natural resources and ecosystems in both physical and monetary terms. According to the SEEA, the core principle behind asset accounting is to estimate and record the opening and closing stock of assets over an accounting period, along with the types of changes in those stocks. This approach captures patterns of change, rates of depletion, shifts in management or legal frameworks, and changes in asset value.

The SEEA Central Framework (CF) provides guidelines for understanding the intricate relationship between the environment and the economy. By following the principles outlined in the SEEA CF, compilers ensure that environmental accounting aligns with the System of National Accounts (SNA) framework, ensuring consistency and coherence across economic and environmental data.

[1] United Nations. *System of Environmental-Economic Accounting 2012: Central Framework*. 2014.

The relationship between economic and environmental assets is measured in three specified areas:

1) **Physical flow accounts** that track flows within the economy and between the economy and the environment.
2) **Stocks and changes in assets** that measure the stock of environmental assets and document any changes over time.
3) **Economic activities and transactions** that record activities and transactions related to the environment, such as environmental protection expenditure or resource extraction.

In Thailand, both land and timber accounts fall under the second category of asset accounting, which encompasses the use of natural and environmental inputs within the Thai economy. Furthermore, the tables generated include changes in the stock of the assets during the identified accounting period.

Physical asset accounts for timber resources in Thailand: Framework and Components

Scope of timber asset accounting

According to the SEEA CF, the scope of environmental asset accounting encompasses all economic activities related to the generation, destruction, harvesting and use of timber. This includes all environmental resources that are either harvested, extracted or utilized during the process of production, consumption and accumulation, forming part of the broader accounting framework.

In terms of economic territory, the scope of measurement is confined to a country's boundary and the resources under its jurisdiction. For timber resources, this would refer to resources within the government's purview such as those found in forest and non-forest areas, cultivated lands, plantations and other land types.

Timber resources are broadly classified into the following categories:

1) Natural timber resources (available and not available for wood supply)
2) Cultivated Timber Resources

Delineating between cultivated and natural timber resources in Thailand

For Thailand, the ADB SEEA team has compiled the physical asset accounts for timber resources, aggregating timber resource data in physical terms at the national level.

Natural timber resources found in natural forests or other naturally regenerating wooded areas, primarily develop through natural processes, such as seed dispersal and growth, without significant human intervention. In Thailand, extraction and use of timber resources found in natural forests is prohibited, as confirmed by Thailand stakeholders

consulted. Since 1989[2], Thailand has prohibited harvesting from natural forests, making national plantations and imported wood the primary sources of timber. Banning of harvesting from natural forests satisfies the condition to be classified as timber resources not available for wood supply. Consequently, all natural timber estimates are included under the "natural timber not available for wood supply" category.

Although natural timber resources not available for wood supply may lack direct economic value, they are still included in the SEEA framework in physical terms. This inclusion aligns with the definition of environmental assets, recognizing their broader ecological and societal benefits. Incorporating these resources also facilitates reconciliation of physical and monetary accounts at a later stage.

During the presentation of the final tables, however, stakeholders clarified that not all timber within natural forests is entirely unavailable for wood supply. For example, in community forests, harvesting may be permitted under specific conditions—such as obtaining authorization from the Royal Forest Department (RFD) and limiting extraction to small-scale, own-use purposes rather than commercial supply. While these exceptions do not alter the national-level prohibition, they highlight the need for careful interpretation of the "not available for wood supply" designation, particularly in contexts where regulated, non-commercial extraction is allowed. Data on the harvest of natural timber in community forests, however, is not available, and the volumes involved are regarded as insignificant relative to total timber supply. This remains an area for future improvement and is discussed further in the recommendations section.

Meanwhile, cultivated timber resources are timber assets actively managed and controlled by people for economic purposes. These include forests, plantations, and other wooded areas specifically maintained for producing timber and related products. In the SEEA framework, cultivated timber is classified as a produced asset due to the human effort and investment involved in its establishment and upkeep. Timber resources found in plantation forests in Thailand are classified under this category.

Accounting period

The accounting period denotes the timeframe during which the stock of assets and any changes are recorded by compilers. The timber accounts follow the same accounting period of land cover accounts which covers the period of 2015 to 2019.

Accounting structure of the physical asset accounts for timber resources

Asset accounts for timber resources compile relevant information, including the quantities of stock and changes over time, such as additions and reductions to the stock. The structure of a physical asset account for timber resources, as defined by the SEEA 2012 Central Framework and adapted to the context of Thailand, is presented in Table 1.

[2] Food and Agriculture Organization of the United Nations (FAO), *Asia-Pacific Forestry Sector Outlook Study: Country Report – Thailand*

Table 1. Physical asset account for timber resources (million cubic metres over bark)

Entries	Year	
	Million cubic meters	
	Natural Timber	**Cultivated Timber**
Opening stock		
Additions to stock		
Natural growth		
Afforestation/Reforestation		
Reclassifications		
Total additions		
Reductions to stock		
Removals		
Felling residues		
Natural Mortality*		
Losses due to forest fire*		
Reclassifications		
Total reductions		
Other changes in stock**		
Closing stock		

**Listed in the basic structure of the physical asset account for timber resources under natural losses but separated as individual entries in the table*

***Not part of the standard structure of the physical asset accounts for timber resources but added to account for changes in stock not captured due to limited data and as a balancing factor based on annual stock information.*

Data Availability and Sources for the Accounting Entries

The main sources of data for the compilation of the timber asset accounting entries primarily include area, volume, and density information from Global Forest Resources Assessment (FRA), relevant forest statistics from the Royal Forest Department (RFD), tree cover loss information from Global Forest Watch, and felling residue information

from secondary literature. Meanwhile, data gaps were present for natural growth and mortality in the absence of forest inventory reports. Data on wood collection activities and reclassifications were also not available.

A comprehensive overview of the data sources used for compiling accounting entries related to natural and cultivated timber in Thailand, expressed in million cubic meters is shown in Table 2.

Table 2 – Summary of data sources for the compilation of the accounting entries

Entries	**Year**	
	Million cubic meters	
	Natural Timber*	**Cultivated Timber**
Opening stock (A)	Global Forest Resources Assessment (FRA), Royal Forest Department	
Additions to stock (B)		
Natural growth	…	…
Afforestation/Reforestation	Royal Forest Department	…
Reclassifications	…	…
Total additions		
Reductions to stock (C)		
Removals		
Permitted Logging	Not applicable	Royal Forest Department
Illegal Logging	Royal Forest Department	…
Wood collection activities	…	…
Felling residues	Literature review	Literature review
Natural Mortality	…	…
Losses due to forest fire	Global forest watch	…
Reclassifications	…	…
Total reductions		
Other changes in stock	Global Forest Resources Assessment (FRA), Royal Forest Department (residual)	
Closing stock		

*not available for wood supply

… data not available

Assumptions and Methodologies for Compiling the Accounting Entries

Opening Stock

The opening stock of timber resources, both for natural and cultivated timber, denotes the volume of timber resources that is recorded at the beginning of each accounting period. This figure corresponds to the closing stock of the preceding year. For instance, the closing stock for 2014 will be the opening stock for 2015, and so on.

Due to the unavailability of direct estimates for the volume of timber in Thailand, our team computed this component using data on forest area and density from the Global Forest Resources Assessment (FRA). The Food and Agriculture Organization's (FAO) Global Forest Resources Assessment (FRA) offers vital insights into the extent, condition, management, and utilization of forest resources.

The FRA obtains natural forest area information from the Royal Forest Department, and a comparison of the data from both sources reveals minimal differences, as seen in Table 3.

Table 3. Comparison of Natural Forest Area Data from RFD and FAO FRA

Year	Royal Forest Department		FAO Forest Resources Assessment
	Forest Area (in Rai)	Forest Area (in 000 has)	Forest Area (in 000 has)
2014	102,285,400.62	16,365.66	16,365.70
2015	102,240,981.88	16,358.56	16,359.00
2016	102,174,805.09	16,347.97	16,348.00
2017	102,156,350.51	16,345.02	16,345.00
2018	102,488,302.19	16,398.13	16,398.00
2019	102,484,072.71	16,397.45	16,397.45

The FRA's data on plantations includes only rubber tree plantations, sourced from the Office of Agricultural Economics. Although the RFD and the Forest Industry Organization (FIO) also provide data on plantations, registration of plantations is not mandatory, making the available data unrepresentative of all plantations in Thailand. Additionally, the FIO data includes area information only from 2020 onward and only covering plantations managed by FIO. Table 4 summarizes the data availability and gaps on plantation forests.

Table 4. Summary of data sources of plantation forest data, their availability and limitations

Source Agency	Data available and period covered	Data limitations
Royal Forest Department	Teak, Rubber, and other plantations from 1992 to present	Registration of plantations is not mandatory, thus data available is not representative of whole Thailand
Forest Industry Organization	Teak, Eucalyptus, and Non-Teak from 2020	No data for the previous years in the accounting period
Forest Resource Assessment	Rubber Plantations from 1990	Limited to rubber plantations

Ideally, cultivated timber resources should include all categories of plantations as found in the countries' geographic terrain. However, due to limited data on other plantations, such as teak and eucalyptus, the ADB team opted to use rubber plantation data from the FRA 2020. This decision was based on the data's consistency and the availability of density information provided by the FRA, which is essential for calculating stock volumes. The stand density, representing the volume of logs with a girth at breast height (gbh) of 15 cm or more (or a diameter at breast height (dbh) of 5 cm or more), used by the FRA for stock calculations is detailed in Table 5.

Table 5. Stand density assumption from FRA 2020

Type of Forest	Volume (m3/ha) (gbh≥15 cm)
Natural forest	94.16
Rubber plantation	100

The density from FRA 2020 was derived from the forest inventory conducted in 2003 – 2008 which is representative of whole country based on the different forest types as shown in Table 6.

Table 6. Forest Density (m3 /ha) based on Forest Inventory data for 2003 - 2008

Type of Forest	Forest Area (ha)	Volume (m3 /ha) (gbh≥15 cm)
Evergreen Forest	4,642,201.10	144.25
Pine Forest	62,057.02	128.11
Mixed Deciduous Forest	7,604,250.37	72.25
Dry Dipterocarp Forest	3,271,046.70	83.26
Other Forest	51,5867.97	27.23
Total	**16,219,357.13**	**94.16**

Other forest density data have also been examined such as information from a REDD+ document of the Department of National Parks, Wildlife, and Plant Conservation (DNP) for 2006, as shown in Table 7.

Table 7. Forest Inventory Data for 2006 based on REDD+ and DNP documentation.

Forest Type	North	North-East	Central	South	East	Total Country
Tropical Evergreen Forest				190.66	118.84	189.55
Dry Evergreen Forest	102.92	129.5	101.3		142.19	116.3
Hill Evergreen Forest	114.07	228.06				120.25
Pine Forest	128.11					128.11
Fresh Water Swamp Forest	4.85			29.87		24.87
Mangrove Forest Plantation			20.67			20.67
Swamp Forest		41.32				41.32
Beach Forest				43.16		43.16
Mixed Deciduous Forest	75	71.19	60.51	38.78	105.73	73.33
Dry Dipterocarp Forest	93.24	73.17	67.13		62.33	86.46
Forest Plantation	51.61	15.5	35.45	80.64	33.6	41.5
Disturbed Forest	22.37	24.28	8.2	24.25	20.86	21.77
Average	83.88	78.21	67.58	171.31	117.66	88.84

The current estimation used the volume information from FRA 2020, but the worksheet also demonstrated the use of the region-specific information from Table 7 for future reference.

Equation (1) below was used to estimate the volume of timber in Thailand at the start of an accounting period, as well as for subsequent volume calculations.

$$Volume\ of\ timber = a \times S.D. \quad (1)$$

Where, a represents the area covered by forest (for estimating natural timber) and rubber plantations (for cultivated timber). The area is expressed in '000 hectares. S.D. denotes the stand density of trees in both the categories. S.D. is measured in cubic meters per hectare. The resulting volume measure is in million cubic meters.

Additions

Under additions, the accounting entries include Natural Growth and Reclassifications. ***Natural growth*** refers to the gross annual increment in timber resources. It denotes the volume of increment of timber over the reference period for all trees with no minimum

diameter[3]. However, it is important to note that Thailand does not collect information on this component and therefore it was not included in the accounting table.

Meanwhile, ***reclassifications*** refer to changes in the area of forest land, other wooded land and other areas of land that lead to increase in the volume of available timber resources. Reclassifications may also occur as a result of changes in management practice that shift timber resources from cultivated to natural or vice versa. ***Afforestation/Reforestation*** falls under this accounting entry.

Afforestation/Reforestation refer to the establishment of forest through planting and/or deliberate seeding on land that, until then, was under a different land use, implies a transformation of land use from non-forest to forest (FRA 2020). In Thailand, data for reforestation is available for both private and government reforestation projects from the RFD, as shown in Table 8. Since there was no information on whether these projects were implemented in either natural or plantation forests, the ADB team categorized them based on their purpose. Projects associated with economic, or livelihood activities were classified under plantation forests.

Table 8. RFD Afforestation/Reforestation Projects and Forest Type Assignments

Afforestation/Reforestation Project	**Forest type assigned to**
Project to promote tree planting for the economy, society and the environment (S.S.I.)	Natural Forest
Project to promote tree planting for the economy, society and environment (SSS.2)	Natural Forest
Activities to promote forestry livelihood	Plantation forest
Project to promote planting of fast-growing trees for alternative energy	Plantation forest
Project to promote the planting of fast-growing trees for industry	Plantation forest
Project to promote tree planting to increase economic forest area (P.E.P.E.)	Plantation forest
Project to promote the planting of economic trees in areas growing rubber trees and agricultural areas.	Plantation forest
Project to support economic tree planting	Plantation forest

[3] United Nations Economic and Social Commission for Asia and the Pacific (UNESCAP). Asset Accounts for Timber. https://unescap.org/sites/default/d8files/event-documents/2.08%20Asset%20accounts%20for%20timber.pdf.

Activities to promote and develop economic tree planting	Plantation forest
Project to promote the planting of economic trees in watershed areas 3, 4 and 5 before the Cabinet resolution on June 30, 1998.	Natural Forest

Data from RFD includes data on the area added due to afforestation/reforestation activities and is reported in rai. To compute volume estimates, the existing values were converted to '000 hectares. Furthermore, volume estimates were computed using equation (1) for cultivated and natural timber resources.

Stocks in afforested/reforested areas were only accounted as timber resources three years after planting. This means the additions to stock of timber resources in 2015 due to afforestation/reforestation in terms of volume were traced back from 2012, and so on. Additions from afforestation/reforestation activities are summarized in Table 9.

Table 9. Volume additions from afforestation/reforestation in Mn m^3

Year	**Natural timber resources not available for wood supply**	**Cultivated timber**
2015	0.32	0.21
2016	0.97	0.33
2017	1.37	0.29
2018	1.59	0.27
2019	1.04	0.75

Reductions

Under reductions, the accounting entries include removals, felling residues, natural losses, catastrophic losses, and reclassifications.

Removals are estimated as the volume of timber resources removed from forest land, other wooded land and other land areas during the accounting period. Removals may be recorded by type of product (e.g., industrial roundwood or fuelwood) or by species of tree (e.g., coniferous or broadleaved). To account for removals, the ADB team included removals from permitted logging, illegal logging, and wood collection activities.

Permitted logging refers to the authorized extraction of timber resources, regulated by legal and institutional frameworks. It denotes the volume or quantity of timber officially approved for harvesting within a specified timeframe, typically in accordance with sustainable forest management principles. This was particularly applied to timber resources in plantations, since logging activities have been banned in natural forests. Estimation for permitted logging of timber was calculated for cultivated timber, specifically rubber plantations.

Data on the annual extraction of rubberwood logs is not directly available. To address this, the ADB team utilized export data reported by the Bureau of Customs, which is also accessible on the Royal Forest Department (RFD) website. The exports data available are rubberwood logs and sawnwood timber reported in cubic meters. Since the sawnwood timber is a form of processed wood, it had to be converted to its roundwood equivalent.

The Food and Agriculture Organization (FAO) of the United Nations published country-specific conversion factors which were used as reference for conversion. However, since the value for Thailand was unavailable, the ADB used the average value of Indonesia and Malaysia and Indonesia, as shown in Table 10.

Table 10. Conversion factor of sawnwood to roundwood

Conversion factor	**Indonesia**	**Malaysia**	**Average**
Conversion (m^3rw/m^3p)	2	1.59	1.75

For each year, the volume measure of rubberwood (sawntimber) was converted to its equivalent roundwood measure. Using 1.75 m^3rw/m^3p as conversion factor multiplied to the sawntimber volume, Table 11 shows the summary of rubberwood removals in Mn m3.

Table 11. Conversion of rubberwood sawntimber to roundwood and the resulting total rubberwood production in Mn m^3

Year	**Rubberwood (logs) In m^3**	**Rubberwood (Sawntimber) In m^3**	**Rubberwood (Sawntimber to roundwood) In m^3**	**Rubberwood in Mn m3**
2015	-	67,123,660	117,130,787	117.13
2016	23	21,045,241	36,723,946	36.72
2017	-	1,264	2,206	0.00
2018	-	2,726,950	4,758,528	4.76
2019	-	2,264,263	3,951,139	3.95

Additionally, under removals are those coming from **Illegal logging** which refers to the unauthorized removal of timber resources in violation of laws and regulations

governing forest use. This includes actions such as harvesting without proper permits, exceeding approved quotas, or logging in protected areas.

The RFD reports monthly data on cases pertaining to encroachment, logging and poaching of wild animals, and logging data is reported in volume terms. However, since this data is reported in fiscal year thus, the first step for estimating illegal logging involves converting the data to align with the calendar year. Moreover, the data does not bifurcate between cultivated and natural timber. Given the information that logging of any forms are prohibited in Thailand's natural forests, the ADB team assumed that all data pertaining to illegal logging in Thailand was reported under natural timber (not available for wood supply). Table 12 summarizes the volume of timber removed due to illegal logging activities

Table 12. Volume of Timber Lost due to Illegal Logging, 2015-2019

Year	Total number of cases	Volume of timber lost (m^3)	Volume of timber lost (million m^3)
2015	6036	4187.31	0.004187
2016	1128	1072.62	0.001073
2017	3713	2764.01	0.002764
2018	3973	2787.09	0.002787
2019	1468	485.69	0.000486

Lastly, under removals are **wood collection activities** which involve the gathering or harvesting of wood for timber and various other purposes, including commercial, subsistence, and informal uses. These activities include both authorized and unauthorized wood extraction and are recorded as part of the physical flows of timber resources. Currently, Thailand does not report any data on the collection of timber resources under this category.

Also included under reductions are ***Felling residues***, which refer to the portion of timber resources that, at the time of felling, are rotten, damaged or in excess in terms of the size requirements. Felling residues exclude small branches and other parts of the tree that are also excluded from the scope of timber resources.

In the absence of data on felling residues, the ADB team conducted a thorough literature review to determine the residue factor for timber production from cultivated timber and illegal logging of natural timber. Literature reveals that nearly 25-50% of timber is lost as felling residues during extraction[4]. For Thailand, an average residue

[4] Food and Agriculture Organization of the United Nations (FAO). *Felling Residues*. https://www.fao.org/4/X6966E/X6966E01.htm.

factor of 35% was applied. Table 13 presents the estimated volume of felling residues during the accounting period (2015-2019).

Table 13. Estimated volume of felling residues (in Mn m^3)

Year	Natural timber resources not available for wood supply	Cultivated timber
2015	0.001465559	40.99577535
2016	0.000375417	12.85338899
2017	0.000967404	0.000771988
2018	0.000975482	1.665484713
2019	0.000169992	1.382898627

Ideally, felling residue factor varies across species of timber. Thus, if the necessary data is available, the table can be further sub-divided to account for different species of timber.

Apart from removals due to extraction and production purposes and the residues that come from these activities, the Timber Accounts also account for reductions due to natural losses and catastrophic losses.

Natural losses refer to reductions in the growing stock (i.e., living, standing trees) within an accounting period due to mortality from causes other than felling. These losses include those resulting from *natural mortality, insect attack, fire, wind throw or other physical damages*. Such losses are recorded only when the timber resource cannot be salvaged or removed.

Meanwhile, ***Catastrophic losses*** refer to reductions that should be recorded when there are exceptional and significant losses of timber resources due to natural causes. Similar with natural losses, catastrophic losses should be recorded only when there is no possibility that the timber resource can be removed.

Due to the data unavailability, reductions due to natural mortality, insect attack, windthrow incidents, and catastrophic losses have not been estimated for Thailand. Estimating reductions due to natural mortality would require forest inventory data, while the other types of losses would typically depend on incident reports detailing the affected areas and timber loss, which are currently unavailable.

To account for timber losses due to forest fires, the team utilized data from Global Forest Watch[5] (GFW), which reports key statistics on global forests, including changes in forest extent and drivers of deforestation. For Thailand, the team retrieved data on tree cover loss from forest fire (measured in hectares). This data was subsequently converted to million cubic meters to be incorporated in the final accounting matrix. As GFW does not differentiate between types of forest (natural/cultivated), all losses under

[5] Global Forest Watch. *Thailand Dashboard: Fires*. https://www.globalforestwatch.org/dashboards/country/THA/?category=fires.

forest fires were recorded under natural timber (not available for wood supply). Table 13 summarizes the estimated reduction in timber stock due to forest fires.

Table 13. Estimated reduction in timber stock due to forest files

Year	Total tree cover loss (ha)	Tree cover loss from forest fire (ha)	in cubic metres	in million cubic metres
2015	120,807.66	240.09	22,607.34	0.02
2016	171,638.62	921.59	86,776.53	0.09
2017	196,456.51	479.87	45,184.29	0.05
2018	133,532.58	113.66	10,702.15	0.01
2019	129,794.03	249.85	23,525.88	0.02

It is important to note that RFD also provides information on forest fires, including the damaged area. However, the decision to use data from Global Forest Watch (GFW) was based on its specificity, as it provides detailed data on tree cover loss specifically attributed to forest fires.

Lastly, reductions due to **reclassifications** are also included in the Timber Accounts. These reductions arise from changes in management practices that result in timber resources being reclassified from cultivated to natural forests or vice versa. Such changes could be conversion of forest lands to agricultural lands or urban areas. However, due to insufficient information, reductions from reclassifications were not recorded.

Closing Stock

The closing stock represents the remaining value of timber resources after accounting for all additions and reductions during the accounting period. It is calculated as an accounting identity:

$$Closing\ Stock\ =\ Opening\ Stock\ +\ Additions\ -\ Reductions$$

Other Changes in Stock

This additional entry is not part of the standard structure of physical asset accounts for timber resources. However, due to data gaps in some entries and the availability of actual closing stock information, it was necessary to include an adjustment to account for changes in stock that were not captured. This adjustment serves as a balancing factor, ensuring consistency with the annual stock data.

To estimate the other changes in stock, the calculated closing stock, based on the available data for the recorded entries, was subtracted from the closing stock figures

using the area reported by the FRA and their density assumption. The results are summarized in Table 14.

Table 14. Estimated Other Changes in Stock, 2015-2019

Year	Natural Timber			Cultivated Timber		
	Closing Stock based on FRA data	Calculated Closing Stock	Other Changes in Stock	Closing Stock based on FRA data	Calculated Closing Stock	Other Changes in Stock
2015	1,540.36	1,541.28	-0.92	370.20	219.42	150.78
2016	1,539.33	1,541.25	-1.92	366.90	320.95	45.95
2017	1,539.05	1,540.65	-1.61	412.10	367.19	44.91
2018	1,544.04	1,540.63	3.41	405.60	405.95	-0.35
2019	1,543.98	1,545.08	-1.09	400.70	401.02	-0.32

Given the information on the additions, reductions, and other changes in stock, the physical asset account for timber resources is shown in Table 15. The summary of approaches made can be found in *APPENDIX*.

Table 15. Physical Asset Account for Timber Resources, 2015-2019

Year	2015		2016		2017		2018		2019	
	Million cubic meters									
	Natural Timber	Cultivated Timber	Natural Timber	Cultivated Timber	Natural Timber	Cultivated Timber	Natural Timber	Cultivated Timber	Natural Timber	Cultivated Timber
Opening stock	1,540.99	377.33	1,540.36	370.20	1,539.33	366.90	1,539.05	412.10	1,544.04	405.60
Additions to stock										
Natural growth	..	..	..	..	..	..	..	..	..	..
Afforestation/Reforestation	0.32	0.21	0.97	0.33	1.37	0.29	1.59	0.27	1.04	0.75
Reclassifications	..	..	..	..	..	..	..	..	..	..
Total additions	0.32	0.21	0.97	0.33	1.37	0.29	1.59	0.27	1.04	0.75
Reductions to stock										
Removals	0.004	117.13	0.001	36.72	0.003	0.002	0.003	4.76	0.000	3.95
Felling residues	0.001	41.00	0.000	12.85	0.001	0.001	0.001	1.67	0.000	1.38
Natural Mortality	..	..	..	..	..	..	..	..	..	..
Losses due to forest fire	0.02	..	0.09	..	0.05	..	0.01	..	0.02	..
Reclassifications	..	..	..	..	..	..	..	..	..	..
Total reductions	0.03	158.13	0.09	49.58	0.05	0.00	0.00	6.42	0.00	5.33
Other changes in stock	-0.92	150.78	-1.92	45.95	-1.61	44.91	3.41	-0.35	-1.09	-0.32
Closing stock	1,540.36	370.20	1,539.33	366.90	1,539.05	412.10	1,544.04	405.60	1,543.98	400.70

Symbol:

.. not available

Way forward and recommendations

The methodologies and assumptions presented offer a structured approach for compiling timber asset accounts; however, the compilation process reveals notable data gaps in critical accounting entries, including natural growth, reductions from natural losses, and reclassifications. Additionally, plantations data currently account only for rubber, despite the presence of other plantation types in Thailand, such as teak and eucalyptus. These gaps restrict the completeness of the accounts and highlight the necessity for enhanced data collection and reporting mechanisms.

To address these challenges, the following recommendations emphasize the importance of improving data availability, exploration of a different accounting period, inclusion of natural timber resources available for wood supply, and enhancing data availability, disaggregation, and consistency across agencies.

Further, as discussed with stakeholders, a clearer delineation between natural timber that is available for wood supply and natural timber that is not available for wood supply is needed—particularly in contexts such as community forests where limited, non-commercial harvesting may occur. This distinction is essential for ensuring accurate classification and improving future iterations of the accounts.

Accounting for other plantation types as data availability and cohesiveness across data compilers improves

Ideally, cultivated timber resources should encompass all types of plantations present within a country's geographic landscape. However, due to insufficient data on other plantation types, such as teak and eucalyptus, the ADB team relied on rubber plantation data from the FRA.

Table 16 highlights the challenges in aligning available data from various agencies to generate consistent and reliable estimates for the extent and production of timber resources in Thailand.

While some data points, such as area coverage, are available, they lack corresponding density information necessary to calculate the volume of timber. This disconnect limits the ability to produce comprehensive estimates.

For instance, the FIO has data on the rubber plantation area, but it does not report production figures for rubberwood. Instead, production data is available from RFD. Moreover, despite RFD confirming that their production data originates from FIO, a comparison of the production data reported by FIO and that published on the RFD website reveals inconsistencies.

These discrepancies and gaps in data alignment across agencies hinder the development of accurate and cohesive timber accounts. A more integrated and standardized approach to data collection and reporting is needed to address these issues and ensure the reliability of timber resource estimates.

Table 16. Data Availability and Gaps for Cultivated Timber Resources in Thailand (2014–2023)

Year	Cultivated Timber Resources											
	Rubber				Teak				Eucalyptus			
	Area	Density	Volume (extent)	Removal Volume (Fellings)	Area	Density	Volume (extent)	Removal Volume (Fellings)	Area	Density	Volume (extent)	Removal Volume (Fellings)
2014	FRA	FRA	FRA	RFD*				RFD*/FIO				
2015	FRA	FRA	FRA	RFD*				RFD*/FIO				
2016	FRA	FRA	FRA	RFD*				RFD*/FIO				
2017	FRA	FRA	FRA	RFD*				RFD*/FIO				
2018	FRA	FRA	FRA	RFD*	RFD			RFD*/FIO				
2019	FRA	FRA	FRA	RFD*				RFD*/FIO				
2020	FRA/FIO			RFD*	FIO			RFD*/FIO	FIO			FIO
2021	FIO			RFD*	FIO			RFD*/FIO	FIO			FIO
2022	FIO			RFD*	FIO			RFD*/FIO	FIO			FIO
2023	FIO			RFD*	FIO			RFD*/FIO	FIO			FIO

Note: RFD* - RFD's data on production was confirmed to only capture FIO-reported data

2015-2019 – current accounting period

Legend

Data available	
Data available but with limitations	
Data not available	

An exploration of a different accounting period may be considered

With the availability of area and production data for rubber, teak, and eucalyptus from 2020 onward for FIO, it may be possible to account for changes during this period in the future. However, this will require the addition of density information for teak and eucalyptus (FRA data may be used for rubber) to enable the estimation of timber volumes accurately. Once this data becomes available, comprehensive accounting for these cultivated timber resources can be explored.

Although FIO data does not represent the entirety of Thailand, its consistency across the variables covered makes it a valuable starting point along while awaiting more comprehensive nationwide data. As a management body, FIO's data can still provide useful estimates to inform policies related to forest and timber resource management.

Inclusion of natural timber available for wood supply in future work

Currently, the Timber Accounts only cover natural timber not available for wood supply due to the banning of logging activities in natural forests. However, recent information highlights the presence of community forests where wood collection activities are permitted within natural forests. Community forests are a critical resource for local livelihoods, providing fuelwood, timber, non-timber forest products (NTFPs), and ecosystem services. While some baseline data on these forests exist, there are opportunities for Thailand to employ targeted surveys to refine and expand its understanding of wood collection activities

As data on wood collection from these community forests is currently unavailable, future accounts could include this information under natural timber available for wood supply once relevant data becomes accessible.

Enhancing data availability, disaggregation and consistency across agencies

Currently, notable data gaps are seen in critical accounting entries such as natural growth, reductions from natural losses, and reclassifications. Natural growth measures the increase in timber volume, typically in cubic meters (m^3) annually, and this estimate is crucial because this provides a comprehensive capacity of forest resources whether natural or cultivated.

Typically, natural growth estimates come from forest inventory data or models that track the growth rates of different timber species. Thus, updating forest inventory data and applying growth functions or yield models specific to the forest type and region is crucial to track annual natural growth. Forest inventories also yield natural mortality estimates which are crucial in understanding forest ecosystem health.

During the final presentation of the estimates, it was noted that the Department of National Parks, Wildlife and Plant Conservation (DNP) conducts regular forest inventories to assess changes in carbon absorption. These carbon absorption estimates may offer a potential proxy for deriving natural growth in volume, subject to appropriate conversion factors and further methodological assessment. This represents a possible avenue for improving the completeness and accuracy of natural growth estimates in future iterations of the accounts.

High-resolution satellite imaging can be employed to detect temporal changes in forest cover, their structure and other relevant data. Regular monitoring also highlights sudden events that alter timber resources within the economy. For instance, Tree mortality can be identified by recording changes through advanced satellite imaging. This includes estimating impact of fire events through thermal and spectral data to identify the volume of loss of timber. High-resolution imaging also captures windthrow damage through fallen or leaning of trees post such events. Additionally, pest/insect attack activities can be confirmed by tracing patterns of discoloration or defoliation.

Supplementary reports may also be used in addition to satellite imaging to provide supporting information. Ideally, reports estimate the area affected, volume of timber loss (bifurcated by types of tree species) and details of restoration efforts (if any).

Under reclassifications, the SEEA CF recommends recording all changes in the status of natural/cultivated timber resources. This indicates that separate reclassification events (example, the conversion of natural forest to plantation area or vice versa) needs to be regularly monitored and documented. This can be done with the help of land use maps that are generated from satellite data. Additionally, field surveys and forest inventory reports can verify these changes for comprehensive recording under the asset accounting framework.

Disaggregation of data across species is also important and may be used for certain accounting entries such as Felling residues. Recording the specific rates for felling residues, further divided into species is important to underpin resource-use efficiency, ascertaining the recovery potential of biomass and carbon accounting. Several methods of data collection can be employed to measure felling residues. These include – field surveys (utilizing biomass sampling methods to estimate the proportion of residue for different timber species), modelling (estimating volume of residue based on specified equations for different categories of trees based on dimensions) and remote sensing (utilizing satellite data to identify and record logging sites, accumulation of residue and monitoring).

Updating of estimates as data availability improves

FRA has recently released an updated report for Thailand for 2025 and has updated the volume information for the natural forest. This can be used to update the figures to reflect a more recent data reference. Moreover, volume information by type of forest produced from the forest inventory of the DNP can be used to generate more robust estimates.

Conclusion

This report has outlined the conceptual framework, methodologies, assumptions, and challenges involved in compiling Thailand's Physical Asset Accounts for Timber Resources, offering valuable insights into the state of timber resources and the data infrastructure required to support its further improvement.

Addressing the highlighted data gaps will not only improve the comprehensiveness of the timber accounts but also strengthen its role as a tool for policy development and sustainable forest management. The continued development of Thailand's Timber Asset

Accounts will contribute significantly to evidence-based policymaking and sustainable forest resource management.

The progress made in compiling Thailand's Timber Asset Accounts reflects the collaborative efforts of key agencies and stakeholders such as the Office of Natural Resources and Environmental Policy and Planning (ONEP), National Statistical Office (NSO), Royal Forest Department (RFD), and Forest Industry Organization (FIO). Moving forward, continued partnerships and capacity-building initiatives will be crucial to fully realize the potential of these accounts

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Appendix.

Summary of approaches used in estimating the accounting entries

Entries		
	Natural Timber	**Cultivated Timber**
Opening stock	- Used FRA's area and density data to estimate the volume of stock	
Additions to stock		
Natural growth	…	…
Afforestation/Reforestation	- Used RFD's reforestation/afforestation project data on area - Assigned projects to the type of forest - Used the area data and multiplied to FRA's density information - Recorded estimated stock of year t-3 to the accounting period	
Reclassifications	…	…
Total additions		
Reductions to stock		
Removals	- Used illegal logging data reported by RFD	- Used RFD's rubberwood exports data and converted sawnwood volume to its roundwood equivalent
Felling residues	- Used residue factor/ Ratio of felling residue per category of timber extracted	
Natural Mortality*	…	…
Losses due to forest fire*	- Used Global Forest Watch's (GFW) tree cover loss data and multiplied the area to FRA's density information	…
Reclassifications	…	…
Total reductions		
Other changes in stock**	- Deducted initially calculated closing stock from stock information using FRA data	
Closing stock		

**Listed in the basic structure of the physical asset account for timber resources under natural losses but separated as individual entries in the table*

***Not part of the standard structure of the physical asset accounts for timber resources but added to account for changes in stock not captured due to limited data and as a balancing factor based on annual stock information.*