Collecting and assessing data on the provisioning and use of wood biomass for energy purposes

Chantal Blom, Roel Delahaye, Redbad Mosterd, Frank Prins & Sjoerd Schenau

Statistics Netherlands, May 2023
PR001858 2021 European Green Deal
Regulation (EU) No 691/2011

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1. Background and general objectives

1.1 Introduction

This report covers part two of the Eurostat grant deliverables, focusing on (wood) biomass for energy purposes as an ecosystem service. The provision of wood biomass for energy purposes is an important ecosystem service. It is widely acknowledged that society source and utilize biomass from ecosystems in diverse ways and for various reasons, such as food, fibre, and energy. In line with the System of National Accounts (SNA) approach, all biomass provisioning that contributes to subsistence production in agriculture, forestry, and fisheries should be encompassed in ecosystem accounts. However, in the Ecosystem Accounts for the Netherlands, biomass used for energy purposes has been excluded thus far. Currently, only the wood provision of round wood for timber as a provisioning service has been included.

1.2 General objectives

In order to systematically develop the ecosystem service biomass for energy purposes, the following objectives have been set:

- Estimate the production of wood biomass suitable for energy purposes, based on the models utilized for round wood production (in cubic meters) developed in our ecosystem accounts.
- Examine the international trade of wood biomass for energy purposes for the Netherlands.
- Compare this information with other external and internal data sources.

The first objective of this report is to use the models developed in our previous ecosystem accounts for wood provisioning. Timber production, as a provisioning service, is already accounted for in our current Natural Capital accounting work. The primary focus is to estimate the potential supply of biomass specifically for energy production in Dutch forests, as well as other natural areas. Additionally, it would be valuable to incorporate data on the use of wood biomass for energy across different economic sectors. By analysing the available data sources, we can assess the feasibility of generating annual figures and identify any potential gaps or limitations in the current data collection and reporting systems.

In addition, we aim to include data on the international trade of wood biomass for energy purposes to provide a comprehensive overview. This information is policy-relevant for the Netherlands as it contributes to discussions on energy security, renewable energy targets, environmental sustainability, economic opportunities, and energy sector policy formulation.

Lastly, we will employ additional internal and external data sources to validate the results. Ensuring data consistency and reliability is important. Therefore, we will compare these numbers with existing information on biomass used for energy production, utilizing data from the Energy accounts, Energy statistics, and International Trade statistics. To integrate the new ecosystem service into the existing work, it is also crucial that the data is available to create a time series, starting from 2013.

1.3 Definition and scope

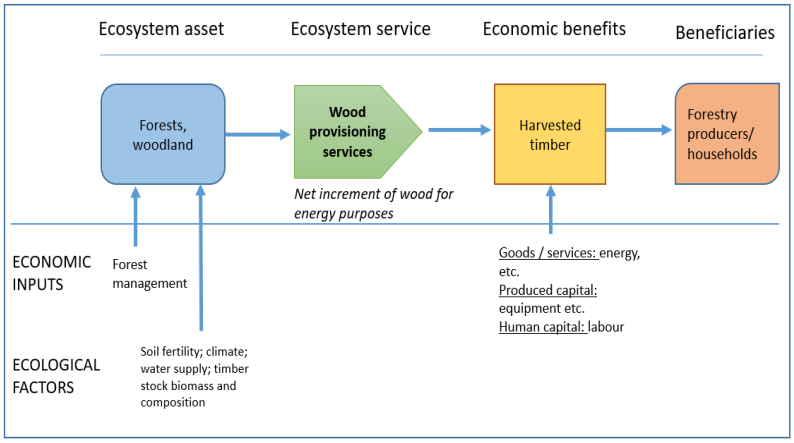
Wood for energy purposes is part of the wood provisioning ecosystem service. This wood provisioning ecosystem service is defined in the proposed guidance note on accounting for the wood provision ecosystem service as '*the ecosystem contributions to the growth of trees and other woody biomass'* (proposed amendment of Regulation (EU) 691/2011). Currently, Statistics Netherlands and Wageningen University (WUR) have been using physical extraction in cubic meters (harvest) to measure the wood provisioning service. However, in the proposed legal module from Eurostat, the unit of measure for the wood provisioning service will be net increment. The proposed legal text specified that it *'shall be reported as net increment as defined in Annex VII [i.e. the proposed Forest accounts legal module] in thousand m^3 overbark'.* The proposed guidance note defines net increment as follows: *'Net annual increment of timber is defined as the average annual volume growth of live trees, calculated from the stock of live trees (growing stock) available at the start of the year less the average annual mortality.'*[1] (European Commission, 2022).

Biomass for energy purposes comes from various sources such as round and brushwood, maize utilized for ethanol production, and so on. This report's focus is mainly on wood biomass for energy purposes, with less emphasis on agricultural sources. The latter are not part of the wood provisioning service, but the crop provisioning service. However, agricultural products are also an essential source of energy and are included in the SEEA EA definition, as mentioned above. Whenever feasible, data on all biomass sources for energy purposes will be collected and presented throughout this report.

1.4 Logic chain

Wood provisioning services are provided by forests and other ecosystem types with wooded biomass. The economic benefit is the harvested timber for energy purposes. These benefits are the result of the combined input of ecosystem services, goods and services, produced capital and human capital. The direct users/beneficiaries are the companies engaged in the forestry sector, households and energy companies that use the biomass to produce electricity or heat.

Figure 1.1. Logic chain of wood provision for energy purposes.



[1] This concept represents 'net annual increment less removals' for the accounting period in the terminology of forest accounts.

2. Data sources and methodology

This chapter describes the used data sources and the methodology to compile the ecosystem service (wood) biomass for energy purposes. The methodology mainly focuses on the regional distribution of the data and the compilation of the ecosystem service map.

2.1 Data sources

Most of the data on wood for energy purposes was described and included in part one of this Eurostat grant report, obtained from Probos through the European Forest Account (EFA) questionnaire. Probos is a Dutch non-profit organization specialized in providing advice and support to forest owners, managers, and stakeholders in the forest and timber sector. They actively engage in research and development projects related to forestry, including forest inventory and monitoring.

Probos also publishes annual reports[2, 3, 4] that highlight the supply and use of wood in the Netherlands. They play a crucial role in collecting and reporting data on wood for energy purposes as part of the Joint Wood Energy Inquiry (JWEE3). The JWEE3 is a collaborative effort involving the UNECE Committee on Forests and the Forest Industry, International Energy Agency (IEA), Food and Agriculture Organization (FAO), and the European Commission (EC). The data provided by Probos is instrumental in tracking trends and patterns of wood usage for energy purposes in the Netherlands, facilitating the formulation of policies and strategies to promote sustainable use of wood resources.

The data published by Probos, as described above, will be utilized to compile the supply and use of wood as an ecosystem service for energy purposes. This involves accounting for two types of wood products: firewood and woody biomass.

Firewood

Firewood primarily consists of roundwood, with a significant portion of Dutch roundwood being utilized for private wood-burning stoves. The remaining roundwood finds application in the manufacturing of furniture and other materials. The annual consumption of firewood in private wood-burning stoves, fireplaces, and inserts is estimated by Statistics Netherlands, drawing data from the Housing Survey Netherlands 2018 (Statistics Netherlands, 2019)[5]. It is assumed that the amount of firewood burned remains relatively consistent over time and is sourced from domestic extraction. It is important to note that the volume of firewood includes thick branches and treetops.

Woody biomass

In 2020, the Netherlands produced approximately 1325 kilotons of woody biomass through management activities and the conversion of wooded areas. Urban areas accounted for more than half of this woody biomass (51 percent), while forests contributed 33 percent, and nature and landscapes provided 16 percent. The transformation of forests, nature, and landscapes into other land uses or nature types significantly influenced the harvest of woody biomass. The majority of this

[2] Houtproductie en -gebruik in Nederland in 2019 - Probos
[3] Houtproductie en -gebruik in Nederland in 2020 - Probos
[4] Houtproductie en -gebruik in Nederland in 2021 - Probos
[5] Houtverbruik huishoudens WoON- onderzoek 2018

biomass is used for energy purposes, while only a small percentage is used for material applications. In 2020, 67,200 tons of Dutch woody biomass was sold in the Netherlands for material applications.

2.2 Methodology

Incorporating a spatial element or map is crucial for ecosystem services analysis and management. Ecosystem services are inherently spatial and are affected by the location and distribution of natural resources, ecological processes, and human activities. The reports of Probos include some spatial information on the supply of wood for energy purposes. This data is shown in Table 2.1 for firewood and in Table 2.2 for woody biomass.

Table 2.1. Supply of firewood (25% moisture) for energy purposes in kilotons, 2020.

Round-wood with bark & heavy branches (kilotons per year)	**2020**
Total	1055
Total excl. waste wood	895
Forest (38%)	340
Built-up areas (35%)	310
Landscape (27%)	245
Waste wood	160

Table 2.1 shows the supply of firewood in the Netherlands for 2020, along with the respective sources. There are three primary sources of firewood: forests, landscapes, and built-up areas (highlighted). The built-up areas category mainly includes firewood from private gardens, either from their own or belonging to others. Waste wood is excluded from the table as it does not originate directly from nature but rather from industries/households (i.e. from accumulation). Including it would result in double-counting.

Table 2.2 presents the supply of woody biomass for energy purposes in the Netherlands. This data is also categorized according to the three main sources mentioned in the data sources provided by Probos.

Table 2.2. Supply of woody biomass for energy purposes in kilotons, 2020.

Woody biomass (kilotons per year)	**2020**
Total	1325
Forest (33%)	440
Built-up areas (51%)	675
Nature and landscape (16%)	210

The data and spatial allocations provided can be converted to the ecosystem types within the extent account of the Netherlands. Table 2.3 illustrates the corresponding ecosystem types associated with the regional allocations from Table 2.1 and Table 2.2. The matching rows are highlighted by corresponding colours. In cases where timber production is restricted in forests with a nature status, we assume that timber production in forests with a nature type ("natuurdoeltype") accounts for only 20 percent of the timber production compared to forests of a similar type without nature status. The other ecosystem types that could potentially produce wood are marked with a “1” (see Table 2.3). At this moment, we do not exactly know the potential of each ecosystem type to produce wood. In the

future we could research the possibilities to fine-tune this table. By using the allocation table, the supply is distributed among the chosen ecosystem types within the extent account.

Table 2.3. Allocation of ecosystem types to firewood and woody biomass.

Ecosystem type	code	Forest	Built-up*	Landscape*	Nature*
(Semi-)natural forest	111	0.2			
Hedges and tree lines	112			1	
Plantation forest	113	1			
Tall herbs	114				1
Heathland	115				1
Drift sand	116				1
Semi-natural grassland	117				1
Biodiverse cropland	118				1
Swamp forest	121	1			
Bogs	122				1
Fens	123				1
Streams and rivers	131				
Lakes	132				
Brackish	133				
Coastal dunes	141				1
Salt marshes	142				1
Beach	143				
Intertidal and mud flats	144				
Shoals	145				
Estuaries	146				
North sea	147				
Wadden sea	148				
Cropland, regular	211			1	
Cropland, extensive	212			1	
Perannuals, regular	213			1	
Perannuals, extensive	214			1	
Pasture, permanent	221			1	
Pasture, temporal	222			1	
Pasture, extensive	223			1	
Greenhouse horticulture	231			1	
Nursery container fields	232			1	
Fallow land	241			1	
Arable field margins	242			1	
Built-up (urban)	311		1		
Built-up (rural)	312		1		
Business park	321		1		
Mining, landfills, etc.	322		1		
Infrastructural	331		1		
Landscape garden	341		1		
Public park (large)	342		1		
Public park (small)	343		1		
Public green space, other	344		1		
Semi-public green space	345		1		
Sport park	351		1		
Residential recreation	352		1		
Marine, other	411				
Forest, other	421	1			
Grassland, other	422			1	
Other terrain	423		1		
Other	431			1	

*For these sources the contribution of ecosystem types are based on a tree cover map.

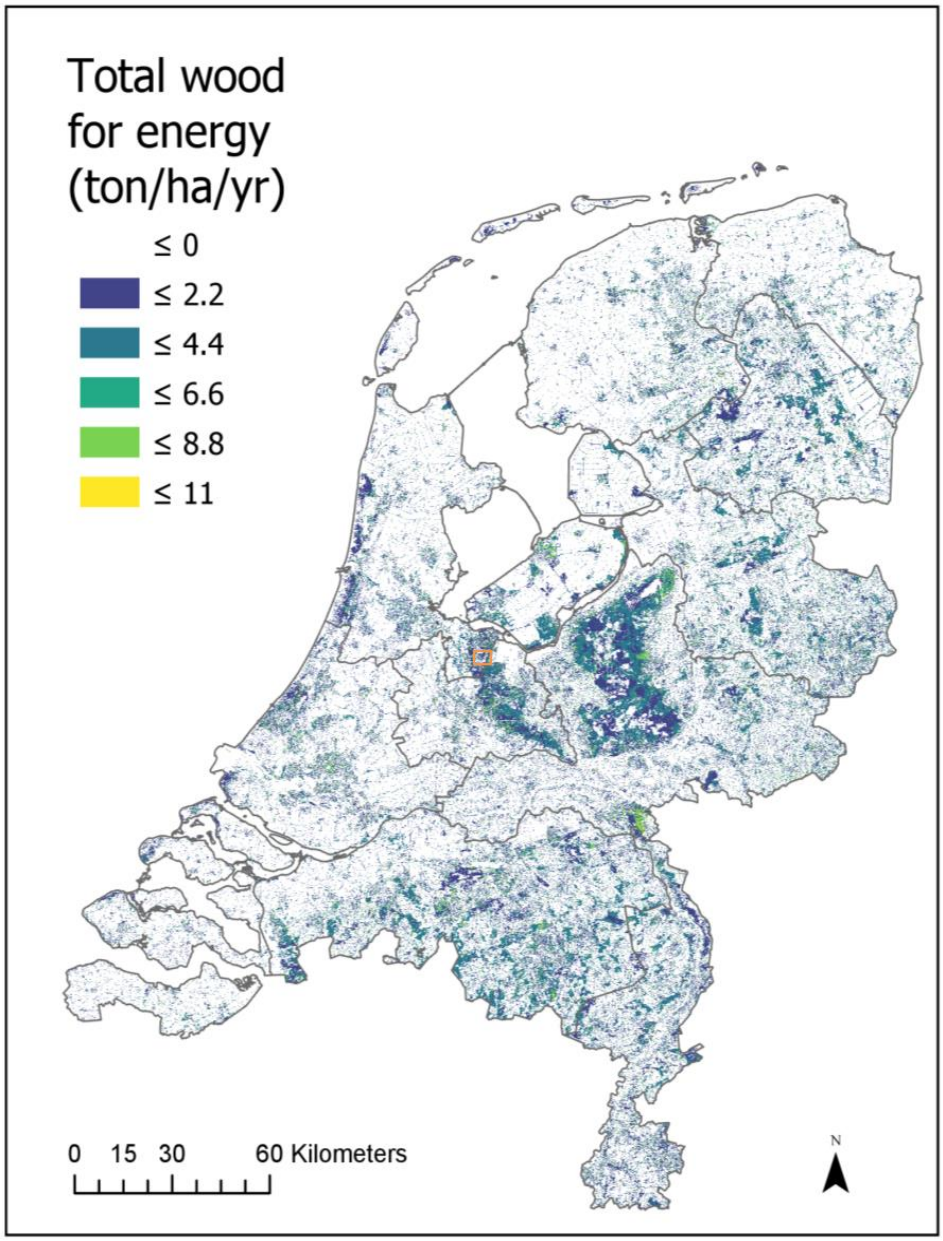
3. Supply of biomass for energy purposes

In this chapter, we present the findings derived from the data collection and methodology outlined in the previous chapter. The focus is on examining the supply of (wood) biomass for energy purposes.

3.1 Regional results

Figure 3.1 illustrates the map of the total supply of wood for energy purposes in the Netherlands for the year 2020. The map represents the spatial distribution of this ecosystem service across the country, providing a visual depiction of the availability of wood as an energy resource.

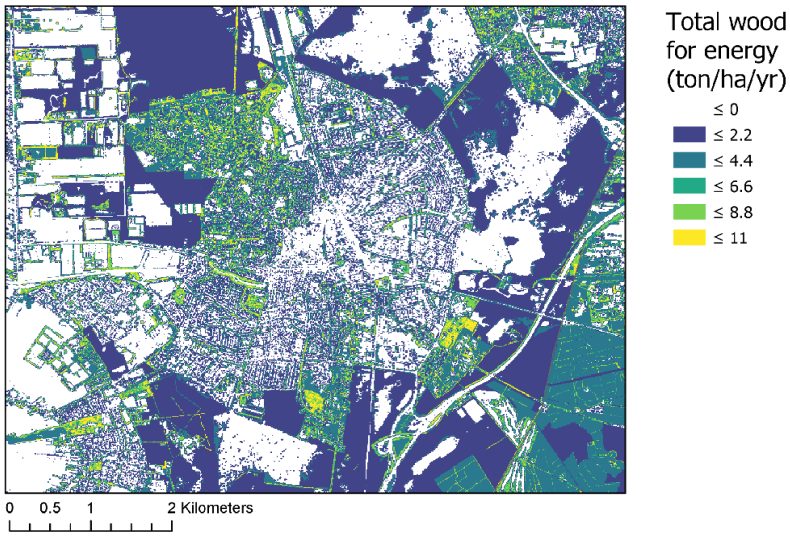
Figure 3.1. Total wood supply for energy purposes of the Netherlands, 2020.



We have zoomed in on a specific region in the map to demonstrate the level of detail included in our analysis. The chosen region is Hilversum, a city surrounded by various types of nature. Figure 3.2

displays this region, providing a closer view of the mapped data. By focusing on Hilversum, we can observe the distribution of wood biomass for energy purposes within the area and better understand how different natural areas contribute to the overall supply. The yellow areas represent forested areas in and surrounding Hilversum.

Figure 3.2. Wood supply for energy purposes in Hilversum and surrounding nature, 2020.



With these maps we were able to calculate the extraction per ecosystem type. The results are presented in Table 3.1. Most of the extraction comes from plantation forest and the built-up area, which is mostly households' gardens.

Table 3.1. Extraction of wood biomass for energy purposes per ecosystem type in kilotons, 2020.

Ecosystem type	Extraction	Ecosystem type	Extraction
Plantation forest	534	Heathland	16
Built-up (urban)	270	Perannuals, regular	10
Infrastructural	218	Other terrain	8
Public green space, other	151	Pasture, extensive	7
Pasture, permanent	129	Bogs	6
Built-up (rural)	119	Fens	5
Grassland, other	108	Perannuals, extensive	4
(Semi-)natural forest	105	Greenhouse horticulture	4
Forest, other	91	Coastal dunes	4
Cropland, regular	62	Mining, landfills, etc.	2
Public park (small)	58	Tall herbs	2
Residential recreation	54	Arable field margins	2
Swamp forest	50	Drift sand	2
Hedges and treelines	40	Landscape garden	1
Business park	37	Cropland, extensive	1
Sport park	29	Cropland, nature	1
Semi-natural grassland	29	Fallow land	0
Pasture, temporal	26	Nursery container fields	0
Semi-public green space	24	Salt marshes	0
Public park (large)	22	Other, different	0

3.2 Statistics on province level

The statistics on province-level extraction were calculated using the map provided in Table 3.2. In this table, the mean and total extraction per province in the Netherlands are presented separately for firewood and woody biomass, as specific extraction data is available for each type of area. The provinces of Noord-Brabant and Gelderland contribute the largest share of wood extracted for energy purposes, and they also have the highest mean extraction rates.

Table 3.2. Mean and total fire and woody biomass production per province based on 2020 data.

PROVINCE	Mean firewood for energy (ton/ha/yr.)	Mean woody biomass for energy (ton/ha/yr.)	Mean firewood and woody biomass for energy (ton/ha/yr.)	Total firewood for energy (kilotons/yr.)	Total woody biomass for energy (kilotons/yr.)	Total firewood and woody biomass for energy (kilotons/yr.)
Drenthe	0.29	0.42	0.70	77	112	188
Flevoland	0.21	0.31	0.52	31	45	77
Friesland	0.14	0.20	0.34	50	69	120
Gelderland	0.38	0.54	0.92	193	277	470
Groningen	0.14	0.22	0.36	34	52	86
Limburg	0.32	0.47	0.80	72	105	177
Noord-Brabant	0.35	0.51	0.86	174	259	434
Noord-Holland	0.16	0.27	0.42	45	76	121
Overijssel	0.32	0.43	0.74	108	145	253
Utrecht	0.32	0.49	0.81	46	71	116
Zeeland	0.09	0.16	0.25	16	29	45
Zuid-Holland	0.16	0.28	0.44	49	84	133

3.3 Time series

The results refer to the year 2020, specifically chosen to align with Part One of the Eurostat grant report on the EFA questionnaire. Establishing a time series for this ecosystem service is crucial, particularly if it is to be integrated into the Dutch natural capital accounts. To meet this objective, a time series starting from 2013 is necessary, with annual updates feasible in subsequent years. Table 3.3 presents the yearly extraction of wood for energy purposes, categorized as round wood and woody biomass, spanning the period from 2019 to 2021.

Table 3.3. Extraction of biomass for energy purposes, in kilotons.

Category	2019	2020	2021
Firewood	1065	1065	1065
Woody Biomass	1167	1166	1288

It is important to note that prior to 2019, the annual publication from Probos was not available. However, the JWEE questionnaire, released every two years from 2007 to 2019, provides data on the extraction of total fuelwood in cubic meters in the Netherlands. This data was used, starting from 2013 and depicted in Table 3.4.

Table 3.4. Extraction of fuel wood, in mln m3 (from JWEE3 questionnaire).

	2013	2015	2017	2019
Total fuel wood	1006	2201	2332	2326

By integrating data from both Probos and the JWEE questionnaire, it becomes feasible to construct a comprehensive time series from 2013 to 2021. Leveraging the trends depicted in Table 3.4, we extrapolated estimations for the years between 2013 and 2018, and the results are presented in Table 3.5.

Table 3.5. Estimated extraction of fuel wood, in kilotons.

	2013	2014	2015	2016	2017	2018	2019	2020	2021
Total fuel wood	929	1482	2034	2094	2155	2152	2149	2220	2183

3.4 Energy statistics

One of the objectives of this report is to compare different data sources. Besides the data from Probos, there is information available from the Energy statistics[6] compiled by Statistics Netherlands. This data sheds light on the production of biomass products for energy purposes and provides explicit details on the variety of products. These categories encompass a broad range of products that are produced for energy purposes, including:

- Wood chips are shredded pieces of wood, for example released during pruning work.
- Clean residual wood is residual wood that is released during the processing of wood within the wood processing industry, for example at round timber sawmills or in the carpentry or furniture industry. This is also called A-wood.
- Waste wood is wood that has previously been used for other purposes, for example furniture or in the construction of buildings. This is also called B-wood.
- Examples of other non-woody biomass are paper sludge and RDF (Refuse Derived Fuel).
- Wood pellets are pieces of compressed wood that are used as fuel.

Table 3.6. Domestic production of biomass products for energy, in kilotons.

	2013	2014	2015	2016	2017	2018	2019	2020
Wood pellets	254	320	308	296	282	345	350	366
Waste wood	864	965	959	1063	1031	1045	1240	1080
Wood chips and clean residual wood	369	407	480	483	492	727	806	1180
Fresh wood blocks	924	918	909	900	892	841	811	785
Residual products from primary agriculture	212	202	197	220	189	142	210	210
Residual products from agro-industry	225	212	266	221	212	46	132	98
Other non-woody biomass	423	452	459	410	683	573	445	527

[6] https://opendata.cbs.nl/statline/#/CBS/en/dataset/83989ENG/table?dl=6B1B5

One major concern is that the biomass production data in this table is based on the energy products, not the extraction of biomass from the environment. The domestic production could potentially be produced from waste or imported materials. The first four categories are related to wood biomass, but come partially from waste and residual flows. The wood of these flows could come from buildings that have stored the wood for many years and might not come from extraction that year. When we add the primary wood biomass categories (wood pellets, wood chips and clean residual wood and fresh wood blocks) together it results in 2331 kilotons in 2020, a little more than the 2220 kilotons of wood extraction for energy purposes that we found in the Probos data. Besides the treatment of waste and residual wood, the difference could also be explained by different conversion factors. Each specific biomass product has a specific conversion factor from cubic meters to kilograms. For the compilation of the ecosystem service, the Probos data from Table 3.3 seems to be the most reliable, as it directly covers wood extraction from the environment. It is also the most consistent with the data that we collected in the EFA.

The data from the Energy statistics does give us information on all products of biomass. Residual products from agricultural processes should also be included in the ecosystem service crop provisioning. From table 3.6, we can see that the use of this is 210 kilotons in 2020. We could assume that the use is equal to the supply. In the future, a separate map could be compiled to allocate the biomass from agriculture to the ecosystem types of the extent account. The residual products from the food processing industry and other non-woody biomass (paper sludge and RDF) are excluded. They occur further in the processing chain and are not directly linked to the extraction from the environment.

4. Domestic use of biomass for energy purposes

Considering an SEEA EA perspective, the use of ecosystem services, particularly wood biomass for energy purposes, holds significant importance. While estimating the supply of this ecosystem service is crucial, understanding its usage by different economic actors is equally essential. The use of wood biomass for energy by electricity generation and households can have notable economic and environmental impacts that must be appropriately addressed. The use of biomass for electricity generation can influence energy security, energy prices, and greenhouse gas emissions. Similarly, the use of wood biomass for household heating can affect energy access, air pollution, and public health. This short chapter aims to provide an overview of the existing data concerning the use of biomass for energy purposes as an ecosystem service.

4.1 Probos: round wood and woody biomass

The Probos annual reports offer insights into the use of both round wood (firewood) and woody biomass. Firewood, primarily used for private wood-burning stoves by households, accounts for a significant portion of the round wood energy application. In 2020, a total of 1166 kilotons of woody biomass were used for energy purposes. Of this amount, 874 kilotons were used within the Netherlands, while 292 kilotons were used abroad (export). In the Netherlands, the majority (75.4 percent) of woody biomass used for energy purposes went to biomass power plants, with the remainder being used in biomass boilers for heat production in companies. Over recent years, the sales of woody biomass in the Netherlands have gradually increased, resulting in a reduction in the amount of biomass exported. This shift is due to the growing domestic use of biomass, particularly in the form of shreds. The results are shown in Table 4.1. It shows the use of both firewood and woody biomass.

Table 4.1. Use of wood biomass for energy purposes in kilotons, 2019-2021.

	2019	**2020**	**2021**
Households (Private stoves)	895	895	895
Power plants	562	659	740
Company boilers	218	215	251

4.2 Energy statistics: use of energy products from biomass

The Energy statistics also publish some data on the use of energy products from biomass. The data are shown in Table 4.2. Not all biomass products are wood biomass products. Wood pellets and fresh logs are considered primary wood biomass that directly come from the environment (domestic or abroad). The Energy statistics do not provide data on the source of the wood that is used to make these wood products. They could be made from domestic extraction or from imported wood. Waste wood, wood chips and clean residual wood originate from residual flows from industries. Residual products from primary agriculture sources are not related to the wood extraction, but are part of the ecosystem service crop production for energy purposes. This issue will be discussed later in chapter 8. Residual products from agro-industry and other non-woody biomass are not directly extracted from the environment and are not part of wood biomass provision for energy purposes.

Table 4.2.Domestic use of biomass products for energy purposes in kilotons, 2013-2020.

	2013	**2014**	**2015**	**2016**	**2017**	**2018**	**2019**	**2020**
Wood pellets	804	298	96	113	101	320	1058	2701
Waste wood	622	739	824	944	789	728	921	726
Ow. for electricity generation	437	555	643	764	611	560	759	569
Ow. in households	185	184	182	180	178	168	162	157
Wood chips and clean residual wood	374	418	502	501	527	746	833	1273
Fresh logs (households)	924	918	909	900	892	841	811	785
Residual products from primary agriculture	212	202	197	220	189	142	210	210
Residual products from agro-industry	225	212	266	221	212	103	157	100
Other non-woody biomass	263	297	292	291	599	445	317	450

5. International trade of biomass for energy purposes

This chapter focuses on examining the international trade of wood biomass specifically intended for energy purposes. In order to compile this information, Statistics Netherlands relies on three primary sources: Probos, Energy statistics[7], and International Trade statistics[8]. The latter two sources obtain their data through industry questionnaires, although from different origins. Energy statistics provide valuable insights into domestic energy production, consumption, as well as imports and exports of various energy sources. On the other hand, International Trade statistics offer crucial data on the volume and value of global trade flows, including wood biomass for energy purposes. Probos uses the International Trade statistics and supplements them with industry expertise to make necessary corrections. These sources collectively form important foundations for comprehending the global trade dynamics of wood biomass for energy, and their integration can provide a more holistic understanding of the subject matter.

5.1 Probos: export figures

In the previous chapter the exports of wood for energy purposes was briefly mentioned. In this chapter we present an overview of the export figures that are found in the data sources from Probos. These are consistent with the supply and use figures that are presented before. The results are shown in Table 5.1.

Table 5.1. Export of fuel wood per type in kilotons, 2019-2021 (Probos, 2020; 2021; 2022)

	2019	**2020**	**2021**
Firewood	170	170	170
Woody biomass	387	292	297
Total	**557**	**462**	**467**

5.2 Energy statistics: import and export of solid biomass products

The Energy Statistics provide comprehensive data on the production, consumption, and international trade of various solid biomass types for energy purposes. Solid biomass refers to organic material from animal or plant sources used for energy generation. However, certain types of biomass, such as those used for biogas production or incineration in waste plants, do not fall under the category of solid biomass. The tables present information on the import and export of various solid biomass products. This data is updated annually and is available for T-2. The solid biomass products are further classified into categories such as wood chips, waste wood, and other non-woody biomass, including paper sludge and Refuse Derived Fuel (RDF). The solid biomass products are defined as follows:

- Wood chips are shredded pieces of wood, for example released during pruning work.
- Waste wood is wood that has previously been used for other purposes, for example furniture or in the construction of buildings. This is also called B-wood.
- Examples of other non-woody biomass are paper sludge and RDF.

[7] https://opendata.cbs.nl/statline/#/CBS/en/dataset/83989ENG/table?dl=6B1B5
[8] https://opendata.cbs.nl/statline/#/CBS/en/dataset/85428ENG/table?dl=90441

The standard unit for the Energy statistics is TJ, however the ecosystem service is defined in kilograms. We need to apply a conversion, using conversion factors. These conversion factors are published by the Netherlands Enterprise agency (Dutch: RVO)[9]. For solid biomass the conversion factor is 15.1 (MJ/unit). Table 5.2 shows the import converted to kilograms, Table 5.3 shows the export converted to kilograms.

Table 5.2. Import of solid biomass in kilotons (Energy Statistics).

	2013	2014	2015	2016	2017	2018	2019	2020
Wood pellets	709	207	0	0	0	189	925	2619
Waste wood	146	163	226	250	127	52	49	15
Other	5	11	22	28	79	75	52	146

Table 5.3. Export of solid biomass in kilotons (Energy Statistics).

	2013	2014	2015	2016	2017	2018	2019	2020
Wood pellets	159	229	213	184	180	214	217	285
Waste wood	388	388	362	368	368	368	368	368
Other	160	155	167	129	129	129	129	129

The classification of "other" does not incorporate solid biomass derived from wood, instead it encompasses materials such as paper sludge and RDF, thus making it irrelevant for the current study. The categories that are of significance are "wood pellets" and "waste wood".

5.3 International Trade statistics

From the International Trade statistics on Statline[10] we can extract the Dutch import, export value and quantities are classified according to border crossing into sections VIII-XV of the Combined Nomenclature (CN). They are based on goods movements where the goods physically cross the Dutch border, without always involving a transfer of ownership.

Table 5.4. Import of solid biomass, in mln kg (International Trade statistics).

	2015	2016	2017	2018	2019	2020	2021*
Firewood	22	13	58	43	96	61	59
Wood pellets	216	208	329	598	1237	2438	3069
Wood briquettes	0	0	0	0	0	0	0
Charcoal	71	72	61	118	85	94	88

**Provisional figures*

Table 5.5. Export of solid biomass, in mln kg (International Trade statistics).

	2015	2016	2017	2018	2019	2020	2021*
Firewood	38	30	8	10	8	6	15
Wood pellets	248	208	232	274	316	227	250
Wood briquettes	0	0	0	0	0	0	0
Charcoal	33	21	13	16	19	26	36

**Provisional figures*

[9] https://www.rvo.nl/sites/default/files/2020/03/Nederlandse-energiedragerlijst-versie-januari-2020.pdf

[10] https://opendata.cbs.nl/#/CBS/nl/dataset/85432NED/Table?ts=1679301929950

There are notable differences in the outcomes of the International Trade statistics and the Energy statistics data on the trade of biomass for energy purposes. While both sources provide data on the international trade of solid biomass products for energy, the Energy statistics tend to have lower figures for the trade of solid biomass. This is primarily due to the fact that the Energy statistics exclude re-exports of biomass products, which are included in the International Trade statistics. It is important to keep this distinction in mind when interpreting and comparing data from the two sources. When it comes to physical (in weight) figures, the Energy statistics data is considered to be more reliable than the International Trade statistics data, which is more focused on monetary values. Converting these monetary values to physical units can be influenced by factors such as changes in currency exchange rates and the use of annual prices.

The data from the Probos reports are based on data from Statistics Netherlands, but are adjusted based on expert knowledge of the industry. This data is also consistent with the supply and use data that was shown in the previous chapters. Therefore, for the purposes of our analysis on the trade of biomass for energy purposes, we have chosen to rely on the Probos data as it provides more accurate and consistent information on the physical quantities of solid biomass products traded.

6. Monetary valuation

The supply in physical terms can also be expressed in monetary terms, using monetary valuation techniques. For wood provisioning services, we apply the stumpage price method. Stumpage prices (in Dutch 'hout op stam') are the prices paid per standing tree, including bark, for the right to harvest from a given land area. The stumpage prices most directly reflect the value of the ecosystem service, because they are actual market prices paid to harvest wood and thus fully consistent with SNA exchange values. Prices are collected and published by Wageningen Economic Research (Wageningen Economic Research, 2021). Stumpage prices are available for different timber categories (pine, douglas, larix, other coniferous, willow, poplar and other deciduous wood). Here, an average stumpage price for all types of timber was taken. There is no further regionalization of the prices.

The value of the ecosystem service timber production is calculated by multiplying the stumpage price (euros/m3) with the total amount of wood harvested (m3). Our current data was expressed in kilotons, so we need to convert this to cubic meters. The supply in cubic meters is shown in Table 6.1.

Table 6.1. Domestic extraction of wood biomass for energy purposes in m_3, 2019 to 2021.

	2019	**2020**	**2021**
Firewood	1779	1779	1779
Woody biomass	1949	1947	2151

When we multiply the extraction in cubic meters with the stumpage prices found in the reports of WEcR, we find the monetary value of the annual flows of the ecosystem services wood provision for energy purposes. The results are shown in Table 6.2.

Table 6.2. Monetary value of wood biomass for energy purposes in mln euro, 2019 to 2021.

	2019	**2020**	**2021**
Wood biomass	123	162	170

The monetary value has been increasing between 2019 and 2021, mostly due to increasing timber prices for the Netherlands. In 2020, the average wood price increased by a third (compared to 2019) to 44 euros per m3. The costs for management and supervision rose the most in absolute and relative terms, from average 82 euros in the years 2016-2019 to 95 euros per ha of forest in 2020. Together with the work by third parties, this cost item is the most important cost item in 2020, accounting for 32% and 27% of the costs respectively (Wageningen Economic Research, 2021).

7. Results

This chapter combines the results from chapter 4.1 to 4.3 and shows an overview of our final results. Table 7.1 and 7.3 show the supply and use of wood biomass for energy purposes, according to the breakdown that is widely used in ecosystem accounting. Table 7.2 is shown to illustrate that the supply is equal to the use of Table 7.3. These results are all based on data from Probos.

Table 7.1. Extraction of wood biomass for energy purposes per ecosystem type in kilotons, 2020.

Ecosystem type	Extraction	Ecosystem type	Extraction
Plantation forest	534	Heathland	16
Built-up (urban)	270	Perannuals, regular	10
Infrastructural	218	Other terrain	8
Public green space, other	151	Pasture, extensive	7
Pasture, permanent	129	Bogs	6
Built-up (rural)	119	Fens	5
Grassland, other	108	Perannuals, extensive	4
(Semi-)natural forest	105	Greenhouse horticulture	4
Forest, other	91	Coastal dunes	4
Cropland, regular	62	Mining, landfills, etc.	2
Public park (small)	58	Tall herbs	2
Residential recreation	54	Arable field margins	2
Swamp forest	50	Drift sand	2
Hedges and treelines	40	Landscape garden	1
Business park	37	Cropland, extensive	1
Sport park	29	Cropland, nature	1
Semi-natural grassland	29	Fallow land	0
Pasture, temporal	26	Nursery container fields	0
Semi-public green space	24	Salt marshes	0
Public park (large)	22	Other, different	0

Table 7.2. Domestic supply of wood biomass for energy purposes in kilotons, 2019-2021.

	2019	2020	2021
Firewood	1065	1065	1065
woody biomass	1167	1166	1288
Total	**2232**	**2231**	**2353**

Table 7.3. Use of wood biomass for energy purposes in kilotons, 2019-2021.

	2019	2020	2021
Power plants	562	659	740
Company boilers	218	215	251
Households	895	895	895
Export	557	462	467
Total	**2232**	**2231**	**2353**

These tables can be integrated in our existing work of Natural capital accounting for the Netherlands. The supply table per ecosystem type from Table 3.1 can also be produced for other years and is compatible with our current supply tables of ecosystem services.

8. Data gaps and limitations

While the results of this report have been useful in compiling the ecosystem service of wood biomass provision for energy purposes and developing an ecosystem service map, there are still notable data gaps and limitations in the current data sources and methodology. This chapter aims to provide a brief overview of these challenges and discuss potential work in the future.

1. **Spatial disaggregation:** The level of detail in spatial disaggregation of the data remains limited. Currently, the attribution of firewood and woody biomass is confined to forest, landscape, and urban areas at the national level. Improving the quality of the ecosystem service map would require more specific data, such as province-level information. However, Probos has stated that such data is currently unavailable, partially due to privacy concerns. Additionally, incorporating finer details regarding the types of trees harvested, such as distinguishing between coniferous, deciduous, and mixed forests, could be achieved by integrating the ecosystem type map with the Top10NL terrain map.

2. **Time series:** For the years 2019 until 2021 we have made a consistent time series. There is data available before 2019, but this comes from a different publications by Probos and does not include the same level of detail that is needed to compile the supply and use account, that is consistent. The data should be available to Probos and for the next update, we should be able to acquire this data to make the time series consistent with our previous work.

3. **Reporting unit:** A challenge arises from the proposed legal module, which states that the unit of measure for wood biomass should be net increment, while the ecosystem service thus far has been reported in kilotons of extraction. This discrepancy in units may impact the usability of the data, highlighting the need for standardization in units of measure. Resolving this issue within the ecosystem accounting work conducted by Statistics Netherlands is pending until the new legal module is finalized later this year.

4. **Data Sources and Comparability:** During the data inventory process, multiple sources of data were analysed. However, these statistics rely on different questionnaires and yield different results. Energy statistics, excluding re-export, tend to be more reliable than International Trade statistics. Nonetheless, the supply and use data were compiled using data from Probos, because of reliability and consistency. Further analysis of the differences between these sources and exploring opportunities for alignment would be valuable.

5. **Inclusion of Agricultural Biomass:** Biomass for energy purposes extends beyond wood biomass to include biomass derived from residual flows in the agricultural sector as well. Although data on the annual supply of agricultural biomass exists, there is limited knowledge about its specific use and international trade. Estimating these aspects and including them in the ecosystem service would provide a more complete representation.

Addressing these data gaps and limitations will contribute to the refinement and robustness of our analysis, allowing for a more comprehensive understanding of the ecosystem service of (wood) biomass provision for energy purposes in the Netherlands.

9. Conclusions

The primary objective of this section of the report was to estimate the production of wood biomass for energy purposes, utilizing the models developed in the Dutch ecosystem accounts for round wood production. The aim was to incorporate this new ecosystem service into our existing work on ecosystem accounting. The results demonstrate the feasibility of achieving this objective with the currently available data sources. In fact, we have successfully generated an ecosystem service map for domestic wood extraction in the Netherlands, using data from 2020. For the time series, we either have existing data or can estimate it using information from Probos.

Furthermore, we have made significant progress in estimating the use of wood biomass and have included relevant figures on international trade. These aspects are crucial components in compiling the ecosystem service and integrating it into our existing framework.

Throughout the report, we have compared our primary data with additional data sources, as outlined in the sub-objectives. It is noteworthy that there are several different sources available, each with its own definition of key concepts such as production, use, and international trade. Energy statistics and International Trade statistics have proven useful in analysing the results, although they are based on distinct statistical principles and definitions. Comparisons can be challenging due to factors like the treatment of re-export and variations in questionnaire design.

In conclusion, we can affirm that the Probos data is the most reliable and consistent among the different elements of the ecosystem service, encompassing supply, use, and international trade. The robustness and consistency of the Probos data make it an invaluable resource for our analyses and the integration of wood biomass for energy purposes within the ecosystem accounting framework. In our upcoming annual update of the Dutch Natural Capital accounts we are able to integrate the results from this report and add (wood) biomass for energy purposes to our wood provisioning ecosystem service.

10. References

European Commission. (2022). *WOOD PROVISION ECOSYSTEM SERVICE – GUIDANCE NOTE Draft version prepared by the Task force on ecosystem accounting for a written consultation by the Environmental accounts working groups (WG EA and MESA).*Statistics Netherlands (2019). *Houtverbruik huishoudens WoONonderzoek 2018*.

Wageningen Economic Research (2020). *Pachtnormen 2020: Berekening hoogst toelaatbare pachtprijzen voor los land, agrarische bedrijfsgebouwen en agrarische woningen.*