

FORESTaccounts



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Country Steering Committee

Costa Rica established a National Steering Committee (NSC) which works to include the NCA in policy formulation, and to support the development of Environmental Accounts. The technical support, data and information provided by representatives of ministries and governmental agencies under the direction of the committee is gratefully acknowledged through a recognition of their leaders:

Mr. Edgar Gutiérrez (President), Minister, Ministry of the Environment and Energy (MINAE)
Mr. José Francisco Pacheco, Vice Minister, Ministry of Finance (MH)
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Disclaimer

This document was prepared with figures from the Forest Account for the period 2008-2011 and 2011-2013 published in May 2016. However, the accounting tables for Forest Accounts available on the website of the Central Bank of Costa Rica correspond to the latest updated version. Given the ongoing revision process and strengthening of the Environmental Accounts, it is possible that the figures in this report do not match the figures published in the updated accounting tables of the website. To have access to the accounting tables published in May 2016, please address your request to the following e-mail address: <u>estadisticasambientales@bccr.fi.cr</u>

This work is part of an ongoing, continuous improvement process of Environmental Accounts compilation. It is therefore not a final or definitive version. The Central Bank of Costa Rica (BCCR) would appreciate suggestions, comments and the submission of complementary and updated data sources, which may help improve future versions of the accounts.

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ACRONYMS

EA	Economic Activity					
BCCR	Banco Central de Costa Rica					
SUT	Supply and Use Table					
FCPF	Forest Carbon Partnership Facility					
FONAFIFO	National Fund for Forest Financing					
INEC	National Institute of Statistics and Census					
INF	National Forest Inventory					
PN	Product nomenclature					
ONF	National Forestry Office					
GDP	Gross Domestic Product					
PES	Payment for Environmental Services					
SEEA- CF	System of Environmental Economic Accounting – Central Framework					
SEEA- EEA	System of Environmental Economic Accounting – Experimental Ecosystem Accounting					
SNA	System of National Accounts					
SINAC	National System of Conservation Areas					
SIREFOR	Forest Resources Information System					



LIST OF TABLES

TABLE 1. Distribution of Land Use in Costa Rica, 2013	9
TABLE 2. Land cover classification	14
TABLE 3. Basic Format of a Supply and Use Table in Monetary Terms	16
TABLE 4. Basic Format of a Supply and Use Table in Physical Terms	16
TABLE 5. Basic Form of Asset Accounts	17
TABLE 6. Average Volume by Forest Type and Tree Size (in m ³ per hectare) – 2015	19
TABLE 7. Average Biomass by Forest Type and Tree Size (tons per hectare) –2015	19
TABLE 8. Average Carbon by Forest Type and Tree Size (tons per hectare) –2015	19
TABLE 9. Average Carbon Dioxide by Forest Type and Tree Size (tons per hectare) –2015	20
TABLE 10. Selection of Strata by Data Source	21
TABLE 11. Land Cover Evolution by Categories (km²)	21
TABLE 12. Evolution of Land Cover by Categories (cover %)	22
TABLE 13. Land Cover Areas for the Years 2008, 2011 and 2013 (Ha)	23
TABLE 14. Land Use Classification	24
TABLE 15. Land Cover Classification	24
TABLE 16. Codes and Descriptions of Forest-Related Activities	32
TABLE 17. Codes and Descriptions of Forest-Related Products	33
TABLE 18. Monetary Supply and Use Table for Forests, 2011 (in millions of colones)	34
TABLE 19. Monetary Supply and Use Table for Forests, 2012 (in millions of colones)	38
TABLE 20. Monetary Supply and Use Table for Forests, 2013 (in millions of colones)	42
TABLE 21. Costa Rica: Land Cover Account, 2008-2011 (hectares)	47
TABLE 22. Costa Rica: Land Cover Account, 2011-2013 (hectares)	48
TABLE 23. Costa Rica: Land Cover Change Matrix, 2008-2011 (hectares)	49
TABLE 24. Costa Rica: Land Cover Change Matrix, 2011-2013 (hectares)	50
TABLE 25. Costa Rica: Physical Assets Account for Forests and Other Wooded Lands, 2008-2011	
(hectares)	51
TABLE 26. Costa Rica: Physical Assets Account for Forests and Other Wooded Lands, 2011-2013	
(hectares)	52
TABLE 27. Costa Rica: Physical Assets Account for Timber Resources, 2008-2011 (tons)	53
TABLE 28. Costa Rica: Physical Assets Account for Timber Resources, 2011-2013 (tons)	54
TABLE 29. Costa Rica: Physical Accounts for Forest Carbon, 2008-2011 (tons)	55
TABLE 30. Costa Rica: Physical Accounts for Forest Carbon, 2011-2013 (tons)	55
TABLE 31. Land Cover Evolution in Relative Terms (in %)	58



LIST OF ANNEXES

ANNEX 1. Land Cover Evolution by Category (km ²)	63
ANNEX 2. Land Cover Evolution by Category (in %)	64
ANNEX 3. Scheme for the Economic Valuation of the Forest	65

LIST OF FIGURES

FIGURE 1. Composition of total wealth	11
FIGURE 2. Systems of National and Environmental Accounts	12
FIGURE 3. Land and Environmental Assets	13
FIGURE 4. Disaggregation of Land Use in the SEEA-CF	14
FIGURE 5. Physical Flows of Natural Inputs, Products and Waste	15
FIGURE 6. Forest – Non Forest Land Cover Change, period 1992-1997	26
FIGURE 7. Forest – Non Forest Land Cover Change, period 1997-2008	27
FIGURE 8. Forest – Non Forest Land Cover Change, period 2008-2013	28
FIGURE 9. Land Cover Change Between Forest and Other Cover Classifications, period 1992-1997	29
FIGURE 10. Land Cover Change Between Forest and Other Cover Classifications, period 1997-2008	30
FIGURE 11. Land Cover Change Between Forest and Other Cover Classifications, period 2008-2013	31
FIGURE 12. Land Cover Changes, 2008-2011	56
FIGURE 13. Land Cover Changes, 2011-2013	57
FIGURE 14. Percentage Increases by Land Cover Origin	57
FIGURE 15. Percentage Increases of Forest Cover Use by Forest Cover Type	58
FIGURE 16. Forest Contribution to the Economy (% of GDP)	59



TABLE OF CONTENTS

1. EXECUTIVE SUMMARY
2. INTRODUCTION
3. THE STATE OF FORESTS IN COSTA RICA
4. DATA SOURCES AND METHODOLOGY10
4.1. Forest Accounting: Conceptual Framework
4.1.1. The Forest account in the SEEA-CF12
4.1.2. Flow Accounts in the SEEA-CF15
4.1.3. Asset Accounts
4.2. Information Sources
4.3. Work conducted using the National Forest Inventory (INF)18
4.4. Forest Cover Time Series
4.4.1. The land asset in environmental accounting23
5. SUPPLY AND USE TABLE (SUT): Flows
6. TABLES FOR THE ASSETS ACCOUNT
7. RESULTS
8. CONCLUSIONS
9. REFERENCES
10. ANNEXES



1. EXECUTIVE SUMMARY

Costa Rica's forest cover has been increasing since 1992. An analysis of the periods 2008-2011 and 2011-2013, shows that the composition of land cover has promoted forest growth by 1% and 3%, respectively. This increase in forest cover took place on land that was previously dedicated to crops and pastures. Specifically, the increase is particularly notable in natural forest, which accounts for over 60% of total of increases forest in both periods.

An increase is also observed in the physical accounts for timber. The data show that the stock of planted forest increased by approximately 27%; however, its average weight within the country's total timber tonnage was approximately 1% in 2011, 2012, and 2013.

The data also indicate that there was a 3% increase in carbon fixed by forests, which is intrinsically related to the increase in forest area and forest conservation.

Forest flow accounts created using supply and use tables (SUTs) for 2011, 2012 and 2013 make it possible to specify forest value within the national accounts. Determining activities and products related to forests also allow to increase the value of this natural asset, bringing to light new added value at market prices within the structure of national accounts.

The forest industry represented less than 0.2% of GDP for the three years analyzed. The weight of the forest sector with respect to GDP rises to an average of almost 1% when considering a "Forest economy" approach, which includes the codes for economic activities EA027, EA056 and EA057 crossed with the codes for the products PN036, PN070 and PN071. Lastly, when economic activities classified as non-extractive of forest products but which make use of forest products are added to the previous category, the share of this "Extended Forest Economy" reaches an average of slightly more than 2% of GDP. It includes the same product codes as the "Forest economy", but the EA category is left open to include imports, profit margins, taxes, and other items related to income generation from extractive activities in the forest.



2. INTRODUCTION

The recovery of forest cover in Costa Rica experienced in the last years rises a series of questions related to forest management. One one hand, the timber industry is seeking to obtain more permits for timber exploitation. Oh the other hand, conservation and reforestation policies are formulated to achieve environmental objectives such as carbon neutrality, increased forest cover and the strengthening of protected areas. It is therefore necessary to develop new indicators that help to guide the design of policies that address the challenges of sustainable development while providing strong management of forest resources.

This report shows advances in terms of forest accounting from a resource perspective. To achieve this objective, the System of Environmental Economic Accounting– Central Framework (SEEA-CF) is used as a guide for designing tables that comply with the basic format of flows and asset accounts (United Nations et al, 2014a). These tables are compatible with those produced by the System of National Accounts (SNA) and provide relevant information to elaborate indicators that support sustainable development policy.

The report also presents preliminary results on the "hidden" value of forests within the national accounts. This exemplifies how an asset may assume greater importance in the economy if productive sectors whose activities are linked to forests are taken into account. Lastly, it attempts to show the importance of forests as providers of ecosystem services. Physical asset accounting plays a fundamental role in this task since it records the amount and state of ecosystem services, which are two essential factors in environmental accounting.

3. THE STATE OF FORESTS IN COSTA RICA

With an area of 51,100 km², Costa Rica has been able to recover a great part of its forest coverage. In 1987 forests represented 21% of the total territory. Since then a series of policies have been implemented to stop deforestation, allowing Costa Rica to achieve, in 2013, a forest coverage of 52.4% of the territory (REDD / CCAD-GIZ-SINAC Program, 2015). It is estimated that the country has achieved an annual forest growth rate of approximately 0.5%, becoming the first tropical country to stop and reverse deforestation (Barquero & Hernández, 2015).

Among the most important provisions that have played a role in forest recovery are the launching of the system of payment for environmental services (PES) and the expansion of protected areas. In the case of the PES, the implementation of an "economic incentive" approach to forest services helps to increase the ecological, environmental and economic values of resources. The PES is mainly financed through a flat fuel tax, of which 3.5% is earmarked for the PES. These funds allow the payment of environmental services for 300,000 hectares of forest which represent nearly 13% of the country's forest area and slightly more than 7.5% of the total territory, as well as 25% of the country's private forests (FONAFIFO, 2015).

With regard to protected areas, according to data from the National System of Conservation Areas (SINAC), 26.3% of the continental territory is considered to be a conservation area (SINAC, 2015). Within these areas, the management of a series of timber extraction permits is regulated by Law No.7575, which provides, mainly, the State obligation to "ensure conservation, protection and management of natural forests, and the management of production, utilization, industrialization and development of the country's natural resources intended for that purpose,



according to the principle of adequate and sustainable use of renewable natural resources" (Asamblea Legislativa, 1996).

Costa Rica's forest cover is classified into six types of forests: mature forest, secondary forest, deciduous forest, palm forest, mangrove forest, and forest plantations, of which mature forests cover the largest area. According to the National Forest Inventory (INF) classification, a mature forest is a forest ecosystem that has resulted from a process of succession which has remained uninterrupted for 75-100 or more years. It is usually assumed that these forests are not subject to anthropic influences (for instance, timber extraction); however, they may be affected by subsistence extractive activities (SIREFOR, 2013).

Table 1 presents data on the percentages of forest distribution according to the INF classification. They show that secondary and primary forest constitute 46% of total coverage, and that primary forest has the highest representation within the forest types.

Type of Forest	Percentage of Total Area, by category (%)
Mature forest	31
Secondary forest	14
Deciduous forest	5
Palm forest	1
Mangrove forest	1
Forest plantation	2
Subtotal	52
Pastures	24
Moors	0
Non-forest	14
Clouds	7
Shadows and clouds	3
Total	100

TABLE 1. Distribution of Land Use in Costa Rica, 2013

Source: Programa REDD/CCAD-GIZ - SINAC (2015).

According to official data from the SINAC, forest coverage reached its lowest point in 1987, after which recovery began due to the effects of various public policies. This shows the interest of the country in recovering forest assets, and the recognition of their importance beyond timber extraction. Costa Rica has invested over \$300 million in payments for environmental services over two decades (FONAFIFO, 2015) elucidating the importance of forest conservation and recognizing forests as agents that produce positive externalities.

Forests as mitigating factors of climate change have become a key element in achieving national objectives such as carbon neutrality by 2021. Carbon sequestration is the way in which forests store CO_2 to convert it into biomass.



Besides the carbon fixation process itself, stopping deforestation avoids the release of CO_2 captured by forests through the years.

The importance of forests within other economic sectors stands out. For instance, tourism represents 4% of GDP, and the scenic beauty that draws tourists to Costa Rica is greatly due to its forested areas, with their great diversity of flora and fauna.

Forest assets are also involved in the country's economic dynamics in the area of hydroelectric generation, which produces slightly more than 80% of the total electricity supply. Forests contribute to keep soil from washing into rivers, avoiding sedimentation that would interrupt the flow that hydroelectric plants need to operate.

The value of forests in the national accounts is also seen in silviculture, which contributes approximately 0.2% of GDP. Environmental accounts help to make the value of forests in the market economy more visible by constructing supply and use tables (flows) that highlight the contribution of forests to other activities in addition to silviculture.

In this way, forests act as providers of environmental goods and services. To understand these new relationships between the economy and forests, it is necessary to use approaches that recognize forests as a resource and forests as ecosystems; therefore providing a more inclusive idea of their true value. Hence, it is clear that forests are fundamental for the functioning of various sectors of the Costa Rican economy. However, an accounting method that shows their underlying value does not exist.

The forests account is intended to fill the information gap with respect to the value of this natural asset. Physical and monetary accounting, as well as flow and stock tables, represent more clearly the changes and interaction of forests with the economy, and have the advantage of being directly connected to the System of National Accounts (SNA), allowing for a link between the SEEA-CF and the SNA.

4. DATA SOURCES AND METHODOLOGY

This section explains the process of creation and use of forest data to advance in the compilation of the forest account. Data management, transformations and calculations conducted to produce statistics and indicators are explained below.

4.1. Forest Accounting: Conceptual Framework

Wealth sustains the income generated by countries. Wealth includes buildings, manufactured goods, infrastructure, and natural assets such as land, forests, fish, minerals and energy, as well as human and social capital.

To obtain a comprehensive overview of the accounting of a country's wealth it is necessary to go beyond the scope of the System of National Accounts. Figure 1 shows how a country's total wealth consists of elements beyond those recorded as "produced capital".





FIGURE 1. Composition of total wealth

Source: http://www.wavespartnership.org/en/wealth-accounting-and-WAVES

The foundation for national wealth accounting is a strong method based on the 2008 System of National Accounts (SNA-2008), which provides statistics designed to serve as useful indicators for better policy-making decisions. The Central Framework of the System of Environmental Economic Accounting (SEEA-CF) applies the accounting concepts, structures, standards and principles of the SNA to environmental information. The SEEA is a multipurpose, conceptual framework designed to understand the reciprocal effects between the economy and the environment, and to describe the stocks of environmental assets and their variations (United Nations et al, 2014a). Countries use GDP as a measurement of economic performance, but it only measures income and current production. Environmental accounting can provide statistics for better management of the economy.

Figure 2 presents the organization of both documents, and implicitly shows their mutual complementarity. The SEEA Experimental Ecosystem Accounting (SEEA-EEA) is also included, which presents a methodology for ecosystem assessment which is still under development.





FIGURE 2. Systems of National and Environmental Accounts

Source: BCCR based on data retrieved from http://www.wavespartnership.org/en/wealth-accounting-and-WAVES

The document of the Central Framework of the System of Economic-Environmental Accounting (SCAE-MC, United Nations et al, 2014a) makes it possible to integrate environmental information with economic information under the same scheme, incorporating physical and monetary information in a coherent manner, using the same definition of economic territory and economic activity based on the concept of the residence of the economic agent. The SEEA-CF also applies accounting principles, structures, standards and principles of the SNA to environmental information, and both of them use the same manuals for classifications in monetary terms.

It is relevant for decision-making and for the development and evaluation of policies, especially those related to sustainable national development. In one single measurement system, it brings together information about water, minerals, energy, timber, water resources, soil, land and ecosystems, pollution and waste, production, consumption and accumulation; and it deals with all of them as a set of accounts of environmental assets, flows, environmental expenditures, and environmentally adjusted macro-aggregates. Additionally, it provides detailed statistics for better management of an economy, and it may also help countries with a rich biodiversity to design strategies to manage trade-offs between ecotourism, agriculture, subsistence livelihood, and ecosystem services.

4.1.1. The Forest account in the SEEA-CF

According to the SEEA, the scope of the account for forests and other woodlands should be based on a land use perspective. It therefore does not include lands that are primarily dedicated to agricultural or urban use, and the account is not strictly defined based on changes in the areas covered by forests. As mentioned previously, the forest account is developed as part of the SEEA-CF. The forest asset is included within the land account; in addition, forests are considered a type of land cover and are viewed differently from silviculture, which is treated as a type of land use.

It is important to mention that there is a difference between the forest asset and the timber asset, and that the SEEA-CF separates them by resource. As shown in



Figure 3, forests belong to the land sub-category, and timber resources found in these lands are regarded as a separate environmental asset.



FIGURE 3. Land and Environmental Assets

Source: BCCR based on data retrieved from United Nations et al (2014a).

Land cover classification has several subdivisions, one of which is forest coverage. Figure 4 extends the classification map to reflect the location of forest accounts within the SEEA-CF. The 14 divisions of the land cover classification are shown in Table 2.



FIGURE 4. Disaggregation of Land Use in the SEEA-CF



Source: BCCR based on data from United Nations et al (2014a).

TABLE 2. Land cover classification

1. Artificial surfaces (including urban and associated
areas)
2. Herbaceous crops
3. Woody crops
4. Multiple or layered crops
5. Grassland
6. Tree-covered areas
7. Mangroves
8. Shrub-covered areas
9. Shrubs and/or herbaceous vegetation, aquatic or
regularly flooded
10. Sparsely natural vegetated areas
11. Terrestrial barren land
12. Permanent snow and glaciers
13. Inland water bodies
14. Coastal water bodies and intertidal areas

Source: United Nations et al (2014a).

According to Lange (2003), forest accounts primarily help to address two issues:

- To establish the real socioeconomic value of forests with respect to the rest of the economy.
- To evaluate the impact of non-forest related policies.



To create these accounts, the SEEA-CF proposes, in a manner analogous to the SNA, two basic sections: one of tables that include the supply and use of a resource (flows), and another one of assets, which provides information about stocks and their changes. Each of those tables follows a format designed to be compatible with the SNA and eventually comparable between countries.

The basic format of the assets and flows accounts in general terms is presented below. This sequence is used for all resources included in the SEEA-CF; the basic information necessary to create the forest tables is mentioned later in this document.

4.1.2. Flow Accounts in the SEEA-CF

The monetary supply and use tables record all flows of products in the economy between different economic units in monetary terms. They are compiled to show the structure of the economy at the level of economic activities. Many of the flows of products recorded in monetary terms refer to the use of natural inputs from the environment (for example, manufacture of wooden products), or activities and payments related to the environment (such as payments for protection of the environment) (United Nations et al, 2014a).

The SEEA-CF gives an integral approach to the interaction between the environment and the economy, establishing that the economy is circumscribed by the environment, and discussing the exchange of inputs, products and wastes. Figure 5 shows the relationships between stakeholders within the flow accounts. According to the SEEA-CF, the monetary supply and use table is divided into two parts: the supply table and the use table. In general, the total supply of each product must be equal to its total use. This equality between total supply and total use of each product is known as identity of supply and use – a fundamental equality both in the monetary supply and use tables, and in those of physical supply and use tables.



FIGURE 5. Physical Flows of Natural Inputs, Products and Waste

Source: United Nations et al (2014a).



Table 3 shows the components of the supply and use table (SUT) in monetary terms; the form follows the format of the tables developed in the 2008 SNA.

	Industries	Households	Government	Accumulation	Rest of the world	Total
Supply table						
Products	Output				Import	Total supply
Use table						
Products	Intermediate consumption	Household final consumption expenditure	Government final consumption expenditure	Gross capital formation (incl. changes in inventories)	Exports	Total Use
	Value added					

TABLE 3. Basic Format of a Supply and Use Table in Monetary Terms

Source: United Nations et al (2014a).

The form of physical accounts in the SUT is very similar to that of monetary accounts, but a column for the environment is added to show flows with the economy. Table 4 shows the basic form of this account.

TABLE 4. Basic Format of a Supply and Use Table in Physical Terms

				Rest of the		
	Industries	Households	Accumulation	world	Environment	Total
Supply table						
Natural inputs					Flows from the environment	Total supply of natural inputs
Products	Output			Imports		Total supply of products
Residuals	Residuals generated by industry	Residuals generated by final household consumptio n	Residuals from scrapping and demolition of produced assets			Total supply of residuals
Use table						
Natural inputs	Extraction of natural inputs					Total use of natural inputs
Products	Intermediat e consumptio n	Household final consumptio n	Gross capital formation	Exports		Total use of products
Residuals	Collection and treatment of waste and other residuals		Accumulation of waste in controlled landfill sites		Residual flows direct to environment	Total use of residuals

Source: United Nations et al (2014a).



4.1.3. Asset Accounts

The objective of asset accounts is to record initial and final stocks of environmental assets and their variations during an accounting period. One of the objectives of environmental assets is to evaluate whether the current patterns of economic activity are depleting available environmental assets. The information contained in the assets accounts may be used as an auxiliary element in the management of these assets, and the evaluations of natural resources and land may be combined with the evaluation of produced and financial assets to obtain a more comprehensive estimation of the national patrimony (United Nations et al, 2014a).

In monetary terms, the limits of assets within the SEEA-CF and the SNA are the same. Therefore, only assets (including natural resources and land) that have an economic value following the SNA valuation principles are included in the SEEA-CF. In this sense, the scope in physical terms is not limited to assets that have an economic value. It is recommended that environmental assets which do not have an economic value be clearly distinguished (United Nations et al, 2014a). Table 5 shows the basic form of the assets account which may be applied for physical and monetary terms, except that stock revaluation can only be applied if accounting is being carried out in monetary terms.

Additions to stocks
Growth in stock
Discoveries of new stocks
Upward reappraisals
Reclassifications
Total additions of stock
Reductions of stock
Extractions
Normal loss of stock
Catastrophic losses
Downward reappraisals
Reclassifications
Total reductions in stock
Revaluation of stocks*
Closing stock of environmental assets

TABLE 5. Basic Format of Asset Accounts

*Only applicable for asset accounts in monetary terms. Source: United Nations et al (2014a).

This is the basic format used to prepare accounts for any environmental asset according to the SEEA-CF. The information sources available to compile forest accounts in Costa Rica are presented below.

4.2. Information Sources

Environmental accounts are built upon monetary and physical data. Institutions from which statistics are obtained differ from what has traditionally been done in



national accounts, due to the fact that new actors and new information is being incorporated. For this reason, the construction of communication channels is vital.

The monetary data is mainly taken from information compiled by the Banco Central de Costa Rica (BCCR), which is in charge of developing the SNA. Essential data for the creation of the environmental accounts are found in the national accounts, such as the supply and use tables (SUTs) for each of the sectors in the economy, the input-output (I-O) matrix, and all the outputs generated from the change of the baseline year and the new production structure for Costa Rica.

The National Forestry Office (ONF), is a source of information of primary data for the national accounts. Physical and monetary data for the forestry sector come from the ONF, specifically those related to timber and wood products. In addition, annual statistics reports are used to put the timber industry and the use of forests for this purpose in context.

The SINAC provides the National Forestry Inventory (INF) for the year 2013 which includes data on forest cover by type of forest, timber volume, CO₂, biomass, carbon, etc. (Programa REDD/CCAD-GIZ-SINAC, 2015). Another important source of information is the study conducted by Pedroni at al (2015). This study links together data on Costa Rican forest coverage for years prior to 2013 and disaggregates it by type of cover under the study's own classification system. This classification does not necessarily coincide with that used by the INF, but it can be used by making a series of assumptions that will be discussed in more detail below.

4.3. Work conducted using the National Forest Inventory (INF)

The statistics used in the assets tables are prepared with data from the National Forest Inventory (INF) of the SINAC. The original database from the INF was used, which contains 286 observations from a census of land parcels stratified by type of forest (using the methodology implemented by the SINAC). Additionaly, information from the SINAC on types of uses and soil cover in Costa Rica was used.

The INF database is used to create cross-tabulations of variables which are considered to be of interest in the generation of statistics for the account. Tables are constructed per stratum and tree-size classification, defining the study variables: timber volume, biomass, CO₂ and carbon. Given that the INF information provides figures per hectare per property, the tables obtained are averages for each of the cross-tabulations. These averages are added to calculate the total per stratum of each of the variables studied. Tables 6 to 9 show the results obtained directly from the INF with the cross-tabulations and variables previously described.



Type of forest	Average volume (m3/ha) [DBH>10 cm]	Average volume (m3/ha) [DBH 2-10 cm]	Average volume (m3/ha) [DBH >2 cm]	Sum of average volume
Palm forest	191.05	5.91	196.96	393.92
Mature forest	338.00	10.33	348.33	696.66
Secondary forest	159.23	9.74	168.97	337.94
Pasture with trees	34.04	0.20	34.24	68.48
Forest plantation	86.17	0.03	86.20	172.40
Mangrove forest	131.67	3.87	135.54	271.08
Total	940.17	30.07	970.24	1,940.48

TABLE 6. Average Volume by Forest Type and Tree Size (in m³ per hectare) – 2015

Source: BCCR based on data retrieved from Programa REDD/CCAD-GIZ – SINAC (2015).

TABLE 7. Average Biomass by Forest Type and Tree Size (tons per hectare) –2015

Type of forest	Biomass average (ton/ha) [DBH >10 cm]	Biomass average (ton/ha) [DBH 2-10 cm]	Biomass average (ton/ha) [DBH >2 cm]	Suma of biomass average
Palm forest	111.33	4.44	115.77	231.55
Mature forest	244.04	9.15	253.19	506.37
Secondary forest	111.27	8.70	119.97	239.94
Pasture with trees	21.75	0.19	21.94	43.88
Forest plantation	51.68	0.09	51.77	103.53
Mangrove forest	123.13	3.84	126.98	253.96
Total	663.20	26.41	689.61	1,379.23

Source: BCCR based on data retrieved from Programa REDD/CCAD-GIZ - SINAC (2015).

TABLE 8. Average Carbon by Forest Type and Tree Size (tons per hectare) -2015

Type of forest	Carbon average (ton/ha) [DBH >10 cm]	Carbon average (ton/ha) [DBH 2-10 cm]	Carbon average (ton/ha) [DBH >2 cm]	Sum of carbon average
Palm forest	55.67	2.86	58.52	117.04
Mature forest	122.02	4.57	126.59	253.19
Secondary forest	55.63	4.35	59.98	119.97
Pasture with trees	10.88	1.49	12.37	24.74
Forest plantation	25.84	0.04	25.88	51.77
Mangrove forest	61.57	2.22	63.78	127.57
Total	331.60	15.53	347.14	694.27

Note: does not include carbon from the soil.

Source: BCCR based on data retrieved from Programa REDD/CCAD-GIZ - SINAC (2015).



Type of forest	CO2 Average (ton/ha) [DBH >10 cm]	CO2 Average (ton/ha) [DBH 2-10 cm]	CO2 Average (ton/ha) [DBH >2 cm]	Average by type
Palm forest	204.11	10.48	214.58	429.16
Mature forest	447.40	16.77	464.18	928.35
Secondary forest	203.99	15.95	219.94	439.89
Pasture with trees	39.88	5.48	45.36	90.71
Forest plantation	94.74	0.16	94.90	189.81
Mangrove forest	225.75	8.12	233.87	467.74
Total	1,215.87	56.96	1,272.83	2,545.66

TABLE 9. Average Carbon Dioxide by Forest Type and Tree Size (tons per hectare) -2015

Note: does not include carbon from the soil.

Source: BCCR based on data retrieved from Programa REDD/CCAD-GIZ - SINAC (2015).

4.4. Forest Cover Time Series

Based on the 2013 INF strata classifiers, a correspondence was established between the SEEA-CF land cover classifications and the work on forest cover carried out by Pedroni, et al. (2015). The latter study takes forest cover images for 1987, 1992, 1997, 2001, 2008, 2011 and 2013, and converts them to area data using their own classification. Two criteria were considered to link the concepts between studies: i) that the classifications of the studies were similar in both form and content; and ii) that the extent of each of the strata in both studies had similar magnitudes.

Table 10 shows the proposed correspondence between classifications by source. A first attempt to construct a consistent time series merged both series. Due to the fact that the INF contains groupd classifications and the study conducted by Pedroni et al. (2015) dissagregates strata by age, for the last year the structure of the final data of the INF was applied, with the aim to create a stable series.

Some difficulties were detected in the attempt to couple the methodologies. For instance, the series developed by Pedroni et al. (2015) for the years 1992 and 2001 does not have data for the categories of "moor" and "pasture". In addition, disaggregated data for the "non-forest" category is not available and the data appears to be comprehended in the "non-forest global" category. By analysis the data of other years, it was observed that the sum of "moor", "pasture" and everything classified as "non-forest" correspond to the figures classified as "non-forest global" of the years 1992 and 2001. Consequently, a structural distribution was conducted using year 1997 as baseline year. Table 11 presents the results of this exercise, which was constructed based on data from the INF and from the study of Pedroni et al. (2015).



INF	Pedroni et al (2015)	SEEA-CF
Mature forest	Matura farrat	
Secondary forest	Mature forest	
Grass with trees	Forest by age	Forest
Plantation	Plantation by age	Plantation
Moor	Moor	Shrub covered area
Pastures without trees	Paddock	Grassland
	Urban	Artificial surfaces
	Water	Inland water bodies
	Bare soil	Terrestrial barren land
Not forestry	No global forest	Sparse natural vegetated areas
	Annual crops	
	Coffee	Crons
	Pineapple	crops
	Other perm crops	
Palm forest	Yolillal	Palm forest
Mangrove forest	Mangroves	Mangroves
Clouds and shadows	N.A	N.A

TABLE 10. Selection of Strata by Data Source

N.A.: Not applicable. Source: BCCR based on data retrieved from Programa REDD/CCAD-GIZ – SINAC (2015), Pedroni et al. (2015) and United Nations et al. (2014a).

TABLE II. Land Cover Evolution by Categories (kin)						
Year	1992	1997	2001	2008	2011	2013
Mature forest (primary and secondary forest)	24,198.41	23,180.38	22,737.41	22,145.49	21,846.05	25,956.52
Forest by age	2,637.34	3,330.97	4,104.14	4,740.73	5,066.32	8,088.30
Mature plantation	717.95	507.98	375.26	262.53	230.91	250.45
Plantation by age	999.92	1224.01	1210.45	1050.07	1234.84	1634.98
Mature palm forest	1,331.70	1,232.26	1,206.73	1,139.92	1,109.00	1,247.69
Palm forest by age	152.19	178.01	188.96	192.96	207.48	297.84
Mature mangrove	401.57	387.12	375.25	358.78	352.74	273.96
Magrove by age	83.47	108.44	109.81	117.4	128.03	112.22



Shrub covered area	102	103.84	103.05	103.85	103.86	130.55
Grassland	11,905.22	12,119.89	12,028.57	12,386.92	12,312.17	4,369.71
Urban	651.21	662.96	657.96	832.89	823.53	976.31
Inland water bodies	181.78	185.05	183.66	240.22	246.13	284.17
Terrestrial barren land	283.93	289.05	286.87	322.8	331.34	316.82
Sparse natural vegetated areas	365.48	372.07	369.27	117.01	46.87	51.88
Annual crops	1,656.03	1,685.89	1,673.18	1,684.29	1,690.96	1,776.74
Coffee	2,889.47	2,941.57	2,919.40	2,604.22	2,559.53	2,389.76
Pineapple	421.24	428.84	425.61	679	696.35	839.15
Other perm crops	2,249.46	2,290.02	2,272.77	2,249.27	2,242.23	2,231.28

Source: BCCR based on data retrieved from Programa REDD/CCAD-GIZ - SINAC (2015), Pedroni et al. (2015).

TABLE 12. Evolution of Land Cover by Categories (cover %)

Year	1992	1997	2001	2008	2011	2013
Mature forest (primary and secondary forest)	47	45	44	43	43	51
Forest by age	5	7	8	9	10	16
Mature plantation	1	1	1	1	0	0
Plantation by age	2	2	2	2	2	3
Mature Yolillal	3	2	2	2	2	2
Yolillal by age	0	0	0	0	0	1
Mature mangrove	1	1	1	1	1	1
Magrove by age	0	0	0	0	0	0
Shrub covered area	0	0	0	0	0	0
Grassland	23	24	23	24	24	9
Urban	1	1	1	2	2	2
Inland water bodies	0	0	0	0	0	1
Terrestrial barren land	1	1	1	1	1	1
Sparse natural vegetated areas	1	1	1	0	0	0
Annual crops	3	3	3	3	3	3
Coffee	6	6	6	5	5	5
Pineapple	1	1	1	1	1	2
Other perm crops	4	4	4	4	4	4

Source: BCCR based on data retrieved from Programa REDD/CCAD-GIZ - SINAC (2015), Pedroni et al. (2015).

This exercise aimed to use all the information available on land cover in the most extensive time series possible. Although the series constructed uses hard data, obtaining a time-consistent series to permit precise calculations of account tables was given the highest priority, even at the cost of decreasing the time period covered. It was therefore decided to use the series that includes data from the years 2008, 2011 and 2013 developed for by Pedroni et al (2015). Table 13 presents the series with the data and time period selected, as well as the corresponding SEEA-CF classification.



Clasificación Pedroni et al (2015))	SEEA-CF	2008	2011	2013
Mature forest and forest by age	Trees	2,688,622	2,691,239	2,762,923
Mature plantation and plantation by age	Plantation	131,261	146,573	166,333
Mature yolillal and yolillal by age	Palm forest	133,289	131,648	136,346
Mature mangroves and mangroves by age	Mangroves	47,617	48,079	49,464
Urban	Artificial surfaces	83,289	82,353	90,970
Paddock	Grassland	1,238,692	1.231.217	1,171,259
	Shrub	, ,	, - ,	, ,
Moor	covered area	10,385	10,386	10,388
Water	Inland water bodies	24,022	24,613	26,478
Bare soil	Terrestrial barren land	32,280	33,134	29,520
No global forest	Sparse natural vegetated areas	11,701	4,687	4,834
Annual crops		168,429	169,096	165,552
Coffee		260,422	255,953	222.673
Pineapple	Crops	67,900	69,635	78.190
Other perm crops		224,927	224,223	207.906
Total		5.122.836	5,122,836	5,122,836

TABLE 13. Land Cove	r Areas for the	Years 2008,	2011 and 2013	(Ha)
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Source: Pedroni et al. (2015) and United Nations et al. (2014a).

4.4.1. The land asset in environmental accounting

The SEEA-CF defines land as an extremely important environmental asset within economic dynamics, delimiting the areas within which economic activities and environmental processes take place (United Nations et al., 2014a). The SEEA-CF manual identifies two main divisions for land accounting: land use and land cover. Land use includes two large accounting sections: *a*) activities carried out; and *b*) ruling institutional provisions for a certain area for purposes of economic production, or for purposes of maintenance and restoration of environmental functions. Table 14 shows the classification of land use according to the 2012 SEEA-CF manual.



TABLE 14. Land Use Classification

1. Land
1.1 Agriculture
1.2 Forest
1.3 Land used for aquaculture
1.4 Use of built-up and related areas
1.5 Land used for maintenance and restoration of environmental functions
1.6 Other uses of land n.e.s. (not elsewhere specified)
1.7 Land not in use
2. Inland waters
2.1 Inland waters used for aquaculture or holding facilities
2.2 Inland waters used for maintenance and restoration of environmental functions
2.3 Other uses of inland waters n.e.s.
2.4 Inland waters not in use

Source: United Nations et al (2014).

Detailed information, including the purpose for which land resources are used, is necessary for land use analysis. Currently, with the information available it is not possible to establish a clear relationship between the SEEA concepts and the definitions used in data sources.

For the case of land cover, the aim is to account what can be physically and biologically observed (including natural vegetation and abiotic areas) which, at its simplest level, includes all the elements of a country's surface. Table 15 shows land cover classifications according to the SEEA-CF.

TABLE 15. Land Cover Classification

1 Artificial surfaces (including urban and ass	ociated areas)
2 Herbaceous crops	
3 Woody crops	
4 Multiple or layered crops	
5 Grassland	
6 Tree-covered areas	
7 Mangroves	
8 Shrub-covered areas	

Source: United Nations et al (2014).

The classifications proposed by the SEEA-CF for land cover can be adjusted to the data classifications for Costa Rica developed by Pedroni et al (2015), which are used as the basis for constructing stock tables for the accounts. With this reclassification, and based on data from matrices on land cover change, an analysis can be carried out for two time periods: 2008-2011 and 2011-2013. These matrices are constructed based on satellite images that show land cover changes for a determined period of time.

Figures 6 to 11 show the land cover changes that took place in Costa Rica by means of satellite images. This analysis makes it possible to construct tables that show



variations in asset stocks, by cover type and by human intervention or natural action. The relationships and behaviors that may be extracted from land cover stock tables are useful to guide policy decisions for conservation and growth. These data may complement figures of value added by industry retrieved from national accounts, and may provide better insight of the impact (positive or negative) of economic activities with respect to sustainable growth.



FIGURE 6. Forest – Non Forest Land Cover Change, period 1992-1997

















FIGURE 9. Land Cover Change Between Forest and Other Cover Classifications, period 1992-1997





FIGURE 10. Land Cover Change Between Forest and Other Cover Classifications, period 1997-2008





FIGURE 11. Land Cover Change Between Forest and Other Cover Classifications, period 2008-2013

Source: Prepared with the information of ADUU (2015) and CDI (2015).

5. SUPPLY AND USE TABLE (SUT): Flows

The supply and use tables generated for the input-output matrix for 2011, 2012 and 2013 were first used to produce data for the flow account; this matrix was prepared using the new structure incorporating the baseline year change carried out by the BCCR. The matrix was transformed into a database format to permit the calculation of the cross-tabulations required to generate the links between forest activities and products, isolating them from the rest of the economy. Tables 16 and 17 show the description and codes selected as forest-related activities (EA) and products (PN).

The product nomenclatures (PN) and economic activities (EA) related to forests were identified in the database and used to construct the SUTs. Tables 18 to 20 show the result for monetary SUTs in the forest account.

Taking the natural resources approach makes it possible to appreciate the value of forests in the economy at market prices beyond timber. It makes the impact of forests in other economic sectors visible, as well as their relevance to the flows of the commercial balance.

EA Description	EA Code	ISIC Code	ISIC Description
Cultivation of foliage	EA013	0119	Cultivation of other non-perennial plants
Cultivation of other plants not perennial and evergreen	EA013	0119	Cultivation of other non-perennial plants
		0170	Regular hunting and trapping, and related services activities
Forestry, timber	EA027	0210	Forestry and other forestry activities
products	EAUZT	0220	Timber extraction
		0240	Forestry support services
Timber production and fabrication of timber		1610	Timber sawing and shaving
	EA056	1621	Fabrication of wood sheets for veneers and wooden boards
except furniture;		1622	Fabrication of carpentry parts and pieces for buildings and construction
items and of materials		1623	Fabrication of wooden containers
used for plaiting		1629	Fabrication of other wooden products; fabrication of cork, straw items, and materials for plaiting
		1701	Fabrication of wood pulp, paper and cardboard
Fabrication of paper and paper products	EA057	1702	Fabrication of paper and corrugated cardboard, and of paper and cardboard containers
		1709	Fabrication of other paper and cardboard articles

TABLE 16. Codes and Descriptions of Forest-Related Activities

Source: BCCR based on data from the ISIC Rev 4 Document.



Description PN	PN Code	ISIC Code	CIIU Description
		170 210 220 240	Regular hunting and trapping, and associated services activities
Forestry, timber	PN036		Forestry and other forestry activities
products			Timber extraction
			Forestry support services
		1610 1621 1622 1623 1629	Timber sawing and shaving
Wood and cork. timber	PN070		Fabrication of wood veneers for plating and wooden boards
and cork products,			Fabrication of carpentry parts and pieces for buildings and construction
items, and materials			Fabrication of wooden containers
			Fabrication of other wooden products; fabrication of cork, straw items, and materials for plaiting
			Fabrication of wood pulp, paper and cardboard
Paper and paper	PN071	1701 1702	Fabrication of paper and corrugated cardboard, and of paper and cardboard containers
products	111071	1709	Fabrication of other paper and cardboard articles

TABLE 17. Codes and Descriptions of Forest-Related Products

Source: BCCR based on data from the ISIC Rev 4 Document.

S	UPPLY				PRODUCTION			
PN Code	Product	Cultivation of foliage	Growing of other non- perennial and perennial plants	Forestry and logging and hunting	Manufacture of wood and of products of wood and cork, except furniture; manufacture of articles of straw and plaiting materials	Manufacture of paper and paper products	Rest of the economy	Total
		(EA013)	(EA20)	(EA027)	(EA056)	(EA057)		
PN036	Forestry products, extraction of wood and hunting	0	0	84,205.04	0	0	205.07	84,410.11
PN070	Wood and cork, wood products and cork, except furniture; articles of straw and plaiting materials	0	0	0	62,269.78	0	0	62,269.78
PN071	Paper and paper products	0	0	0	0	304,640.37	0	304,640.37
Rest of	the economy	7.127.05	7,218.95	0	1.31	7,524.08	32,138,554.63	32,160,426.02
	Total	7,127.05	7,219.95	84,205.04	62,271.09	312,164.45	32,138,759.70	32,611,746.28

TABLE 18. Monetary Supply and Use Table for Forests, 2011 (in millions of colones)



TABLE 18 (Continued)

SU	PPLY	IMPORTS	TAXES	SUBSIDIES	MARGINS	TOTAL
PN Code	Product					
PN036	Forestry products, extraction of wood and hunting	829.37	242.43	0	0	85,482
PN070	Wood and cork, wood products and cork, except furniture; articles of straw and plaiting materials	32.120.17	5,054.86	0	18,233	117,678
PN071	Paper and paper products	299.662.95	9,149.88	0	85,377	698,829
Rest of the economy		7.995.909.14	1.719.452.29	-48,826.98	-103,609.60	41,723,350.87
Τα	otal	8,328,521	1,733,899	-48,827	0	42,625,339



TABLE 18 (Continued)

	USE		IN	TERMEDIATE CO	ONSUMPTION			
PN Code	Product	Cultivation of foliage	Growing of other non- perennial and perennial plants	Forestry and logging and hunting	Manufacture of wood and of products of wood and cork, except furniture; manufacture of articles of straw and plaiting materials	Manufacture of paper and paper products	Rest of the economy	Total
		(EA013)	(EA20)	(EA027)	(EA056)	(EA057)		
PN036	Forestry products,							
	extraction of wood and hunting	0	0	0	26,438.44	0	2,697.30	29,135.74
PN070	Wood and cork, wood products and cork, except furniture; articles of straw and plaiting materials	3.23	88.82	0	5,334.83	14.82	91,828.08	97,269.77
PN071	Paper and paper products	96.22	0	0	27.81	153,805.18	346,793.10	500,722.32
Rest of the economy		1.910.41	3,239.32	6,513.71	22,749.73	67,362.40	13,114,607.32	13,216,382.88
	Total	2,009.85	3,328.14	6,513.71	54,550.82	221,182.40	13,555,925.79	13,843,510.71



TABLE 18 (Continued)

U	SE	FINAL CONSUMPTION	EVENETS	GROSS CAPITAL	TOTAL	
PN Code	Product	EXPENDITURE	EAFORIS	FORMATION		
PN036	Forestry products, extraction of wood and hunting	9,000.78	47,157.60	187.79	85,481.91	
PN070	Wood and cork, wood products and cork, except furniture; articles of straw and plaiting materials	4,183.77	16,316.25	0	117,769.79	
PN071	Paper and paper products	100,414.45	97,788.33	0	698,925.11	
Rest of th	e economy	17,210,125.49	6,481,661.89	4,474,097.25	41,382,267.51	
Тс	otal	17,323,724.49	6,642,924.07	4,474,285.04	42,284,444.31	

Note: "Rest of the economy" means all that is not contemplated in the codes EA and PN explicit in the table. Source: BCCR.



SUPPLY PRODUCTION Manufacture of wood and of products of wood and cork, Growing of other Forestry and except Manufacture of non-perennial logging and Cultivation of foliage furniture; paper and Rest of the economy and perennial **PN Code** Product Total hunting manufacture of paper products plants articles of straw and plaiting materials (EA056) (EA057) (EA013) (EA20) (EA027) Forestry products, PN036 extraction of 0 0 49,218.57 0 0 272.82 49,491.39 wood and hunting Wood and cork, wood products and cork, except PN070 furniture; 0 0 0 95,565.03 0 609.94 96,174.97 articles of straw and plaiting materials Paper and PN071 0 0 0 0 335,647.20 4,873.01 340,520.21 paper products 3,403.88 38,709,274.48 Rest of the economy 25,241.69 21,084.90 945.3 736.51 38,760,686.76 Total 25,241.69 21,084.90 50,163.87 96,301.54 339,051.09 38,715,030.26 39,246,873.33

TABLE 19. Monetary Supply and Use Table for Forests, 2012 (in millions of colones)



TABLE 19 (Continued)

SU	PPLY					
PN Code	Product	IMPORTS	TAXES	SUBSIDIES	MARGINS	TOTAL
PN036	Forestry products, extraction of wood and hunting	705.44	351.37	0	2,929.92	53,478
PN070	Wood and cork, wood products and cork, except furniture; articles of straw and plaiting materials	40,920.71	12,107.53	0	20,537.08	169,739
PN071	Paper and paper products	297,492.88	7,585.18	0	137,466.68	783,064
Rest of the economy		8.068.736.59	1,971,375.45	-2,089.17	-160,932.68	48,637,776.94
Тс	otal	8,407,855.61	1,991,418.54	-2,089.17	0	49,644,058.31



TABLE 19 (Continued)

	USE			INT	ERMEDIATE CONSUMPTION			
PN Code	Product	Cultivation of foliage (EA013)	Growing of other non-perennial and perennial plants (EA20)	Forestry and logging and hunting (EA027)	Manufacture of wood and of products of wood and cork, except furniture; manufacture of articles of straw and plaiting materials (EA056)	Manufacture of paper and paper products (EA057)	Rest of the economy	Total
PN036	Forestry products, extraction of wood and hunting	0	18.53	1,308.76	13,194.13	0.94	2,989.42	17,512.77
PN070	Wood and cork, wood products and cork, except furniture; articles of straw and plaiting materials	21.57	266.74	0	22,958.80	187.13	110,296.91	133,730.16
PN071	Paper and paper products	2,095.95	0.09	0	194.62	121,845.87	366,104.63	490,240.16
Re	est of the economy	12.290.21	10,572.92	5,645.43	18,233.25	112,166.09	17,064,406.79	17,223,314.68
	Total	14,407.73	10,858.28	6,954.18	54,580.79	234,200.04	17,543,795.75	17,864,796.77



TABLE 19 (Continued)

USE		FINAL CONSUMPTION	EVENDES	GROSS CAPITAL	τοται	
PN Code	Product	EXPENDITURE	EAFURIS	FORMATION	TOTAL	
PN036	Forestry products, extraction of wood and hunting	13,938.16	20,670.29	1,357.90	53,478.12	
PN070	Wood and cork, wood products and cork, except furniture; articles of straw and plaiting materials	9,058.66	19,873.23	3,184.36	165,846.42	
PN071	Paper and paper products	157,410.54	102,718.58	2,299.20	752,668.48	
Rest of the economy		19.294.004.38	7,375,218.42	4,779,527.82	48,672,065.30	
Тс	otal	19,474,411.75	7,518,481.52	4,786,369.27	49,644,058.31	

Note: "Rest of the economy" means all that is not contemplated in the codes EA and PN explicit in the table. Source: BCCR.



TABLE 20. Monetary Supply and Use Table for Forests, 2013 (in millions of colones)

S	UPPLY				PRODUCTION			
PN Code	Product	Cultivation of foliage (EA013)	Growing of other non- perennial and perennial plants (EA20)	Forestry and logging and hunting (EA027)	Manufacture of wood and of products of wood and cork, except furniture; manufacture of articles of straw and plaiting materials (EA056)	Manufacture of paper and paper products (EA057)	Rest of the economy	Total
PN036	Forestry products, extraction of wood and hunting	0	0	47,163	0	0	516.57	47,680.03
PN070	Wood and cork, wood products and cork, except furniture; articles of straw and plaiting materials	0	0	0	94,148.55	0	133.94	94,281.48
PN071	Paper and paper products	0	0	0	0	310,663.42	6,739.57	317,402.99
Rest of the economy		22.630.78	18,604.14	589.58	478.69	3,364.24	40,766,340.85	40,812,008.28
	Total	22,631.78	18,604	47,753.05	94,626.23	314,027.66	40,773,730.92	41,271,372.79



TABLE 20 (Continued)

SU	PPLY						
PN Code	Product	IMPORTS	TAXES	SUBSIDIES	MARGINS	TOTAL	
PN036	Forestry products, extraction of wood and hunting	719.27	345.71	0	2,532.31	51,277.32	
PN070	Wood and cork, wood products and cork, except furniture; articles of straw and plaiting materials	39,048.99	12,038.25	0	20,965.42	166,334.14	
PN071	Paper and paper products	330,725.51	8,514.81	0	141,326.58	797,969.88	
Rest of the economy		8.105.505.11	2,075,676.14	-2,194.01	-164,824.31	50,826,171.21	
Тс	otal	8,475,998.87	2,096,575.91	-2,194.01	0	51,841,752.55	



TABLE 20 (Continued)

USE INTERMEDIATE CONSUMPTION								
PN Code	Product	Cultivation of foliage	Growing of other non- perennial and perennial plants	Forestry and logging and hunting	Manufacture of wood and of products of wood and cork, except furniture; manufacture of articles of straw and plaiting materials	Manufacture of paper and paper products	Rest of the economy	Total
PN036	Forestry products, extraction of wood and hunting	0	14.48	1,256.13	12,786.54	0.98	2,944.57	17,002.08
PN070	Wood and cork, wood products and cork, except furniture; articles of straw and plaiting materials	21.72	194.11	0	23,070.51	205.66	116,792.31	140,284.31
PN071	Paper and paper products	2,250.07	0.07	0	212.26	115,637.84	405,669.19	523,768.43
Rest of the economy		13.075.76	7,785.98	5,257.58	18,481.51	105,339.92	17,753,899.64	17,903,839.39
	Total	15,347.55	7,994.63	6,513.71	54,550.82	221,182.40	18,279,305.70	18,584,894.81



TABLE 20 (Continued)

USE		FINAL CONSUMPTION EXPENDITURE	EXPORT	GROSS CAPITAL FORMATION	TOTAL	
PN Code	Product					
PN036	Forestry products, extraction of wood and hunting	14,880.10	14,569.05	4,825.49	51,277.32	
PN070	Wood and cork, wood products and cork, except furniture; articles of straw and plaiting materials	9,261.03	16,789.80	0	166,334.14	
PN071 Paper and paper products		167,618.33	104,292.74	2,291.38	797,969.88	
Rest of the economy		20,681,316,.35	7,580,195.72	4,660,819.77	50,826,171.23	
Total		20,873,076	7,715,845	4,667,937	51,841,753	

Note: "Rest of the economy" means all that is not contemplated in the codes EA and PN explicit in the table. Source: BCCR.

6. TABLES FOR THE ASSETS ACCOUNT

The results for the forest assets account based on the information collected and processed are presented below. Table 21 and Table 22 show that forest cover showed a sustained increase from 2,953,171 hectares in 2008, to 2,969,460 hectares in 2011, and 3,065,600 hectares in 2013. The net increase in the country's forest cover in the 2008-2011 period was 16,290 hectares, while it was 96,140 hectares between 2011- 2013.

Tables 23 and 24 show changes in forest composition, as well as each of the types of land covers identified. Among the variations in this period, that with the greatest impact was the increase stemming from lands that were previously used for pastures and were transformed into forests by the end of 2011. During the 2011-2013 period, the greatest contributions to increases in forest cover came both from land that was originally used as pastures, and from land that had been previously used for agriculture.

Of particular interest was to observe the distribution of forest cover at a more disaggregated level. Tables 25 and 26 show that natural forest is the type of cover that gained the most weight in total forest composition. Furthermore, this category experienced the greatest increases in both time periods.

Tables 27 and 28 show Costa Rica's potential timber stock. While traditional statistics report effective extracted wood, the SEEA-CF approach presents information on the accumulation (or reduction) of the forest asset considered appropriate for the extraction of wood, regardless of whether it is unavailable due to conservation efforts or because the land is dedicated to another activity.

Tables 27 and 28 show that although cultivated wood resources grow through time, this growth (and the level of this resource in general) is very small compared to those wood resources which are not available for timber extraction, which reflects the emphasis on conservation that has been developed in the country. The last two tables in this section (Tables 29 and 30) present the physical accounts for forest carbon. The tons of carbon were calculated using average carbon tables prepared using data from the INF and hectares of forest cover. Although the integral approach of carbon accounts is based on the SEEA-EEA, the SEEA-CF allows the construction of fixed carbon in both time periods. This goes hand in hand with –and is a consequence of – the increase in forest cover reported in the land cover figures.

	Artificial surfaces	Crops	Grassland	Tree covered area	Mangroves	Shrub covered area	Sparse natural vegetated areas	Terrestrial barren land	Inland water bodies	TOTAL
Opening stock - Land cover										
at 1 January 2008	83,289	721,678	1,238,692	2,953,171	47,617	10,385	11,701	32,280	24,022	5,122,836
Additions to stock										
Managed expansion	1,491	2,165	3,457	17,103	563	1	0	1,395	926	27,101
Natural expansion										
Total additions to stock	1,491	2,165	3,457	17,103	563	1	0	1,395	926	27,101
Reductions in stock										
Managed reduction	2,426	4,936	10,932	814	101	0	7,014	541	336	27,101
Natural reduction										
Total reductions in stock	2,426	4,936	10,932	814	101	0	7,014	541	336	27,101
Closing stock - Land cover at										
31 December 2011	82,353	718,906	1,231,217	2,969,460	48,080	10,385	4,687	33,135	24,614	5,122,836

TABLE 21. Costa Rica: Land Cover Account, 2008-2011 (hectares)



TABLE 22. Costa Rica: Land Cover Account, 2011-2013 (hectares)

	Artificial surfaces	Crops	Grassland	Tree covered area	Mangroves	Shrub covered area	Sparse natural vegetated areas	Terrestrial barren land	Inland water bodies	TOTAL
Opening stock - Land cover										
at 1 January 2011	82,353	718,906	1,231,217	2,969,460	48,079	10,386	4,686	33,135	24,613	5.122.836
Additions to stock										
Managad averagian	0 671	0 070	767	06.616	1 540	2	620	104	2 2 2 0	110 521
Managed expansion	8,671	8,873	/6/	96,616	1,549	2	639	184	2,229	119.531
Natural expansion										
Total additions to stock	8,671	8,873	767	96,616	1,549	2	639	184	2,229	119.531
Reductions in stock										
Managed reduction	54	53,458	60,725	476	164	0	491	3,798	363	119.531
Natural reduction										
Total reductions in stock	54	53 <i>,</i> 458	60,725	476	164	0	491	3,798	363	119.531
Closing stock - Land cover at										
31 December 2013	90,970	674,321	1,171,259	3,065,600	49,464	10,387	4,835	29,521	26,479	5.122.836



		In	Increases (positive numbers) and decreases (negative numbers) from other land areas									
Land cover	Opening area: 1 January 2008	Artificial surfaces	Crops	Grassland	Tree covered areas	Mangroves	Shrub covered areas	Sparse natural vegetated areas	Terrestrial barren land	Inland water bodies	Net change	Closing area: 31 December 2011
Artificial surfaces	83,289	0	1,376	11	-2,224	-30	0	22	-172	82	- 935	82,353
Crops	721,678	-1,376	0	621	-2,416	-48	-1	1,544	-1,061	-36	- 2,771	718,906
Grassland	1,238,692	-11	-621	0	-10,188	4	0	3,244	208	-113	- 7,476	1,231,217
Tree covered areas	2,953,171	2,224	2,416	10,188	0	-182	0	1,953	323	-632	16,290	2,969,460
Mangroves	47,617	30	48	-4	182	0	0	50	-97	254	462	48,079
Shrub covered areas	10,385	0	1	0	0	0	0	0	0	0	1	10,386
Sparse natural vegetated areas	11,701	-22	-1,544	-3,244	-1,953	-50	0	0	-65	-136	- 7,014	4,687
Terrestrial barren areas	32,280	172	1,061	-208	-323	97	0	65	0	-10	854	33,134
Inland water bodies	24,022	-82	36	113	632	-254	0	136	10	0	590	24,613
Total	5,122,836											5,122,836

TABLE 23. Costa Rica: Land Cover Change Matrix, 2008-2011 (hectares)



		In	creases (po	ositive num	bers) and	decrease	s (negativ	e numbers	s) from oth	er land are	as	
Land cover	Opening area: 1 January 20011	Artificial surfaces	Crops	Grassland	Tree covered areas	Mangroves	Shrub covered areas	Sparse natural vegetated areas	Terrestrial barren land	Inland water bodies	Net change	Closing area: 31 December 2013
Artificial surfaces	82,353	0	3976	4,192	-47	-7	0	50	258	195	8,617	90,970
Crops	718,906	-3,976	0	8,655	-48,038	-848	-2	217	-184	-410	- 44,585	674,321
Grassland	1,231,217	-4,192	-8655	0	-46,171	-541	0	224	544	-1,166	- 59,958	1,171,259
Tree covered areas	2,969,460	47	48,038	46,171	0	-31	0	-445	2,265	96	96,140	3,065,600
Mangroves	48,079	7	848	541	31	0	0	-13	122	-151	1,385	49,464
Shrub covered areas	10,386	0	2	0	0	0	0	0	0	0	2	10,388
Sparse natural vegetated areas	4,687	-50	-217	-224	445	13	0	0	108	73	148	4,834
Terrestrial barren areas	33,134	-258	184	-544	-2,265	-122	0	-108	0	-501	- 3,614	29,520
Inland water bodies	24,613	-195	410	1,166	-96	151	0	-73	501	0	1,865	26,478
Total	5,122,836											5,122,836

TABLE 24. Costa Rica: Land Cover Change Matrix, 2011-2013 (hectares)

Dhusical account for forest land					
cover 2008-2011 (bectares)		Total			
cover, 2008-2011 (nectares)	Natural forests	Planted timber	Palm forests	Mangrove	
Opening stock - Forest land, 1					
January 2008	2,688,622	131,260	133,289	47,617	3,000,788
Additions to stock					
Afforestation		42,475	4,908		47,383
Natural expansion	92,238			2,962	95,200
Total additions to stock	92,238	42,475	4,908	2,962	142,583
Reduction in stock					
Deforestation		27,161	6,549		33,710
Natural regression	89,621			2,501	92,122
Total reductions in stock	89,621	27,161	6,549	2,501	125,832
Closing stock - Forest land, 31					
December 2011	2,691,239	146,574	131,648	48,079	3,017,539

TABLE 25. Costa Rica: Physical Assets Account for Forests and Other Wooded Lands, 2008-2011 (hectares)



TABLE 26. Costa Rica: Physical Assets Account for Forests and Other Wooded Lands, 2011-2013 (hectares)

Physical account for forest land					
cover 2011-2012 (bestares)		Total			
(inectares)	Natural forests	Planted timber	Palm forests	Mangrove	
Opening stock - Forest land, 1					
January 2011	2,691,239	146,574	131,648	48,079	3,017,539
Additions to stock					
Afforestation		32,803	6,882		39,685
Natural expansion	105,729			2,457	108,186
Total additions to stock	105,729	32,803	6,882	2,457	147,870
Reduction in stock					
Deforestation		13,044	2,184		15,228
Natural regression	34,046			1,072	35,118
Total reductions in stock	34,046	13,044	2,184	1,072	50,346
Closing stock - Forest land, 31					
December 2013	2,762,922	166,333	136,346	49,464	3,115,064



TABLE 27. Costa Rica: Physical Assets Account for Timber Resources, 2008-2011 (tons)

	Type of timber resource							
Physical account for timber resources, tonnes 2008-2011	Planted timber resources	Natural timber resources						
		Available for wood supply	Not available for wood supply					
Opening stock - Timber resources, 1 January 2008	4,737,582		453,815,238					
Additions to stock								
Afforestation	1,533,058							
Natural growth			15,568,947					
Total additions to stock	1,533,058		15,568,947					
Reductions in stock								
Removals	980,327							
Felling residues								
Natural losses			15,127,221					
Catastrophic losses								
Total reductions in stock	980,327		15,127,221					
Closing stock - Timber resources, 31								
December 2011	5,290,299		454,256,964					



TABLE 28. Costa Rica: Physical Assets Account for Timber Resources, 2011-2013 (tons)

		Type of timber resource	
Physical account for timber resources, tonnes	Planted timber resources	Natural timbe	er resources
2011-2013		Available for wood supply	Not available for wood supply
			-
Opening stock - Timber resources, 1 January			
2011	5,290,299		454,256,964
Additions to stock			
Afforestation	1,183,953		17846047,27
Natural growth			
Total additions to stock	1,183,953		17,846,047
Reductions in stock			
Removals	470,786		
Felling residues			
Natural losses			5,746,580
Catastrophic losses			
Total reductions in stock	470,786		5,746,580
Closing stock - Timber resources, 31			
December 2013	6,003,466		466,356,405

TABLE 29. Costa Rica: Physical Accounts for Forest Carbon, 2008-2011 (tons)

		Type of forest resource						
Physical account for forest carbon, tonnes, 2008-2011		Planted forest						
	Natural forests	Planted timber Palm forests		Mangrove				
Opening stock of forest carbon, 1 January 2008	226,907,639	2,368,796	5,200,264	2,328,316	236,805,014			
Additions to forest carbon	7,784,473	766,526	191,492	144,845	8,887,336			
Reductions in forest carbon	7,563,623	490,167	255,505	122,274	8,431,570			
Net change in carbon over period	220,850	276,359	-64,013	22,570	455,766			
Closing stock of forest carbon, 31 December	227 420 400		E 100 0E1	2 250 000	227 260 700			
2011	227,128,488	2,645,154	5,136,251	2,350,886	237,260,780			

Source: BCCR based on Pedroni et al. (2015).

TABLE 30. Costa Rica: Physical Accounts for Forest Carbon, 2011-2013 (tons)

Physical account for forest carbon, tonnes, 2011-2013		Total			
	Natural forests	Planted timber	Palm forests	Mangrove	
Opening stock of forest carbon, 1 January 2011	227,128,488	2,645,154	5,136,251	2,350,886	237,260,780
Additions to forest carbon	8,923,024	591,976	268,500	120,149	9,903,649
Reductions in forest carbon	2,873,290	235,393	85,214	52,428	3,246,326
Net change in carbon over period	6,049,733	356,583	183,286	67,720	6,657,323
Closing stock of forest carbon, 31 December					
2013	233,178,222	3,001,738	5,319,537	2,418,606	243,918,103

7. RESULTS

A number of results can be derived from the work carried out and the tables that were prepared based on this work. With the evolution of the country's forest cover, it is observed that since 1992 the mature forest cover stabilized and that new forests have been replenishing the amount of forest in the country.

Data on forest distribution show the composition of Costa Rica's forest cover. Although the data indicate levels of coverage that differ from those published in previous years, the tendencies encountered are very similar. The difference in levels of coverage is an important point to consider when designing public policies, since the form and strength of these policies is related to the amount and type of existing forest.

The identification of forest strata or categories enables the identification of the degree of progress towards goals on carbon fixation, timber capacity, scenic beauty, etc. Approaching the forest as a resource contributes to a better understanding of its value beyond the timber industry. Although this is certainly an important use, there are another series of goods and services that stem from the management of this asset. To show the true contribution of forests, it is necessary to separate them from the agricultural sector, whose inclusion blurs the true importance of the forest as a natural resource. In 2011 the agriculture, silviculture and fishing industry (included in a single category) accounted for 5.8% of production (BCCR, 2015); however, this says little about the real contribution of the forest, since traditional national accounting does not include this item.

The work carried out based on data from Pedroni et al. (2015) allows the construction of land cover stock tables and the identification of forest cover increases and reductions. Figures 12 and 13 present this information for each of the land cover classifications during the periods 2008-2011 and 2011-2013.



FIGURE 12. Land Cover Changes, 2008-2011

Source: BCCR based on Pedroni et al. (2015).





FIGURE 13. Land Cover Changes, 2011-2013

Source: BCCR based on Pedroni et al. (2015).

Figures 13 and 14 show that the greatest increases in forest cover are due to decreases in the areas that were previously dedicated to crops and pastures. Figure 13 shows specific cover gains in both time periods, with forests showing the greatest percentage increases. Figure 14 disaggregates the forest cover gain by type of forest, showing that the greatest increases are found in natural forest for both time periods.



FIGURE 14. Percentage Increases by Land Cover Origin





FIGURE 15. Percentage Increases of Forest Cover Use by Forest Cover Type

Source: BCCR based on Pedroni et al. (2015).

Table 31 shows data on the opening and closing of land accounts. Variations in artificial areas can be observed among the two periods. In spite of the increase in non-forest areas, forest areas grew by a total of 4%.

	Artificial surfaces	Crops	Grassland	Tree covered area	Mangroves	Shrub covered area	Sparse natural vegetated areas	Terrestrial barren land	Inland water bodies
2008-2011	-1%	0%	-1%	1%	1%	0%	-60%	3%	2%
2011-2013	10%	-6%	-5%	3%	3%	0%	3%	-11%	8%
2008-2013	9%	-7%	-5%	4%	4%	0%	-59%	-9%	10%

TABLE 31. Land Cover Evolution in Relative Terms (in %)

Source: BCCR based on Pedroni et al. (2015).

The forest flow account created with information from the supply and use tables for 2011, 2012 and 2013 makes it possible to identify the value of forests within the national accounts. The identification of activities and forest-related products allow to expand the value of this natural asset, bringing to light a new added value at market prices with the structure of the SNA.

Figure 16 shows that within traditional forest accounting, silviculture represents less than 0.3% of GDP for each of the three years analyzed. If the accounting is extended and other products with timber components, resins or other materials extracted from the forest to be processed in the industry are included in forest accounting, the weight of the forestry sector goes up to almost 1% on average, and it is known as the "Forest Economy". The "Forest Economy" includes the codes for



the economic activities EA027, EA056 and EA057 crossed with the codes for the products PN036, PN070 and PN071. Finally, if economic activities that are not classified as extraction of forest products, but that make use of these products, are included in the calculations, the added value amounts to slightly more than 2% of the GDP. This classification is known as the "Forest Extended Economy". It incorporates the same product codes, but leaves the EA category open, which allows to include imports, profit margins, taxes and other income-generating activities related to extractive forest activities.



FIGURE 16. Forest Contribution to the Economy (% of GDP)

Source: BCCR.



8. CONCLUSIONS

It should be acknowledged that forests are more than just their timber value. The data presented in this report allow to visualize the forest share in the national economy, showing that forests have an added value beyond that of silviculture. Physical accounting makes it possible to contextualize this contribution, foreseeing forest depletion and guiding conservation or extraction policies according to the state of the asset.

Update and continuous improvement of data by the entities responsible for forest monitoring is necessary. The National Forest Inventory (INF) is an input of high value due to its vast amount of information about forests; hence the relevance to follow up these statistics as a continuous process. Since the INF characterizes the status of forests at a single point in time, this information should be updated periodically. This will help to improve the Forest Account in the future.

Indicators based on physical stocks and valuation techniques can be created to show the ecosystem services values provided by forests. Debates about conservation, extraction permits, and contributions to other productive sectors of the economy will be enriched with comparable statistics that report the added value of each of these services and/or goods, providing incentives to develop policies that promote activities that are shown to have greater added value.

The necessity of implementing ecosystem accounts is made clear by the previous conclusion. The natural resource approach is not sufficient to estimate the total value of forests in the economy. The valuation of goods and services using an ecosystem approach is required. Physical accounting leads to the recognition of the fact that the greatest value of the asset lies in services provided to society which do not have a market price. This makes it necessary to address this issue using the SEEA-EEA manual, which covers those aspects of accounting which are not included in the SEEA-CF (United Nations et al., 2014b).



9. REFERENCES

Agresta, Dimap, Universidad de Costa Rica, Universidad Politécnica de Madrid (2015a) Final Report: Generating a consistent historical time series of activity data from land use change for the development of Costa Rica's REDD plus reference level: Protocolo metodológico. Report on consultancy prepared for the Government of Costa Rica under the Carbon Fund of the Cooperative Fund for Forest Carbon (CFFC)

Agresta, Dimap, Universidad de Costa Rica, Universidad Politécnica de Madrid (2015b) Coverage index as a basis for estimating decreases and increases in carbon stocks: Generating a consistent historical time series of activity data from land use change for the development of Costa Rica's REDD plus reference level. Report on consultancy prepared for the Government of Costa Rica under the Carbon Fund of the Cooperative Fund for Forest Carbon (CFFC) Asamblea Legislativa (1996) Ley Forestal, No. 7575. Febrero de 1996.

Asamblea Legislativa (1996) Ley Forestal, No. 7575. Febrero de 1996.

Barquero, A. I., & Hernández, G (2015). Forests and payment for environmental services in Costa Rica. Ambientico, 12-16.

FAO (2015) Contribution of the forestry sector to national economies, 1990-2011. A. Lebedys and Y. Li. Working document on forestry finance FSFM/ACC/09. FAO, Roma.

Lange, Glenn-Marie (2003). Manual for Environmental and Economic Accounts for Forestry.

Oficina Nacional Forestal (2012). Usos y aportes de la madera en Costa Rica 2011. San José: ONF.

ONU (2009). Clasificación Industrial Internacional Uniforme de todas las actividades económicas. Revisión 4. Nueva York: División Estadística, Organización de las Naciones Unidas (ONU).

Pedroni, L., Espejo, A., y Villegas, J. F. (2015) Nivel de referencia de emisiones y absorciones forestales de Costa Rica ante el Fondo de Carbono de FCPF: metodología y resultados. Preparado para el Gobierno de Costa Rica bajo el Fondo Cooperativo para el Carbono de los Bosques (FCPF). San José.

Programa REDD/CCAD-GIZ-SINAC (2015) Inventario Nacional Forestal de Costa Rica 2014-2015. Resultados y Caracterización de los Recursos Forestales. Preparado por: Emanuelli, P., Milla, F., Duarte, E., Emanuelli, J., Jiménez, A. y Chavarría, M.I. Programa Reducción de Emisiones por Deforestación y Degradación Forestal en Centroamérica y la República Dominicana (REDD/CCAD/GIZ) y Sistema Nacional de Áreas de Conservación (SINAC) Costa Rica. San José.

SINAC-SIREFOR (2012) Reporte Estadístico Forestal 2012. San José: SINAC.

SIREFOR (2013) Reporte Estadístico Forestal 2013. San José: SIREFOR.

United Nations, European Union, Food and Agriculture Organization of the United Nations, International Monetary Fund, Organisation for Economic Co-operation and



Development, The World Bank (2014a) System of Environmental-Economic Accounting 2012–Central Framework. United Nations, Document symbol: ST/ESA/STAT/Ser. F/109.

United Nations, European Union, Food and Agriculture Organization of the United Nations, Organisation for Economic Co-operation and Development, and World Bank Group (2014b) System of Environmental-Economic Accounting 2012—Experimental Ecosystem Accounting. United Nations, Document symbol: ST/ESA/STAT/Ser.F/112.

WAVES Wealth Accounting and the Valuation of Ecosystem Services. (April, 2014). *http://www.wavespartnership.org/en/natural-capital-accounting-0*.



10. ANNEXES

Year	1992	1997	2001	2008	2011	2013
Mature forest	24,198.41	23,180.38	22,737.41	22,145.49	21,846.05	25,956.52
Mature forest	13,448.07	12,882.31	12,636.13	12,307.17	12,140.76	14,425.12
Secondary forest	10,750.34	10,298.07	10,101.28	9,838.31	9,705.29	11,531.40
Mature plantation	717.95	507.98	375.26	262.53	230.91	250.45
Plantation < 5 years	999.92	626.17	483.70	332.07	424.75	371.83
Plantation 5 -10 years	0.00	597.84	382.04	240.32	225.92	405.51
Plantation 10 - 15 years	0.00	0.00	344.71	230.57	177.84	235.90
Plantation 15 - 20 years	0.00	0.00	0.00	247.11	192.29	188.68
Plantation 20 - 25 years	0.00	0.00	0.00	0.00	214.04	204.71
Plantation 25 - 30 years	0.00	0.00	0.00	0.00	0.00	228.35
Forest < 5 years	2,637.34	1,173.48	1,321.95	1,311.59	922.38	1,449.45
Forest 5 -10 years	0.00	2,157.49	948.99	1,057.98	1,056.64	1,135.99
Forest 0 - 15 years	0.00	0.00	1,833.20	723.45	891.57	1.378.36
Forest 15 - 20 years	0.00	0.00	0.00	1,647.71	648.34	1,187.96
Forest 0 - 25 years	0.00	0.00	0.00	0.00	1,547.39	862.19
Forest 25-30 years	0.00	0.00	0.00	0.00	0.00	2,074.35
Shrub covered areas	0.00	103.84	0.00	103.85	103.86	130.55
Grassland	0.00	12,119.89	0.00	12,386.92	12,312.17	4,369.71
Urban	0.00	662.96	0.00	832.89	823.53	976.31
Water	0.00	185.05	0.00	240.22	246.13	284.17
Terrestrial barren land	0.00	289.05	0.00	322.80	331.34	316.82
Sparse natural vegetated areas	20,705.81	372.07	0.00	117.01	46.87	51.88
Annual crops	0.00	1,685.89	20,920.34	1,684.29	1,690.96	1,776.74
Coffee	0.00	2.941.57	0.00	2.604.22	2.559.53	2.389.76
Pineapple	0.00	428.84	0.00	679.00	696.35	839.15
Other perm crops	0.00	2,290.02	0.00	2,249.27	2,242.23	2,231.28
Mature Palm Forest	1,331.70	1,232.26	1,206.73	1,139.92	1,109.00	1,247.69
Palm Forest < 5 years	152.19	65.07	67.28	50.00	49.08	78.01
Palm Forest 5 -10 years	0.00	112.94	40.17	46.52	34.16	46.91
Palm Forest 10 - 15 years	0.00	0.00	81.51	26.44	37.57	36.81
Palm Forest 15 - 20 years	0.00	0.00	0.00	70.00	22.59	41.35
Palm Forest 20 - 25 years	0.00	0.00	0.00	0.00	64.08	24.43
Palm Forest 25 - 30 years	0.00	0.00	0.00	0.00	0.00	70.33
Mature Mangrove	401.57	387.12	375.25	358.78	352.74	273.96
Mangrove < 5 years	83.47	44.78	24.60	31.85	29.62	19.18

ANNEX 1. Land Cover Evolution by Category (km²)



Mangrove 5 -10 years	0.00	63.66	30.49	15.98	21.74	19.22
Mangrove 10 - 15 years	0.00	0.00	54.72	22.15	12.56	15.85
Mangrove 15 - 20 years	0.00	0.00	0.00	47.42	19.52	9.29
Mangrove 20 - 25 years	0.00	0.00	0.00	0.00	44.59	14.69
Mangrove 25 - 30 years	0.00	0.00	0.00	0.00	0.00	33.99

Source: BCCR based on Pedroni et al. (2015).

ANNEX 2. Land Cover Evolution by Category (in %)

Year	1992	1997	2001	2008	2011	2013
Mature forest	47.24	45.25	44.38	43.23	42.64	50.67
Mature forest	26.25	25.15	24.67	24.02	23.70	28.16
Secondary forest	20.99	20.10	19.72	19.20	18.95	22.51
Mature plantation	1.40	0.99	0.73	0.51	0.45	0.49
Plantation < 5 years	1.95	1.22	0.94	0.65	0.83	0.73
Plantation 5 -10 years	0.00	1.17	0.75	0.47	0.44	0.79
Plantation 10 - 15 years	0.00	0.00	0.67	0.45	0.35	0.46
Plantation 15 - 20 years	0.00	0.00	0.00	0.48	0.38	0.37
Plantation 20 - 25 years	0.00	0.00	0.00	0.00	0.42	0.40
Plantation 25 - 30 years	0.00	0.00	0.00	0.00	0.00	0.45
Forest < 5 years	5.15	2.29	2.58	2.56	1.80	2.83
Forest 5 -10 years	0.00	4.21	1.85	2.07	2.06	2.22
Forest 0 - 15 years	0.00	0.00	3.58	1.41	1.74	2.69
Forest 15 - 20 years	0.00	0.00	0.00	3.22	1.27	2.32
Forest 0 - 25 years	0.00	0.00	0.00	0.00	3.02	1.68
Forest 25-30 years	0.00	0.00	0.00	0.00	0.00	4.05
Shrub covered areas	0.00	0.20	0.00	0.20	0.20	0.25
Grassland	0.00	23.66	0.00	24.18	24.03	8.53
Urban	0.00	1.29	0.00	1.63	1.61	1.91
Water	0.00	0.36	0.00	0.47	0.48	0.55
Terrestrial barren land	0.00	0.56	0.00	0.63	0.65	0.62
Sparse natural vegetated areas	40.42	0.73	0.00	0.23	0.09	0.10
Annual crops	0.00	3.29	40.84	3.29	3.30	3.47
Coffee	0.00	5.74	0.00	5.08	5.00	4.66
Pineapple	0.00	0.84	0.00	1.33	1.36	1.64
Other perm crops	0.00	4.47	0.00	4.39	4.38	4.36
Mature Palm Forest	2.60	2.41	2.36	2.23	2.16	2.44
Palm Forest < 5 years	0.30	0.13	0.13	0.10	0.10	0.15
Palm Forest 5 -10 years	0.00	0.22	0.08	0.09	0.07	0.09
Palm Forest 10 - 15 years	0.00	0.00	0.16	0.05	0.07	0.07
Palm Forest 15 - 20 years	0.00	0.00	0.00	0.14	0.04	0.08
Palm Forest 20 - 25 years	0.00	0.00	0.00	0.00	0.13	0.05
Palm Forest 25 - 30 years	0.00	0.00	0.00	0.00	0.00	0.14
Mature Mangrove	0.78	0.76	0.73	0.70	0.69	0.53
Mangrove < 5 years	0.16	0.09	0.05	0.06	0.06	0.04
Mangrove 5 -10 years	0.00	0.12	0.06	0.03	0.04	0.04



Mangrove 10 - 15 years	0.00	0.00	0.11	0.04	0.02	0.03
Mangrove 15 - 20 years	0.00	0.00	0.00	0.09	0.04	0.02
Mangrove 20 - 25 years	0.00	0.00	0.00	0.00	0.09	0.03
Mangrove 25 - 30 years	0.00	0.00	0.00	0.00	0.00	0.07

Source: BCCR based on Pedroni et al. (2015).



ANNEX 3. Scheme for the Economic Valuation of the Forest

Source: BCCR.

The diagram above attemps to show, in a simplified way, the forest values from the perspectives of ecosystem services and of natural resources. The three figures in the top are ecosystem services identified in the Costa Rican economy which do not have a market price, but make a significant contribution to total wealth. The following three figures in the bottom of the annex present the values calculated in this research. They correspond to goods extracted from the forest, considered as a natural resources. These goods do have a market value, but are dispersed throughout the economy without being classified as goods obtained from forests.