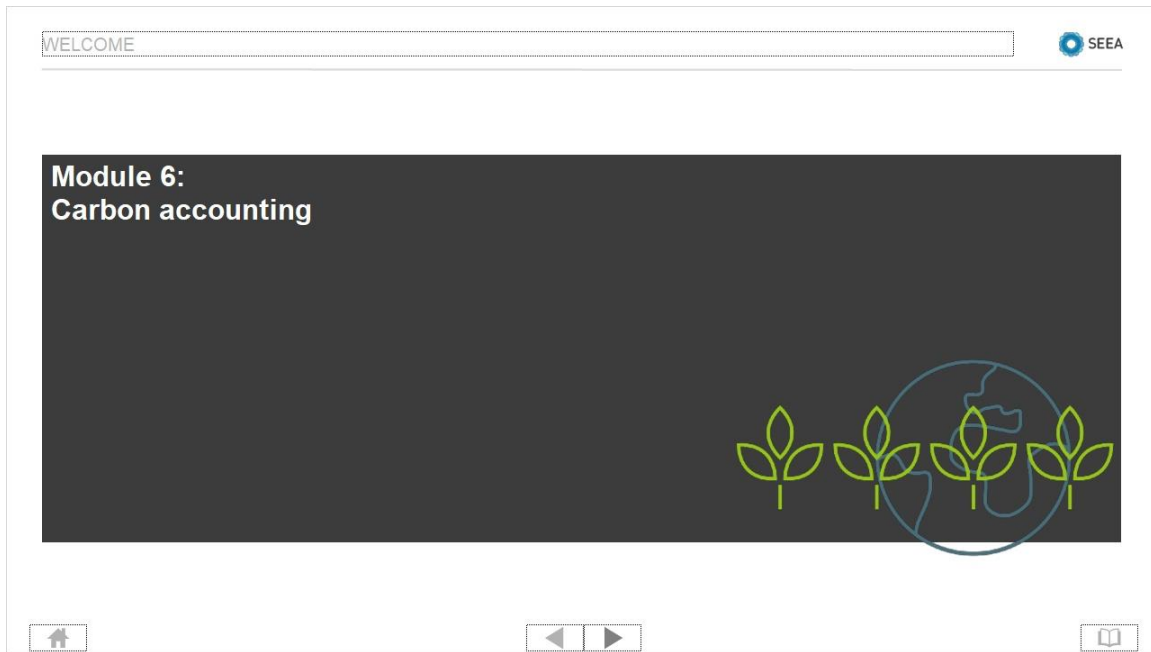


1. Module 1 - Introduction

1.1 Welcome



Notes:

1.2 Module units

MODULE 6: CARBON ACCOUNTING

Page 2 / 39

SEEA

Module units

The carbon accounting module will walk you through the four units listed below. We recommend completing these units in the given order.

**Unit 1:
Carbon account**

- What is it?
- Why do we need it?
- What does it look like?
- Expertise and data required.

**Unit 2:
Compilers**

- Basic concepts of carbon accounting.
- Steps behind compiling a carbon stock accounts.

**Unit 3:
Data providers**

- Concepts
- Carbon cycle, flows and balance.
- Data options, examples and issues.

**Unit 4:
Review**

- Quiz
- Summary

1.3 Module objectives

MODULE 6: CARBON ACCOUNTING, UNIT 1: CARBON ACCOUNT

Page 3 / 39

SEEA

Module objectives

After completing the SEEA Carbon Accounting module you will be able to:

Click on each point to learn more.

Understand why carbon accounting is important!

Understand how carbon accounting fits into the SEEA.

Compiling a carbon stock account.


Understand the basics of carbon cycles and pools.

Understand the data options and sources for carbon accounting.

Published by Articulate® Storyline www.articulate.com

Explanation 1 (Slide Layer)

MODULE 6: CARBON ACCOUNTING, UNIT 1: CARBON ACCOUNT




Page 3 / 39  SEEA

Module objectives

After completing the SEEA Carbon Accounting module you will be able to:


Click on each point to learn more.

Understand why carbon accounting is important!	These accounts provide indicators for ecosystem condition such as net carbon balance and primary productivity.
Understand how carbon accounting fits into the SEEA.	
Compiling a carbon stock account.	
Understand the basics of carbon cycles and pools.	
Understand the data options and sources for carbon accounting.	



Explanation 2 (Slide Layer)

MODULE 6: CARBON ACCOUNTING, UNIT 1: CARBON ACCOUNT




Page 3 / 39  SEEA

Module objectives

After completing the SEEA Carbon Accounting module you will be able to:

Click on each point to learn more.

Understand why carbon accounting is important!	
Understand how carbon accounting fits into the SEEA.	The SEEA includes basic concepts for and the structure of accounts that include carbon (ecosystem services of carbon sequestration and storage of carbon).
Compiling a carbon stock account.	
Understand the basics of carbon cycles and pools.	
Understand the data options and sources for carbon accounting.	



Explanation 3 (Slide Layer)

MODULE 6: CARBON ACCOUNTING, UNIT 1: CARBON ACCOUNT





Page 3 / 39 SEEA

Module objectives

After completing the SEEA Carbon Accounting module you will be able to:

Click on each point to learn more.

Understand why carbon accounting is important!	
Understand how carbon accounting fits into the SEEA.	
Compiling a carbon stock account.	The carbon stock account provides consistent and comparable information for policies aimed at protecting and restoring natural ecosystems. It helps to monitor the maintenance of carbon stocks in the biosphere.
Understand the basics of carbon cycles and pools.	
Understand the data options and sources for carbon accounting.	



Explanation 4 (Slide Layer)

MODULE 6: CARBON ACCOUNTING, UNIT 1: CARBON ACCOUNT





Page 3 / 39 SEEA

Module objectives

After completing the SEEA Carbon Accounting module you will be able to:


Click on each point to learn more.

Understand why carbon accounting is important!	
Understand how carbon accounting fits into the SEEA.	
Compiling a carbon stock account.	
Understand the basics of carbon cycles and pools.	The basics of the carbon cycles and pools, including carbon stocks and carbon flows.
Understand the data options and sources for carbon accounting.	



Explanation 5 (Slide Layer)

MODULE 6: CARBON ACCOUNTING, UNIT 1: CARBON ACCOUNT

Page 3 / 39  SEEA

Module objectives

After completing the SEEA Carbon Accounting module you will be able to:

Click on each point to learn more.

Understand why carbon accounting is important!





Understand how carbon accounting fits into the SEEA.

Compiling a carbon stock account.

Understand the basics of carbon cycles and pools.


Understand the data options and sources for carbon accounting.

Understanding the data options and sources can also provide information to support environmental measures.



1.4 What is Carbon Accounting?

MODULE 6: CARBON ACCOUNTING, UNIT 1: CARBON ACCOUNT

Page 4 / 39  SEEA





What is carbon accounting?

Carbon accounting is measuring, monitoring, benchmarking and reporting accounts for carbon as an asset (depletion), carbon-related services (sequestration and storage), and carbon as a characteristic of ecosystem condition: "**productivity**".

Click to learn more about **productivity**.

It is important to note that carbon accounts are considered a "**thematic account**" in the context of ecosystem accounting.

Click to learn more about **thematic accounts**.



1.5 What is Carbon Accounting?

MODULE 6: CARBON ACCOUNTING, UNIT 1: CARBON ACCOUNT

Page 5 / 39

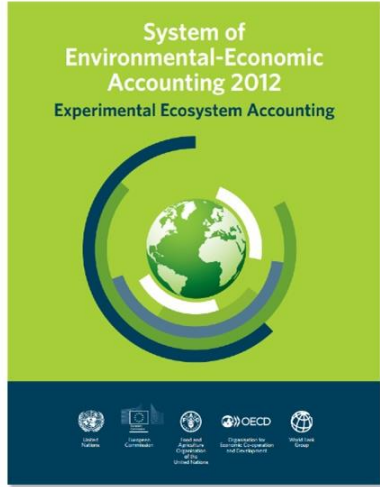
SEEA

What is carbon accounting?

The SEEA EEA includes carbon accounting in three contexts:

- Carbon as an asset (Section 4.4 and Table 4.6, pp 87-90)
- Carbon-related ecosystem services - sequestering of carbon and carbon storage (Table 3.3, p. 59; Paragraphs A3.16-19 and Figure A3.4, pp. 65-66)
- Carbon as a characteristic of ecosystem asset condition (Section 4.3 and Tables 4.3 and 4.4, pp. 72-86)

Click on the cover to open the report and learn more about SEEA-EEA and its carbon accounting.



1.6 Importance of Carbon Accounting

MODULE 6: CARBON ACCOUNTING, UNIT 1: CARBON ACCOUNT

Page 6 / 39

SEEA


Importance of carbon accounting

Carbon accounting is important because carbon plays an extensive role in the environment and the economy.

This is why we need to account for carbon:


- To develop policies on climate change and low carbon policy. It's also important to link to international guidelines (IPCC and REDD+)
- To help assess changes in land cover, land use on carbon stocks and sequestration
- To build the required carbon accounts for timber and soil resources (SEEA-CF)
- To serve as indicators for the locations of significant changes (natural and manmade additions/reductions to carbon stock)

Hover over the abbreviations to learn more.



Explanation 1 (Slide Layer)

MODULE 6: CARBON ACCOUNTING, UNIT 1: CARBON ACCOUNT

Page 6 / 39  SEEA


Importance of carbon accounting


Carbon accounting is important because carbon plays an extensive role in the environment and the economy.



This is why we need to account for carbon:


- To develop policies on climate change and low carbon policy. It's also important to link to international guidelines (IPCC and REDD+)
- To help assess changes in land cover, land use on carbon stocks and sequestration
- To build the required carbon accounts for timber and (SEEA-CF)
- To serve as indicators for the locations of significant and manmade additions/reductions to carbon stocks

Hover over the abbreviations to learn more.








Explanation 2 (Slide Layer)

MODULE 6: CARBON ACCOUNTING, UNIT 1: CARBON ACCOUNT

Page 6 / 39  SEEA


Importance of carbon accounting


Carbon accounting is important because carbon plays an extensive role in the environment and the economy.



This is why we need to account for carbon:


- To develop policies on climate change and low carbon policy. It's also important to link to international guidelines (IPCC and REDD+)
- To help assess changes in land cover, land use on carbon stocks and sequestration
- To build the required carbon accounts for timber and (SEEA-CF)
- To serve as indicators for the locations of significant and manmade additions/reductions to carbon stocks

Hover over the abbreviations to learn more.







Explanation 3 (Slide Layer)

MODULE 6: CARBON ACCOUNTING, UNIT 1: CARBON ACCOUNT

Page 6 / 39

SEEA


Importance of carbon accounting

Carbon accounting is important because carbon plays an extensive role in the environment and the economy.

This is why we need to account for carbon:

- To develop policies on climate change and low carbon policy. It's also important to link to international guidelines (IPCC and REDD+)
- To help assess changes in land cover, land use on carbon stocks and sequestration
- To build the required carbon accounts for timber and soil resources (SEEA-CF)
- To serve as indicators for the locations of significant changes (natural and man-made additions/reductions to carbon stock)

Hover over SEEA-CF: System of Environmental Economic Accounting (2012) – Central Framework



Home

Navigation

Bookmarks

1.7 Carbon Accounting Representation

MODULE 6: CARBON ACCOUNTING, UNIT 1: CARBON ACCOUNT

Page 7 / 39

SEEA

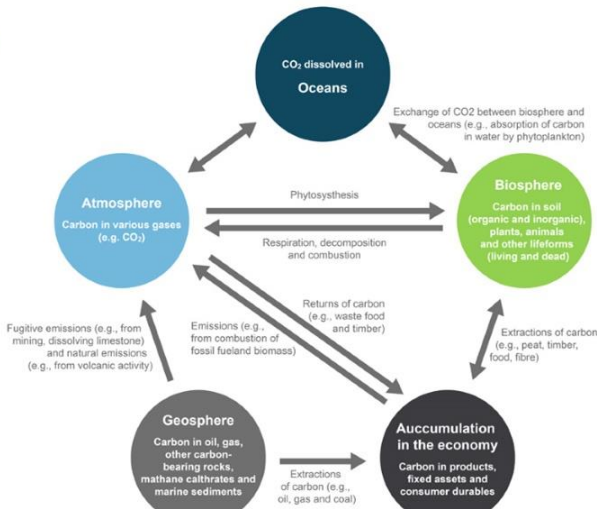
Carbon accounting representation

Before compiling carbon accounts, it's important to understand the main components of the carbon cycle.

The main components are:

- Oceans
- Atmosphere
- Geosphere
- Biosphere
- Accumulation in the economy

The components shown in the figure are those stocks and flows that provide the context for carbon accounting.



Source: SEEA EEA, 2014, Figure 4.1, p. 88.

Home

Navigation

Bookmarks

1.8 Carbon Accounting Representation

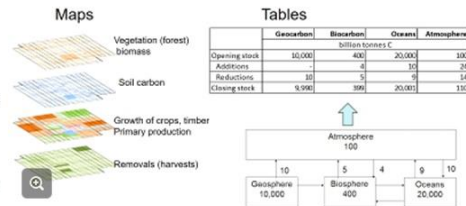
Carbon accounting representation

After the carbon cycle components are understood, carbon accounting can then be represented in terms of stocks in a **carbon stock account**, using maps and tables (additions and reductions).

Accounting for carbon must therefore consider both stocks and changes in stocks of carbon in the geosphere, biosphere, atmosphere, oceans and the economy.

It is important to know that both the opening and closing stocks of carbon are recorded. The various changes between the beginning and end of the accounting period are recorded as either additions to, or reductions in, the stock.

For full details on the carbon stock account, please refer to Table 4.6 of SEEA EEA, Page 89 (shown below).



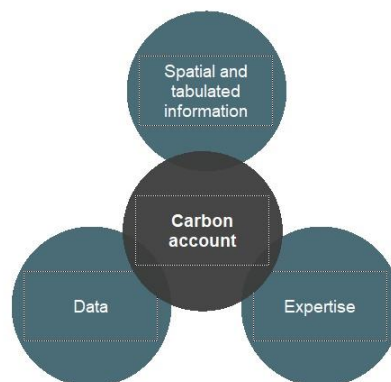
The table above is a simplified example of a carbon stock account. The table shows the stocks, additions and transfers between different type of spheres.

1.9 Carbon Account Data and Expertise Requirements

Carbon account data and expertise requirements


Compiling carbon accounts requires **spatial information** along with **data** and **expertise**. To learn more about these requirements, please take a look at the figure.

Click on each requirement to learn more.



Explanation 1 (Slide Layer)

MODULE 6: CARBON ACCOUNTING, UNIT 1: CARBON ACCOUNT

Page 9 / 39  SEEA

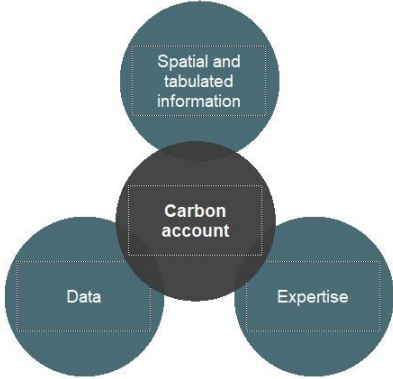
Carbon account data and expertise requirements





Compiling carbon accounts requires **spatial information** along with **data** and **expertise**. To learn more about these requirements, please take a look at the figure.

Click on each requirement to learn more.

Spatial information includes:


- The conceptual framework for ecosystem accounting involves the integration of data relating to three types of spatial units - ecosystem assets (EA), ecosystem types (ET) and ecosystem accounting areas (EAA).
- These areas are key elements of the ecosystem extent account and provide the basis for spatial analysis in the other ecosystem accounts.
- Ecosystem accounting tables that can provide, for example, coefficients for storage and sequestration by land cover type.





Explanation 2 (Slide Layer)

MODULE 6: CARBON ACCOUNTING, UNIT 1: CARBON ACCOUNT

Page 9 / 39  SEEA

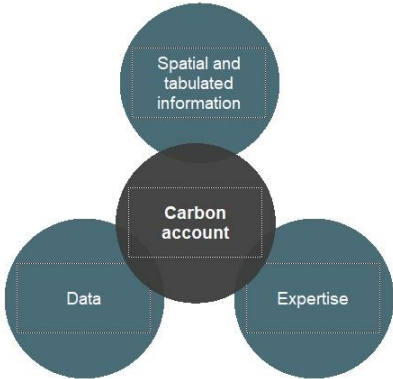
Carbon account data and expertise requirements





Compiling carbon accounts requires **spatial information** along with **data** and **expertise**. To learn more about these requirements, please take a look at the figure.

Click on each requirement to learn more.

For data, they can include measurements for:

- biocarbon (above-ground biomass) from satellite data
- carbon sequestration and storage from vegetation cover
- soil carbon according to soil type
- removals due to agriculture, forestry data, fires





Explanation 3 (Slide Layer)

MODULE 6: CARBON ACCOUNTING, UNIT 1: CARBON ACCOUNT

Page 9 / 39

SEEA

Carbon account data and expertise requirements

Compiling carbon accounts requires **spatial information** along with **data** and **expertise**. To learn more about these requirements, please take a look at the figure.

Click on each requirement to learn more.

For expertise, you can depend on:

- Ecologists (for biophysical modeling)
- Agriculture, forestry experts
- Geographers (for GIS, remote sensing)

1.10 Module units

MODULE 6: CARBON ACCOUNTING

Page 10 / 39

SEEA

Module units

The carbon accounting module will walk you through the four units listed below. We recommend completing these units in the given order.

Unit 1: Carbon accounting <ul style="list-style-type: none">● What is it?● Why do we need it?● What does it look like?● Expertise and data required.	Unit 2: Compilers <ul style="list-style-type: none">● Basic concepts of carbon accounting.● Steps behind compiling a carbon stock accounts.	Unit 3: Data providers <ul style="list-style-type: none">● Concepts● Carbon cycle, flows and balance.● Data options, examples and issues.	Unit 4: Review <ul style="list-style-type: none">● Quiz● Summary
--	---	--	--

1.11 Compilers

MODULE 6: CARBON ACCOUNTING, UNIT 2: COMPILERS

Page 11 / 39

SEEA




Compilers

Over the course of this module, please keep the following carbon definitions, as described by SEEA EEA, in mind:

1. **Carbon as an asset** (can be considered biomass, soil carbon)
2. **Carbon-related ecosystem services** include:
 - Storage (carbon stored in soil, water and biomass)
 - Sequestration or primary production (including carbon removals from the atmosphere)

Primary production is the provision of food, energy, and/or materials.
3. **Carbon can be seen as a characteristic of ecosystem asset condition** (i.e., in condition accounts). For example, biomass growth and accumulation is an indicator of productive ecosystems.

Click on the definitions to learn more.



Explanation 1 (Slide Layer)

MODULE 6: CARBON ACCOUNTING, UNIT 2: COMPILERS

Page 11 / 39

SEEA




Compilers

Over the course of this module, please keep the following carbon definitions, as described by SEEA EEA, in mind:

1. **Carbon as an asset** (can be considered biomass, soil carbon)
2. **Carbon-related ecosystem services** include:
 - Storage (carbon stored in soil, water and biomass)
 - Sequestration or primary production (including carbon removals from the atmosphere)


Primary production is the provision of food, energy, and/or materials.
3. **Carbon can be seen as a characteristic of ecosystem asset condition** (i.e., in condition accounts). For example, biomass growth and accumulation is an indicator of productive ecosystems.

Click on the definitions to learn more.



Explanation 2 (Slide Layer)

MODULE 6: CARBON ACCOUNTING, UNIT 2: COMPILERS

Page 11 / 39  SEEA





Compilers

Over the course of this module, please keep the following carbon definitions, as described by SEEA EEA, in mind:

1. **Carbon as an asset** (can be considered biomass, soil carbon)
2. **Carbon-related ecosystem services** include:
 - Storage (carbon stored in soil, water and biomass)
 - Sequestration or primary production (including carbon removals from the atmosphere)


Primary production is the provision of food, energy, and/or materials.
3. **Carbon can be seen as a characteristic of ecosystem asset condition** (i.e., in condition accounts). For example, biomass growth and accumulation is an indicator of productive ecosystems.

Click on the definitions to learn more.



Explanation 3 (Slide Layer)

MODULE 6: CARBON ACCOUNTING, UNIT 2: COMPILERS

Page 11 / 39  SEEA





Compilers

Over the course of this module, please keep the following carbon definitions, as described by SEEA EEA, in mind:

1. **Carbon as an asset** (can be considered biomass, soil carbon)
2. **Carbon-related ecosystem services** include:
 - Storage (carbon stored in soil, water and biomass)
 - Sequestration or primary production (including carbon removals from the atmosphere)

Primary production is the provision of food, energy, and/or materials.
3. **Carbon can be seen as a characteristic of ecosystem asset condition** (i.e., in condition accounts). For example, biomass growth and accumulation is an indicator of productive ecosystems.

Click on the definitions to learn more.



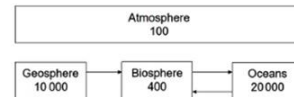
1.12 Carbon Stock Example

Carbon stock example

Let's compile a carbon stock account together by walking through this simplified example. Based on the figure, the following information is provided for different components of the carbon cycle:

- Atmosphere has 100 MtC *
- Geosphere has 10,000 MtC
- Biosphere has 400 MtC
- Oceans have 20,000 MtC

*MtC = Megatonnes (million tonnes) of carbon



Fill in the opening stock row in the carbon stock account table and check your answers.

	Geocarbon	Biocarbon	Oceans	Atmosphere
Opening stock				
Additions				
Reductions				
Closing stock				

OK

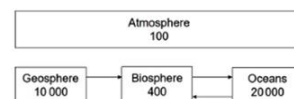
Correct (Slide Layer)

Carbon stock example

Let's compile a carbon stock account together by walking through this simplified example. Based on the figure, the following information is provided for different components of the carbon cycle:

- Atmosphere has 100 MtC *
- Geosphere has 10,000 MtC
- Biosphere has 400 MtC
- Oceans have 20,000 MtC

*MtC = Megatonnes (million tonnes) of carbon



Fill in the opening stock row in the carbon stock account table and check your answers.

	Geocarbon	Biocarbon	Oceans	Atmosphere
Opening stock				
Additions				
Reductions				
Closing stock				

Very good!



Continue

Incorrect (Slide Layer)

MODULE 6: CARBON ACCOUNTING, UNIT 2: COMPILERS

Page 12 / 39

SEEA

Carbon stock example

Let's compile a carbon stock account together by walking through this simplified example. Based on the figure, the following information is provided for different components of the carbon cycle:

- Atmosphere has 100 MtC *
- Geosphere has 10,000 MtC
- Biosphere has 400 MtC
- Oceans have 20,000 MtC

*MtC = Megatonnes (million tonnes) of carbon

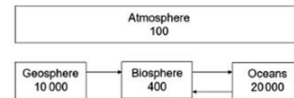
Fill in the opening stock row in the carbon stock account table and check your answers.

	Geocarbon	Biocarbon	Oceans	Atmosphere
Opening stock	10000	400	20000	100
Additions				
Reductions				
Closing stock				

Not quite right.

Take a look at the solution!

Continue



1.13 Carbon Stock Example

MODULE 6: CARBON ACCOUNTING, UNIT 2: COMPILERS

Page 13 / 39

SEEA

Carbon stock example

Now you have the opening stock values for the carbon stock account example.

Next we'll consider additions to the atmosphere (i.e., reductions from the other components). Those listed for this carbon account are shown in the figure below:

Now, let's fill in the reductions and additions rows in the carbon stock account table and check our answers.

	Geocarbon	Biocarbon	Oceans	Atmosphere
Opening stock	10000	400	20000	100
Additions				
Reductions				
Closing stock				

OK

Correct (Slide Layer)

MODULE 6: CARBON ACCOUNTING, UNIT 2: COMPILERS

Page 13 / 39

SEEA

Carbon stock example

Now you have the opening stock values for the carbon stock account example.

Next we'll consider additions to the atmosphere (i.e., reductions from the other components). Those listed for this carbon account are shown in the figure below:

Now, let's fill in the reductions and additions rows in the carbon stock account table and check our answers.

```
graph LR; G[Geosphere 10 000] -- 10 --> A[Atmosphere 100]; B[Biosphere 400] -- 5 --> A; O[Oceans 20 000] -- 9 --> A; A --> G; A --> B; A --> O;
```

	Geocarbon	Biocarbon	Oceans	Atmosphere
Opening stock	10000	400	20000	100
Additions				
Reductions				
Closing stock				

Very good!

Note: $10 + 5 + 9 = 24$
This is an addition to the atmosphere coming from the other components.

Continue

Incorrect (Slide Layer)

MODULE 6: CARBON ACCOUNTING, UNIT 2: COMPILERS

Page 13 / 39

SEEA

Carbon stock example

Now you have the opening stock values for the carbon stock account example.

Next we'll consider additions to the atmosphere (i.e., reductions from the other components). Those listed for this carbon account are shown in the figure below:

Now, let's fill in the reductions and additions rows in the carbon stock account table and check our answers.

```
graph LR; G[Geosphere 10 000] -- 10 --> A[Atmosphere 100]; B[Biosphere 400] -- 5 --> A; O[Oceans 20 000] -- 9 --> A; A --> G; A --> B; A --> O;
```

	Geocarbon	Biocarbon	Oceans	Atmosphere
Opening stock	10000	400	20000	100
Additions				24
Reductions	10	5	9	
Closing stock				

Not quite right.

Note: $10 + 5 + 9 = 24$
This is an addition to the atmosphere coming from the other components.

Continue

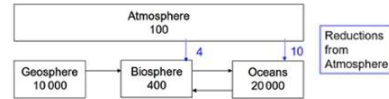
1.14 Carbon Stock Example

Carbon stock example

Alright, now we have the opening stock values and the additions for the example.

Next we'll consider the reductions to atmosphere (i.e., additions from the other components) for this carbon account, as shown in the figure below.

Now, let's fill in the additions and reductions rows in the carbon stock account table and check our answers.



	Geocarbon	Biocarbon	Oceans	Atmosphere
Opening stock	10000	400	20000	100
Additions				24
Reductions	10	5	9	
Closing stock				

OK

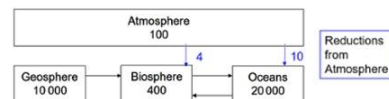
Correct (Slide Layer)

Carbon stock example

Alright, now we have the opening stock values and the additions for the example.

Next we'll consider the reductions to atmosphere (i.e., additions from the other components) for this carbon account, as shown in the figure below.

Now, let's fill in the additions and reductions rows in the carbon stock account table and check our answers.



	Geocarbon	Biocarbon	Oceans	Atmosphere
Opening stock	10000	400	20000	100
Additions				24
Reductions	10	5	9	
Closing stock				

Very good!

Note: $0 + 4 + 10 = 14$
This is a reduction from the atmosphere going to the other components.

Continue

Incorrect (Slide Layer)

MODULE 6: CARBON ACCOUNTING, UNIT 2: COMPILERS

Page 14 / 39

SEEA

Carbon stock example

Alright, now we have the opening stock values and the additions for the example.

Next we'll consider the reductions to atmosphere (i.e., additions from the other components) for this carbon account, as shown in the figure below.

Now, let's fill in the additions and reductions rows in the carbon stock account table and check our answers.

Atmosphere
100

Geosphere
10 000

Biosphere
400

Oceans
20 000

4

10

Reductions from Atmosphere

	Geocarbon	Biocarbon	Oceans	Atmosphere
Opening stock	10000	400	20000	100
Additions	0	4	10	24
Reductions	10	5	9	14
Closing stock				

Not quite right.

Note: $0 + 4 + 10 = 14$
This is a reduction from the atmosphere going to the other components.

Continue

1.15 Carbon Stock Example

MODULE 6: CARBON ACCOUNTING, UNIT 2: COMPILERS

Page 15 / 39

SEEA

Carbon stock example

Great! The opening stock values along with the additions and reductions for the example are now completed.

Now it's time to do some calculations to close the carbon stock account.

To close out all of the components, we need to calculate the amount of the closing stocks.

Fill in the closing stock account cells in the carbon stock account table and check our answers.

Atmosphere
100

Geosphere
10 000

Biosphere
400

Oceans
20 000

	Geocarbon	Biocarbon	Oceans	Atmosphere
Opening stock	10000	400	20000	100
Additions	0	4	10	24
Reductions	10	5	9	14
Closing stock				

OK

Home

Navigation

Bookmarks

Correct (Slide Layer)

MODULE 6: CARBON ACCOUNTING, UNIT 2: COMPILERS

Page 15 / 39

SEEA

Carbon stock example

Great! The opening stock values along with the additions and reductions for the example are now completed.

Now it's time to do some calculations to close the carbon stock account.
To close out all of the components, we need to calculate the amount of the closing stocks.

Fill in the closing stock account cells in the carbon stock account table and check our answers.

	Geocarbon	Biocarbon	Oceans	Atmosphere
Opening stock	10000	400	20000	100
Additions	0	4	10	24
Reductions	10	5	9	14
Closing stock				

Very good!

Closing Stock for Atmosphere =
Opening Stock + Additions – Reduction
Use the column -> $100 + 24 - 14 = 110$

Continue

Incorrect (Slide Layer)

MODULE 6: CARBON ACCOUNTING, UNIT 2: COMPILERS

Page 15 / 39

SEEA

Carbon stock example

Great! The opening stock values along with the additions and reductions for the example are now completed.

Now it's time to do some calculations to close the carbon stock account.
To close out all of the components, we need to calculate the amount of the closing stocks.

Fill in the closing stock account cells in the carbon stock account table and check our answers.

	Geocarbon	Biocarbon	Oceans	Atmosphere
Opening stock	10000	400	20000	100
Additions	0	4	10	24
Reductions	10	5	9	14
Closing stock	9990	399	20001	110

Not quite right.

Closing Stock for Atmosphere =
Opening Stock + Additions – Reduction
Use the column -> $100 + 24 - 14 = 110$

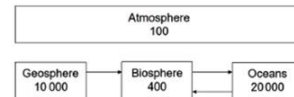
Continue

1.16 Carbon Stock Example

Carbon stock example

Well done!

Now you are able to complete a carbon stock account by calculating the additions and reductions for each component in the carbon cycle.



	Geocarbon	Biocarbon	Oceans	Atmosphere
Opening stock	10000	400	20000	100
Additions	0	4	10	24
Reductions	10	5	9	14
Closing stock	9990	399	20001	110

1.17 Additions to Stock

Additions to stocks

Did you know that there are six types of additions in the carbon stock account that you may consider?

They are:

- **Natural expansion** (e.g. natural growth of unmanaged ecosystems)
- **Managed expansion** (e.g. human-managed growth of plantations)
- **Discoveries** (geocarbon)
- **Upwards reappraisals** (new information resulting in increased estimates of stock)
- **Reclassifications of carbon assets** (e.g. between semi-natural and natural ecosystems)
- **Imports** (displayed separately, along with exports)



Hover above each type of addition to learn more.

Source: SEEA EEA, pages 97-99.

Explanation 1 (Slide Layer)

MODULE 6: CARBON ACCOUNTING, UNIT 2: COMPILERS

Page 17 / 39

SEEA

Additions to stocks

Did you know that there are six types of additions in the carbon stock account that you may consider?

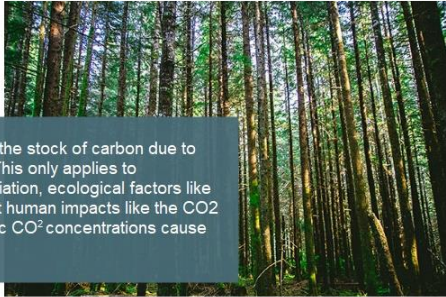
They are:





- **Natural expansion** (e.g. natural growth of managed ecosystems)
- **Managed expansion** (e.g. human-managed growth)
- **Discoveries** (geocarbon)
- **Upwards reappraisals** (new information, e.g. improved estimates of stock)
- **Reclassifications of carbon assets** (e.g. from natural to managed ecosystems)
- **Imports** (displayed separately, along with exports)

1. Natural expansion covers increases in the stock of carbon due to natural growth, over an accounting period. This only applies to biocarbon. It may be caused by climatic variation, ecological factors like a reduction in grazing pressure, and indirect human impacts like the CO₂ fertilization effect (where higher atmospheric CO₂ concentrations cause faster plant growth).

Hover above each type of addition to learn more.

Source: SEEA EEA, pages 97-99.





Explanation 2 (Slide Layer)

MODULE 6: CARBON ACCOUNTING, UNIT 2: COMPILERS

Page 17 / 39

SEEA

Additions to stocks

Did you know that there are six types of additions in the carbon stock account that you may consider?


They are:





- **Natural expansion** (e.g. natural growth of managed ecosystems)
- **Managed expansion** (e.g. human-managed growth)
- **Discoveries** (geocarbon)
- **Upwards reappraisals** (new information, e.g. improved estimates of stock)
- **Reclassifications of carbon assets** (e.g. from natural to managed ecosystems)
- **Imports** (displayed separately, along with exports)

2. Managed expansion covers increases in the stock due to human-managed growth. This will be recorded both for biocarbon in ecosystems and accumulations in the economy, in inventories, consumer durables, fixed assets and waste stored in controlled landfill sites. It also includes greenhouse gases injected into the earth.

Hover above each type of addition to learn more.

Source: SEEA EEA, pages 97-99.





Explanation 3 (Slide Layer)

MODULE 6: CARBON ACCOUNTING, UNIT 2: COMPILERS

Page 17 / 39

SEEA

Additions to stocks

Did you know that there are six types of additions in the carbon stock account that you may consider?


They are:





- **Natural expansion** (e.g. natural growth of unmanaged ecosystems)
- **Managed expansion** (e.g. human-induced growth of managed ecosystems)
- **Discoveries** (geocarbon)
- **Upwards reappraisals** (new information that improves estimates of stock)
- **Reclassifications of carbon assets** (e.g. changes in the classification of natural ecosystems)
- **Imports** (displayed separately, along with exports)

3. Discoveries of new stock, including the emergence of new resources added to stock. They usually come from exploration and evaluation. This applies mostly - and perhaps exclusively - to geocarbon.

Hover above each type of addition to learn more.

Source: SEEA EEA, pages 97-99.





Explanation 4 (Slide Layer)

MODULE 6: CARBON ACCOUNTING, UNIT 2: COMPILERS

Page 17 / 39

SEEA

Additions to stocks

Did you know that there are six types of additions in the carbon stock account that you may consider?

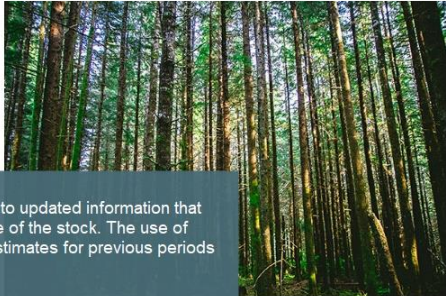
They are:





- **Natural expansion** (e.g. natural growth of unmanaged ecosystems)
- **Managed expansion** (e.g. human-induced growth of managed ecosystems)
- **Discoveries** (geocarbon)
- **Upwards reappraisals** (new information that improves estimates of stock)
- **Reclassifications of carbon assets** (e.g. changes in the classification of natural ecosystems)
- **Imports** (displayed separately, along with exports)

4. Upward reappraisals are changes due to updated information that permits a reassessment of the physical size of the stock. The use of updated information may require revising estimates for previous periods to ensure continuity over time.

Hover above each type of addition to learn more.

Source: SEEA EEA, pages 97-99.





Explanation 5 (Slide Layer)

MODULE 6: CARBON ACCOUNTING, UNIT 2: COMPILERS

Page 17 / 39

SEEA

Additions to stocks

Did you know that there are six types of additions in the carbon stock account that you may consider?

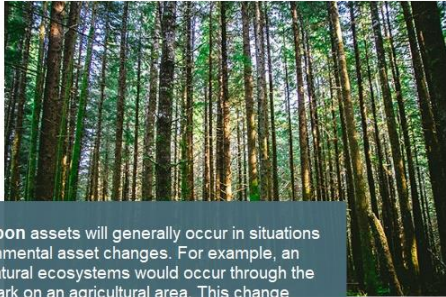
They are:

- **Natural expansion** (e.g. natural growth of unmanaged ecosystems)
- **Managed expansion** (e.g. human-managed growth of plantations)
- **Discoveries** (geocarbon)
- **Upwards reappraisals** (new information resulting in increased estimates of stock)
- **Reclassifications of carbon assets** (e.g. between semi-natural and natural ecosystems)
- **Imports** (displayed separately, along with exports)

5. **Reclassifications of carbon assets** will generally occur in situations in which the use of an environmental asset changes. For example, an increase in carbon in semi-natural ecosystems would occur through the establishment of a national park on an agricultural area. This change would be equalized by an equivalent decrease in agricultural ecosystems. In this case, it's only the land use that has changed; reclassifications will usually have no impact on the total quantity of carbon.

Hover above each type of addition to learn more

Source: SEEA EEA, pages 97-99.



Explanation 6 (Slide Layer)

MODULE 6: CARBON ACCOUNTING, UNIT 2: COMPILERS

Page 17 / 39

SEEA

Additions to stocks

Did you know that there are six types of additions in the carbon stock account that you may consider?


They are:

- **Natural expansion** (e.g. natural growth of unmanaged ecosystems)
- **Managed expansion** (e.g. human-managed growth of plantations)
- **Discoveries** (geocarbon)
- **Upwards reappraisals** (new information resulting in increased estimates of stock)
- **Reclassifications of carbon assets** (e.g. between semi-natural and natural ecosystems)
- **Imports** (displayed separately, along with exports)

6. **Imports** are recorded to account for imports of produced goods (e.g. petroleum products). Imports are shown separately so that they can be compared to exports.

Hover above each type of addition to learn more

Source: SEEA EEA, pages 97-99.



1.18 Reductions to Stock

MODULE 6: CARBON ACCOUNTING, UNIT 2: COMPILERS

Page 18 / 39

SEEA

Reductions in stocks


On the other side, there are also six types of reductions in carbon stock that you can consider.

They are:

- **Natural contraction** (natural losses from unmanaged ecosystems, e.g. due to fire or floods)
- **Managed contraction** (e.g. human removal of timber from plantations)
- **Downwards reappraisals** (new information resulting in decreased stock estimates)
- **Reclassifications** (e.g. between semi-natural and natural ecosystems)
- **Exports** (shown separately from imports)
- **Catastrophic losses**

Click on each type of reduction to learn more.

Source: SEEA EEA, pages 97-99.



Explanation 1 (Slide Layer)

MODULE 6: CARBON ACCOUNTING, UNIT 2: COMPILERS

Page 18 / 39

SEEA

Reductions in stocks

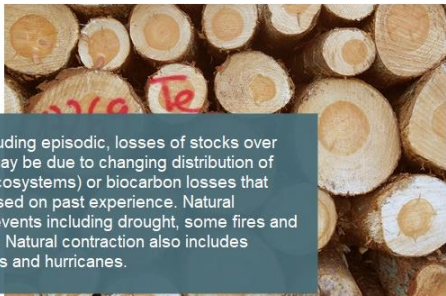
On the other side, there are also six types of reductions in carbon stock that you can consider.

They are:

- **Natural contraction** (natural losses from unmanaged ecosystems, e.g. due to fire or floods)
- **Managed contraction** (e.g. human removal of timber from plantations)
- **Downwards reappraisals** (new information resulting in decreased stock estimates)
- **Reclassifications** (e.g. between semi-natural and natural ecosystems)
- **Exports** (shown separately from imports)
- **Catastrophic losses**

Click on each type of reduction to learn more.

Source: SEEA EEA, pages 97-99.



1. **Natural contraction** covers natural, including episodic, losses of stocks over the course of an accounting period. They may be due to changing distribution of ecosystems (e.g. a contraction of natural ecosystems) or biocarbon losses that might reasonably be expected to occur, based on past experience. Natural contraction includes losses from episodic events including drought, some fires and floods, as well as pest and disease attacks. Natural contraction also includes losses due to volcanic eruptions, tidal waves and hurricanes.

Explanation 2 (Slide Layer)

MODULE 6: CARBON ACCOUNTING, UNIT 2: COMPILERS

Page 18 / 39 SEEA

Reductions in stocks

On the other side, there are also six types of **reductions** in carbon stock that you can consider.

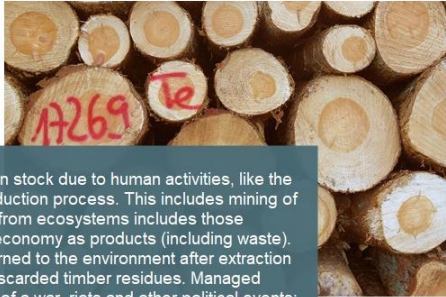
They are:

- **Natural contraction** (natural losses from unmanaged ecosystems, e.g. due to fire or floods)
- **Managed contraction** (e.g. human removal or harvest of carbon through a production process)
- **Downwards reappraisals** (changes due to updated information that permits a reassessment of the stock's physical size)
- **Reclassifications** (e.g. between stocks)
- **Exports** (shown separately from other reductions)
- **Catastrophic losses**

2. **Managed contractions** are reductions in stock due to human activities, like the removal or harvest of carbon through a production process. This includes mining of fossil fuels and felling of timber. Extraction from ecosystems includes those quantities that continue to flow through the economy as products (including waste). It also includes the stocks immediately returned to the environment after extraction because they are unwanted, for example discarded timber residues. Managed contraction also includes losses as a result of a war, riots and other political events; and technological accidents such as major toxic releases.

Click on each type of reduction to learn more.

Source: SEEA EEA, pages 97-99.



Explanation 3 (Slide Layer)

MODULE 6: CARBON ACCOUNTING, UNIT 2: COMPILERS

Page 18 / 39 SEEA

Reductions in stocks

On the other side, there are also six types of **reductions** in carbon stock that you can consider.


They are:

- **Natural contraction** (natural losses from unmanaged ecosystems, e.g. due to fire or floods)
- **Managed contraction** (e.g. human removal or harvest of carbon through a production process)
- **Downwards reappraisals** (changes due to updated information that permits a reassessment of the stock's physical size)
- **Reclassifications** (e.g. between stocks)
- **Exports** (shown separately from other reductions)
- **Catastrophic losses**

3. **Downwards reappraisals** reflect changes due to updated information that permits a reassessment of the stock's physical size. The reassessments may also relate to changes in the assessed quality or grade of the natural resource. The use of updated information may require the revision of estimates for previous periods to ensure continuity over time.

Click on each type of reduction to learn more.

Source: SEEA EEA, pages 97-99.



Explanation 4 (Slide Layer)

MODULE 6: CARBON ACCOUNTING, UNIT 2: COMPILERS

Page 18 / 39

SEEA

Reductions in stocks

On the other side, there are also six types of **reductions** in carbon stock that you can consider.

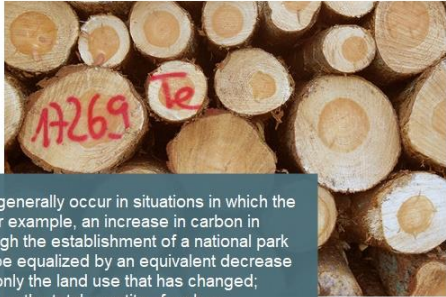
They are:

- **Natural contraction** (natural losses from unmanaged ecosystems, e.g. due to fire or floods)
- **Managed contraction** (e.g. human removal of timber from plantations)
- **Downwards reappraisals** (new information resulting in decreased stock estimates)
- **Reclassifications** (e.g. between semi-natural and agricultural ecosystems)
- **Exports** (shown separately from other reductions so they may be compared with imports)
- **Catastrophic losses**

4. **Reclassifications** of carbon assets will generally occur in situations in which the use of an environmental asset changes. For example, an increase in carbon in semi-natural ecosystems would occur through the establishment of a national park on an agricultural area. This change would be equalized by an equivalent decrease in agricultural ecosystems. In this case it's only the land use that has changed; reclassifications will usually have no impact on the total quantity of carbon.

Click on each type of reduction to learn more.

Source: SEEA EEA, pages 97-99.



Explanation 5 (Slide Layer)

MODULE 6: CARBON ACCOUNTING, UNIT 2: COMPILERS

Page 18 / 39

SEEA

Reductions in stocks

On the other side, there are also six types of **reductions** in carbon stock that you can consider.


They are:

- **Natural contraction** (natural losses from unmanaged ecosystems, e.g. due to fire or floods)
- **Managed contraction** (e.g. human removal of timber from plantations)
- **Downwards reappraisals** (new information resulting in decreased stock estimates)
- **Reclassifications** (e.g. between semi-natural and agricultural ecosystems)
- **Exports** (shown separately from other reductions so they may be compared with imports)
- **Catastrophic losses**

5. **Exports**: A line for exports enables accounting for exports of produced goods (e.g. petroleum products). Exports are shown separately from the other reductions so they may be compared with imports.

Click on each type of reduction to learn more.

Source: SEEA EEA, pages 97-99.



Explanation 6 (Slide Layer)

MODULE 6: CARBON ACCOUNTING, UNIT 2: COMPILERS

Page 18 / 39

SEEA

Reductions in stocks


On the other side, there are also six types of reductions in carbon stock that you can consider.

They are:

- **Natural contraction** (natural losses from unmanaged ecosystems, e.g. due to fire or floods)
- **Managed contraction** (e.g. human removal of timber from plantations)
- **Downwards reappraisals** (new information resulting in lowered stock estimates)
- **Reclassifications** (e.g. between stocks)
- **Exports** (shown separately from managed contraction)
- **Catastrophic losses**

Click on each type of reduction to learn more.

Source: SEEA EEA, pages 97-99.



6. Catastrophic losses, as defined in the SNA, are not shown as a single entry but are allocated between managed contraction and natural contraction. Managed contraction would include fires deliberately lit to reduce the risk of uncontrolled wild fires. For the purposes of accounting, reductions due to human accidents, such as oil well ruptures, would also be included under managed contraction. Catastrophic losses could, however, be identified separately in the table or a related table.

1.19 Additions and Reductions to Stock

(Drag and Drop, 10 points, 1 attempt permitted)

MODULE 6: CARBON ACCOUNTING, UNIT 2: COMPILERS

Page 19 / 39

SEEA

Additions and reductions to stocks

You've just learned about different addition and reduction types in the carbon stock account. Now can you match the types to the correct category?

Drag the type into its category

Additions	Reductions

Managed contraction

Natural expansion

Upwards reappraisals

Exports

Imports

Catastrophic losses

OK

Drag Item	Drop Target
Natural expansion	Rectangle 9
Exports	Rectangle 10
Upwards reappraisals	Rectangle 9
Imports	Rectangle 9
Catastrophic losses	Rectangle 10
Managed contraction	Rectangle 10

Drag and drop properties
Snap dropped items to drop target (Tile)
Delay item drop states until interaction is submitted

Feedback when correct:

Well done.

Feedback when incorrect:

Take a look at the solution.

Correct (Slide Layer)

MODULE 6: CARBON ACCOUNTING, UNIT 2: COMPILERS

Page 19 / 39 SEEA

Additions and reductions to stocks

You've just learned about different addition and reduction types in the carbon stock account. Now can you match the types to the correct category?

Drag the type into its category

Additions	Reductions

Natural expansion

Upwards reappraisals

Right!

Well done.

Continue

Incorrect (Slide Layer)

MODULE 6: CARBON ACCOUNTING, UNIT 2: COMPILERS

Page 19 / 39 SEEA

Additions and reductions to stocks

You've just learned about different addition and reduction types in the carbon stock account. Now can you match the types to the correct category?

Drag the type into its category

Additions	Reductions
Natural expansion	Managed contraction
Upwards reappraisals	Exports
Imports	Catastrophic losses

Natural expansion

Upwards reappraisals

Not quite right.

Take a look at the solution.

Continue

1.20 Exercise

Carbon stock account – exercise

Let's go further into developing a carbon stock account and include a physical land cover account. **Table 1** contains data about stocks, additions, and reductions from different land covers.

The main objective of this exercise is to calculate the **net change** in the ...

1. Simplified carbon stock account.
2. Account for ecosystem services from carbon sequestration.

Table 1: Physical Account for Land Cover

	Artificial surfaces	Crops	Grassland	Tree covered area	Mangroves	Shrub covered area	Regularly flooded areas	Sparse natural vegetated areas	Terrestrial barren land	Permanent snow, glaciers and inland water bodies	Total
Opening Stock	16	7	14	23	7	19	7	6	1	0	100
Additions to Stock	3	11	0	0	0	0	0	1	0	0	15
Reductions in Stock	0	0	1	8	1	2	0	3	0	0	15
Closing Stock	19	18	13	15	6	17	7	4	1	0	100

1.21 Exercise

Carbon stock account and carbon sequestration service – exercise

To compile the simplified carbon stock account, we'll use **Table 2**.

In addition, to compile the account of ecosystem services from carbon sequestration, we'll use **Table 3**.

All right, let's get started!

Table 2: Simplified Carbon Stock Account

	Artificial surfaces	Crops	Grassland	Tree covered area	Mangroves	Shrub covered area	Regularly flooded areas	Sparse natural vegetated areas	Terrestrial barren land	Permanent snow, glaciers and inland water bodies	Total
Carbon Stored (tonnes/ha)	5	40	10	200	800	80	300	8	0	0	
Carbon Stock (tonnes)											
Opening											
Additions											
Reductions											
Net change											
Closing											

Table 3: Account of Ecosystem Services from Carbon Sequestration (tonnes/year)

	Artificial surfaces	Crops	Grassland	Tree covered area	Mangroves	Shrub covered area	Regularly flooded areas	Sparse natural vegetated areas	Terrestrial barren land	Permanent snow, glaciers and inland water bodies	Total
Carbon Sequestration (tonnes/ha/year)	1	20	2	30	100	5	40	1	0	0	
Carbon Sequestration (tonnes/year)											
Opening: Carbon Sequestration											
Closing: Carbon Sequestration											
Net change											

1.22 Exercise

(Drag and Drop, 10 points, 1 attempt permitted)

MODULE 6: CARBON ACCOUNTING, UNIT 2: COMPILERS

Page 22 / 39

SEEA

Carbon stock account – exercise

To compile the carbon stock account, you need to use both tables, and fill its blanks with the corresponding values.

This is how you should perform the calculation:
Take each value in the physical land cover account and multiply by the corresponding column in the lookup table (first row of Table 2)

For example:

- Artificial surfaces opening stock = 16ha (given in Table 1)
- Carbon storage for artificial surfaces = 5 tonnes/ha (given in Table 2)
- Opening carbon storage for artificial surfaces = $16 \times 5 = 80$ tonnes

Total will be the sum of all values in the row that details the opening carbon storage values.

Continue the same calculation for the next three types of land cover.

Drag the results to their correct places and click "OK"!

Table 1: Physical Account for Land Cover

	Artificial surfaces	Crops	Grassland	Tree covered area	Mangroves	Shrub covered area	Regularly flooded areas	Sparse natural vegetated areas	Terrestrial barren land	Permanent snow, glaciers and ice	Perennially flooded wetlands and inland water bodies	Total
Opening Stock	16	7	14	23	7	19	7	6	1	0	0	100
Additions to Stock	8	11	0	0	0	0	0	1	0	0	0	15
Reductions in Stock	0	0	1	8	1	2	0	3	0	0	0	15
Closing Stock	19	18	13	15	6	17	7	4	1	0	0	100

Table 2: Simplified Carbon Stock Account

	Artificial surfaces	Crops	Grassland	Tree covered area	Mangroves	Shrub covered area	Regularly flooded areas	Sparse natural vegetated areas	Terrestrial barren land	Permanent snow, glaciers and ice	Perennially flooded wetlands and inland water bodies	Total
Carbon Stored (tonnes/ha)	5	40	10	200	800	80	300	8	0	0	0	
Carbon Stock (tonnes)												
Opening	80											
Additions												
Reductions												
Net change												
Closing												

280

140

4600

OK

Drag Item	Drop Target
280	Rectangle 3
140	Rectangle 4
4600	Rectangle 5

Drag and drop properties
Snap dropped items to drop target (Stack random)
Delay item drop states until interaction is submitted

Feedback when correct:

Das stimmt! Sie haben die richtige Antwort gewählt.

Feedback when incorrect:

Sie haben nicht die richtige Antwort gewählt.

Correct (Slide Layer)

Carbon stock account – exercise

To compile the carbon stock account, you need to use both tables, and fill its blanks with the corresponding values.

This is how you should perform the calculation:

Take each value in the physical land cover account and multiply by the corresponding column in the lookup table (first row of Table 2)

For example:

- Artificial surfaces opening stock = 16ha (given in Table 1)
- Carbon storage for artificial surfaces = 5 tonnes/ha (given in Table 2)
- Opening carbon storage for artificial surfaces = $16 \times 5 = 80$ tonnes

Total will be the sum of all values in the row that details the opening carbon storage values.

Continue the same calculation for the next three types of land cover.

Drag the results to their correct places and click "OK"!

Table 1: Physical Account for Land Cover

	Artificial surfaces	Crops	Grassland	Tree covered area	Mangroves	Shrub covered area	Regularly flooded areas	Sparse natural vegetation areas	Terrestrial barren land	Permanent snow, glaciers and ice	Wetlands	Total
Opening Stock	16	7	14	23	7	19	7	6	1	0	0	100
Additions to Stock	0	11	0	0	0	0	0	1	0	0	0	15
Reductions in Stock	0	0	1	8	1	2	0	3	0	0	0	15
Closing Stock	16	18	13	15	6	17	7	4	1	0	0	100

Table 2: Simplified Carbon Stock Account

	Artificial surfaces	Crops	Grassland	Tree covered area	Mangroves	Shrub covered area	Regularly flooded areas	Sparse natural vegetation areas	Terrestrial barren land	Permanent snow, glaciers and ice	Wetlands	Total
Carbon Stored (tonnes/ha)	5	40	10	200	800	80	300	8	0	0	0	
Carbon Stock (tonnes)	80	720	140	4600	5600	1520	2100	48	0	0	0	14368
Opening												
Additions												
Reductions												
Net change												
Closing												

280 140 4800

Correct!

Continue

Incorrect (Slide Layer)

Carbon stock account – exercise

To compile the carbon stock account, you need to use both tables, and fill its blanks with the corresponding values.

This is how you should perform the calculation:

Take each value in the physical land cover account and multiply by the corresponding column in the lookup table (first row of Table 2)

For example:

- **Artificial surfaces** opening stock = 16ha (given in Table 1)
- Carbon storage for **artificial surfaces** = 5 tonnes/ha (given in Table 2)
- Opening carbon storage for **artificial surfaces** = $16 \times 5 = 80$ tonnes

Total will be the sum of all values in the row that details the opening carbon storage values.

Continue the same calculation for the next three types of land cover.

Drag the results to their correct places and click "OK"!

Table 1: Physical Account for Land Cover

Not quite right.

Take a look at the solution!

[Continue](#)

	T1	T2	T3	T4	T5	T6	T7	T8	T9	T10	Total
Opening Stock	16	7	14	25	7	19	7	6	1	6	100
+ Additions to Stock	8	11	0	0	0	0	0	1	0	0	15
- Reductions in Stock	0	0	1	8	1	2	0	3	0	0	15
Closing Stock	19	18	13	15	6	17	7	4	1	0	100

Not quite right.

Take a look at the solution!

Table 2: Simplified Carbon Stock Account

[illegible]

280 140 4600

Richtig (Slide Layer)

Carbon stock account – exercise

To compile the carbon stock account, you need to use both tables, and fill its blanks with the corresponding values.

This is how you should perform the calculation:

Take each value in the physical land cover account and multiply by the corresponding column in the lookup table (first row of Table 2)

For example:

- **Artificial surfaces** opening stock = 16ha (given in Table 1)
- Carbon storage for **artificial surfaces** = 5 tonnes/ha (given in Table 2)
- Opening carbon storage for **artificial surfaces** = $16 \times 5 = 80$ tonnes

Total will be the sum of all values in the row that details the opening carbon storage values.

Continue the same calculation for the next three types of land cover.

Drag the results to their correct places and click "OK"!

Table 1: Physical Account for Land Cover

			KES		MPS	Tara	Sed moss vegetated	red land the glaciers ter bates
--	--	--	-----	--	-----	------	-----------------------	---------------------------------------

Richtig

Das stimmt! Sie haben die richtige Antwort gewählt.

Opening Stock
Additive to labor
Reductions in SP
Closing Stock

Richtig

Das stimmt! Sie haben die richtige Antwort gewählt.

Table 2: Simplified C

Carbon Stored (tonne)
Carbon Stock (tonne)
Opening
Additions
Reductions
Net change
Closing

280 140

Fortfahren

Falsch (Slide Layer)

MODULE 6: CARBON ACCOUNTING, UNIT 2: COMPILERS

Page 22 / 39

SEEA

Carbon stock account – exercise

To compile the carbon stock account, you need to use both tables, and fill its blanks with the corresponding values.

This is how you should perform the calculation:
Take each value in the physical land cover account and multiply by the corresponding column in the lookup table (first row of Table 2)

For example:

- Artificial surfaces opening stock = 16ha (given in Table 1)
- Carbon storage for artificial surfaces = 5 tonnes/ha (given in Table 2)
- Opening carbon storage for artificial surfaces = $16 \times 5 = 80$ tonnes

Total will be the sum of all values in the row that details the opening carbon storage values.

Continue the same calculation for the next three types of land cover.

Drag the results to their correct places and click "OK"!

Table 1: Physical Account for Land Cover

	Artificial surfaces	Crops	Grassland	Tree covered area	Mangroves	Shrub covered area	Regularly flooded areas	Sparse natural vegetation	Terrestrial barren land	Marine and coastal ecosystems and inland water bodies	Total
Opening Stock	16	7	14	23	7	19	7	6	1	0	100
Additions to Stock	9	11	0	0	0	0	0	1	0	0	15
Reductions in Stock	0	0	1	8	1	2	0	3	0	0	15
Closing Stock	19	18	13	15	6	17	7	4	1	0	100

Table 2: Simplified Carbon Stock Account

	Artificial surfaces	Crops	Grassland	Tree covered area	Mangroves	Shrub covered area	Regularly flooded areas	Sparse natural vegetation	Terrestrial barren land	Marine and coastal ecosystems and inland water bodies	Total
Carbon Stored (tonnes/ha)	5	40	10	200	800	80	800	8	0	0	
Carbon Stock (tonnes)	80	280	140	4600	5600	1520	2100	48	0	0	14368
Opening											
Additions											
Reductions											
Net change											
Closing											

280 140

Falsch

Sie haben nicht die richtige Antwort gewählt.

Fortfahren

1.23 Exercise

(Drag and Drop, 10 points, 1 attempt permitted)

MODULE 6: CARBON ACCOUNTING, UNIT 2: COMPILERS

Page 23 / 39

SEEA

Carbon stock account – exercise

Now, we'll complete the same calculations for the additions and reductions in land cover under the additions and reductions to carbon stocks in Table 2.

For example:

- Artificial surfaces additions to stock = 3ha (given in Table 1)
- Carbon Storage for Artificial Surfaces = 5 tonnes/ha (given in Table 2)
- Additions to carbon stock for artificial surfaces = $3 \times 5 = 15$ tonnes

The totals will be the sums of all values in the additions and reductions rows.

Perform the same calculation for the addition and reductions to stock (Table 1) in the carbon stock account (Table 2).

Drag the results to their correct places and click "OK"!

Table 1: Physical Account for Land Cover

	Artificial surfaces	Crops	Grassland	Tree covered area	Mangroves	Shrub covered area	Regularly flooded areas	Sparse natural vegetation	Terrestrial barren land	Marine and coastal ecosystems and inland water bodies	Total
Opening Stock	16	7	14	23	7	19	7	6	1	0	100
Additions to Stock	9	11	0	0	0	0	0	1	0	0	15
Reductions in Stock	0	0	1	8	1	2	0	3	0	0	15
Closing Stock	19	18	13	15	6	17	7	4	1	0	100

Table 2: Simplified Carbon Stock Account

	Artificial surfaces	Crops	Grassland	Tree covered area	Mangroves	Shrub covered area	Regularly flooded areas	Sparse natural vegetation	Terrestrial barren land	Marine and coastal ecosystems and inland water bodies	Total
Carbon Stored (tonnes/ha)	5	40	10	200	800	80	800	8	0	0	
Carbon Stock (tonnes)	80	280	140	4600	5600	1520	2100	48	0	0	14368
Opening											
Additions	15										
Reductions											
Net change											
Closing											

440 0

OK

Drag Item	Drop Target
440	Rectangle 3
0	Rectangle 4

Drag and drop properties
Snap dropped items to drop target (Stack random)
Delay item drop states until interaction is submitted

Correct (Slide Layer)

MODULE 6: CARBON ACCOUNTING, UNIT 2: COMPILERS

Page 23 / 39

SEEA

Carbon stock account – exercise

Now, we'll complete the same calculations for the additions and reductions in land cover under the additions and reductions to carbon stocks in Table 2.

For example:

- **Artificial surfaces** additions to stock = 3ha (given in Table 1)
- Carbon Storage for **Artificial Surfaces** = 5 tonnes/ha (given in Table 2)
- Additions to carbon stock for artificial surfaces = $3 \times 5 = 15$ tonnes

The **totals** will be the sums of all values in the additions and reductions rows.

Perform the same calculation for the addition and reductions to stock (Table 1) in the carbon stock account (Table 2).

Drag the results to their correct places and click "OK"!

Table 1: Physical Account for Land Cover

	Artificial surfaces	Crops	Grassland	Tree covered area	Mangroves	Shrub covered area	Regularly flooded areas	Sparse natural vegetated areas	Terrestrial barren land	Terrestrial aquatic ecosystems and inland water bodies	Total
Opening Stock	16	7	14	23	2	19	7	6	0	0	100
Additions to Stock	3	11	0	0	0	0	0	1	0	0	15
Reductions in Stock	0	0	1	8	1	2	0	3	0	0	15
Closing Stock	19	18	13	15	6	17	7	4	1	0	100

Table 2: Simplified Carbon Stock Account

	Artificial surfaces	Crops	Grassland	Tree covered area	Mangroves	Shrub covered area	Regularly flooded areas	Sparse natural vegetated areas	Terrestrial barren land	Terrestrial aquatic ecosystems and inland water bodies	Total
Carbon Stored (tonnes/ha)	5	40	10	200	800	80	300	8	0	0	
Carbon Stock (tonnes)	80	280	140	4600	5600	1520	2100	48	0	0	14368
Opening	15										
Additions											
Reductions											
Net change											
Closing											

4400

Correct!

Continue

Incorrect (Slide Layer)

MODULE 6: CARBON ACCOUNTING, UNIT 2: COMPILERS

Page 23 / 39

SEEA

Carbon stock account – exercise

Now, we'll complete the same calculations for the additions and reductions in land cover under the additions and reductions to carbon stocks in Table 2.

For example:

- **Artificial surfaces** additions to stock = 3ha (given in Table 1)
- Carbon Storage for **Artificial Surfaces** = 5 tonnes/ha (given in Table 2)
- Additions to carbon stock for artificial surfaces = $3 \times 5 = 15$ tonnes

The totals will be the sums of all values in the additions and reductions rows.

Perform the same calculation for the addition and reductions to stock (Table 1) in the carbon stock account (Table 2).

Drag the results to their correct places and click "OK"!

Not quite right.
Take a look at the solution!

Continue

Table 1: Physical Account for Land Cover

Opening Stock	14	7	14	23	7	19	7	6	1	0	100
Additions to Stock	3	11	0	0	0	0	0	1	0	0	15
Reductions in Stock	0	0	1	8	1	2	0	3	0	0	15
Closing Stock	19	18	13	15	6	17	7	4	1	0	100

Table 2: Simplified Carbon Stock Account

	Artificial surfaces	Crops	Grassland	Tree covered area	Mangroves	Shrub covered area	Regularly flooded areas	Sparse natural vegetated areas	Terrestrial barren land	Terrestrial aquatic ecosystems and inland water bodies	Total
Carbon Stored (tonnes/ha)	5	40	10	200	800	80	300	8	0	0	
Carbon Stock (tonnes)											
Opening	80	280	140	4600	5600	1520	2100	40	0	0	14380
Additions	15	440	0	0	0	0	0	0	0	0	
Reductions											
Net change											
Closing											

440 0

1.24 Module units

MODULE 6: CARBON ACCOUNTING

Page 24 / 39

SEEA

Module units

The carbon accounting module will walk you through the four units listed below. We recommend completing these units in the given order.

Unit 1: Carbon accounting

- What is it?
- Why do we need it?
- What does it look like?
- Expertise and data required.

Unit 2: Compilers

- Basic concepts of carbon accounting.
- Steps behind compiling a carbon stock accounts.

Unit 3: Data providers

- Concepts
- Carbon cycle, flows and balance.
- Data options, examples and issues.

Unit 4: Review

- Quiz
- Summary

Published by Articulate® Storyline www.articulate.com

1.25 Data providers

MODULE 6: CARBON ACCOUNTING, UNIT 3: DATA PROVIDERS

Page 25 / 39

SEEA

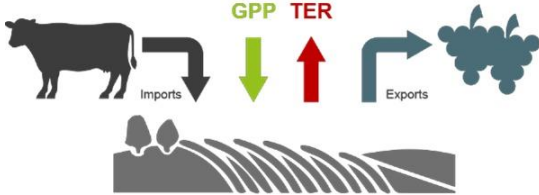
Data providers




In this unit, you will explore different sources of data that can help you obtain the carbon balance, as estimated from (annual) flows and opening stock. Through this you will become familiar with what data sources are available.

We will also take an in-depth look at other countries (case studies) and how they have approached carbon accounting.

It is important to note that carbon is stored in the main pools of **Soil** and **Biomass**. Transfers may take place between and within them.

GPP = Gross Primary Production
TER = Carbon release/respiration





1.26 Data providers

MODULE 6: CARBON ACCOUNTING, UNIT 3: DATA PROVIDERS

Page 26 / 39

SEEA




Data providers

Data sources vary according to the different carbon stock account items.

The main data sources by carbon accounting items for biocarbon are:

- **Opening stocks:**
 - Soil Organic Carbon **SOC**
 - Biomass **TCB**
- **Fluxes and transfers**
 - Gross Primary Production **GPP**
 - Terrestrial Ecosystem Respiration **TER** (carbon release/respiration)
 - Human use of primary production **TPPU**
 - Carbon imports
- **Balance**
 - Net Ecosystem Production **NEP**
 - Net Ecosystem Carbon Balance **NECB**

You can hover over the main carbon items (in green) to learn more about their data sources.



Explanation 1 (Slide Layer)

MODULE 6: CARBON ACCOUNTING, UNIT 3: DATA PROVIDERS

Page 26 / 39

SEEA

Data providers





Data sources vary according to the different carbon stock account items.

The main data sources by carbon accounting items for biocarbon are:

- **Opening stocks:**
 - Soil Organic Carbon **SOC**
 - Biomass **TCB**
- **Fluxes and transfers**
 - Gross Primary Production **GPP**
 - Terrestrial Ecosystem Respiration **TER** (carbon release/respiration)
 - Human use of primary production **TPPU**
 - Carbon imports
- **Balance**
 - Net Ecosystem Production **NEP**
 - Net Ecosystem Carbon Balance **NECB**

For **Soil Organic Carbon (SOC)**, you can refer to Joint Research Center (JRC) map of SOC ([Hiederer and Köchy, 2012](#)), the top soil (1-30cm) and subsoil layer (30-100cm); and EEA estimate of SOC, 30cm.

You can hover over the main carbon items (in green) to learn more about their data sources.



Explanation 2 (Slide Layer)

MODULE 6: CARBON ACCOUNTING, UNIT 3: DATA PROVIDERS

Page 26 / 39

SEEA

Data providers





Data sources vary according to the different carbon stock account items.

The main data sources by carbon accounting items for biocarbon are:

- **Opening stocks:**
 - Soil Organic Carbon **SOC**
 - Biomass **TCB**
- **Fluxes and transfers**
 - Gross Primary Production **GPP**
 - Terrestrial Ecosystem Respiration **TER** (carbon release/respiration)
 - Human use of primary production **TPPU**
 - Carbon imports
- **Balance**
 - Net Ecosystem Production **NEP**
 - Net Ecosystem Carbon Balance **NECB**

For **Biomass (TCB)**, you can get the downscaled forest biomass from the European Environment Agency (EEA). You can also get the upscaled biomass for non-forest biomass from the EEA.

You can hover over the main carbon items (in green) to learn more about their data sources.



Explanation 3 (Slide Layer)

MODULE 6: CARBON ACCOUNTING, UNIT 3: DATA PROVIDERS

Page 26 / 39

SEEA

Data providers





Data sources vary according to the different carbon stock account items.

The main data sources by carbon accounting items for biocarbon are:

- **Opening stocks:**
 - Soil Organic Carbon **SOC**
 - Biomass **TCB**
- **Fluxes and transfers**
 - Gross Primary Production **GPP**
 - Terrestrial Ecosystem Respiration **TER**
 - Human use of primary production **TPPU**
 - Carbon imports
- **Balance**
 - Net Ecosystem Production **NEP**
 - Net Ecosystem Carbon Balance **NECB**

For Gross Primary Production (**GPP**), you can refer to **downscaled NASA-CASA NPP** (from 8km to 1km), converted to GPP by adding autotrophic respiration from MODIS (Running et al., 2004)

You can hover over the main carbon items (in green) to learn more about their data sources.



Explanation 4 (Slide Layer)

MODULE 6: CARBON ACCOUNTING, UNIT 3: DATA PROVIDERS

Page 26 / 39

SEEA

Data providers





Data sources vary according to the different carbon stock account items.

The main data sources by carbon accounting items for biocarbon are:

- **Opening stocks:**
 - Soil Organic Carbon **SOC**
 - Biomass **TCB**
- **Fluxes and transfers**
 - Gross Primary Production **GPP**
 - Terrestrial Ecosystem Respiration **TER** (carbon release)
 - Human use of primary production **TPPU**
 - Carbon imports
- **Balance**
 - Net Ecosystem Production **NEP**
 - Net Ecosystem Carbon Balance **NECB**

For human use of primary production (**TPPU**), you can refer to **downscaled regional statistics on crops** (Eurostat), timber (EFISCEN, National FI and EFIMED) and grazing livestock, using land-cover and vegetation indices.

You can hover over the main carbon items (in green) to learn more about their data sources.



Explanation 5 (Slide Layer)

MODULE 6: CARBON ACCOUNTING, UNIT 3: DATA PROVIDERS

Page 26 / 39

SEEA

Data providers





Data sources vary according to the different carbon stock account items.

The main data sources by carbon accounting items for biocarbon are:

- **Opening stocks:**
 - Soil Organic Carbon **SOC**
 - Biomass **TCB**
- **Fluxes and transfers**
 - Gross Primary Production **GPP**
 - Terrestrial Ecosystem Respiration **TER** (carbon release/respiration)
 - Human use of primary production **TPPU**
 - Carbon imports
- **Balance**
 - Net Ecosystem Production **NEP**
 - Net Ecosystem Carbon Balance **NECB**

Refer to downscaled **NASA-CASA Soil respiration** (from 8km to 1km), converted to TER by adding autotrophic respiration from MODIS (Running et al., 2004).

You can hover over the main carbon items (in green) to learn more about their data sources.



Explanation 6 (Slide Layer)

MODULE 6: CARBON ACCOUNTING, UNIT 3: DATA PROVIDERS

Page 26 / 39

SEEA

Data providers





Data sources vary according to the different carbon stock account items.

The main data sources by carbon accounting items for biocarbon are:

- **Opening stocks:**
 - Soil Organic Carbon **SOC**
 - Biomass **TCB**
- **Fluxes and transfers**
 - Gross Primary Production **GPP**
 - Terrestrial Ecosystem Respiration **TER** (carbon release/respiration)
 - Human use of primary production **TPPU**
 - Carbon imports
- **Balance**
 - Net Ecosystem Production **NEP**
 - Net Ecosystem Carbon Balance **NECB**

For Net Ecosystem Production (**NEP**) and Net Ecosystem Carbon Balance (**NECB**), it's good to know that **NEP** is estimated from **GPP** and **TER**, and **NECB** estimated by aggregating all flows.

You can hover over the main carbon items (in green) to learn more about their data sources.



1.27 Balancing estimates

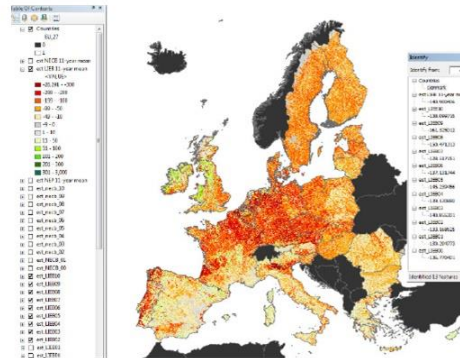
Balancing estimates

Here is an example of balancing carbon stock account items in Europe. 61 parameters were mapped to produce carbon accounts following the Convention on Biological Diversity – Ecosystem Natural Capital Accounts (CBD-ENCA) 'Quick-Start Package'.

The main parameters were evaluated against independent reference data to assess their quality and test them for estimating consistent carbon accounts.

Click the button to switch between two different maps.

Switch



The first map illustrates the transfer of carbon across Europe. The **Balance of lateral imports and exports = carbon "returns" – carbon "uses"**.

Source: CBD-ENCA.

Untitled Layer 1 (Slide Layer)

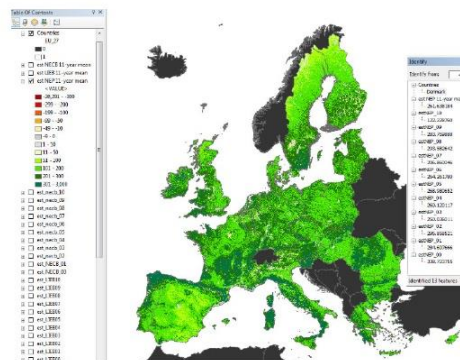
Balancing estimates

Here is an example of balancing carbon stock account items in Europe. 61 parameters were mapped to produce carbon accounts following the Convention on Biological Diversity – Ecosystem Natural Capital Accounts (CBD-ENCA) 'Quick-Start Package'.

The main parameters were evaluated against independent reference data to assess their quality and test them for estimating consistent carbon accounts.

Click the button to switch between two different maps.

Switch



This map shows the carbon transfer by estimating the NECB. **Net Ecosystem Production (NEP) = Gross Primary Production (GPP) – Terrestrial Ecosystem Respiration (TER)**.

The map shows a decade average, with areas in green indicating dominant sink functions (most of Europe). Red indicates dominant source functions (e.g. parts of north-west Europe, Po valley in Italy, and spots of forest-burned areas of Portugal).

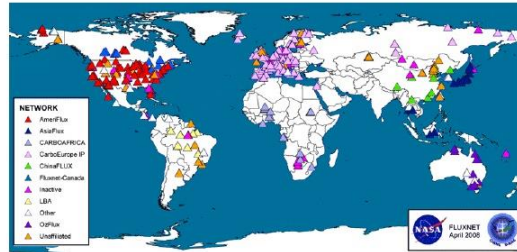
1.28 Data validation

Data validation

Data verification and validation is important in estimating the items in a carbon stock account.

We recommend the FLUXNET website. Its tools assist you in acquiring, querying, browsing, plotting and manipulating diverse combinations of heterogeneous data from many sites and over many years.

Visit fluxnet.fluxdata.org to learn more about FLUXNET.



Source: Fluxdata (<http://fluxnet.fluxdata.org/>)

1.29 Data sources

International data sources for carbon stocks

These international sources for carbon stocks and lookup tables are available to you:

- **Terrestrial Carbon Management Data Sets and Analyses**
Source: Carbon Dioxide Information Analysis Centre, **CDIAC**

- **Land-Use and Ecosystems**
Source: Carbon Dioxide Information Analysis Centre, **CDIAC**

- **Global carbon biomass lookup tables**
Source: Carbon Dioxide Information Analysis Centre, **CDIAC**

- **National Biomass and Carbon Dataset**
Source: Woods Hole Research Centre, **WHRC**

- **Project Carbon Sequestration**
Source: **Forestry Commission** (UK)

Follow the various links to get more information.



1.30 Data sources

International data sources for carbon sequestration and storage

In addition, here are some useful international sources of data on carbon sequestration and storage:

- **Carbon and Biodiversity Calculator**
Source: CBD Secretariat, LifeWeb and **UNEP-WCMC**
- **UNEP-WCMC Ecosystem Services Toolkit**
Source: Climate regulation, **UNEP-WCMC, 2011**
- **Envision**, Source: **Oregon State University**
- **InFOREST**, Source: **Virginia Department of Forestry**
- **REDD+ – Reduce Emissions from Deforestation and forest Degradation**, Source: **Forest Carbon Partnership Facility**
- **Guidelines for National Greenhouse Gas Inventories Vol. 4. Agriculture, Forestry and other Land Use (AFOLU)**; Source: **IPCC (Intergovernmental Panel on Climate Change) 2006**
- **Greenhouse Gas Emissions from Agriculture, Forestry and other Land Use**, Source: **FAO - FAOSTAT**



1.31 Case study

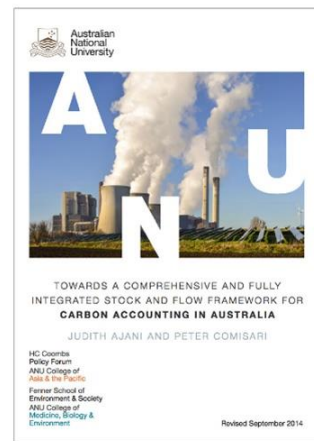
Carbon accounting in Australia – case study

The goal of the carbon accounting project in Australia was to study the feasibility of creating comprehensive carbon accounts. The project's title was "Towards a Comprehensive and Fully Integrated Stock and Flow Framework."

Background: In November 2012, the Australian Bureau of Statistics, Department of Environment and Australian National University began a project to:

- Identify the potential need for carbon stock information and data.
- Populate the SEEA carbon stock account for Australia.
- Assess the requirements for a regularly produced carbon stock account for Australia.

The results of the study showed that geocarbon (exclusively fossil fuel) makes up the overwhelming majority of the carbon stock in Australia. The study estimated that biocarbon and geocarbon levels are 11.5% and 88.5%, respectively, of the total carbon estimate. In the figures, biocarbon was estimated at 31,081 Mt C, while the geocarbon was 239,581 Mt C (exclusively fossil fuel). That totaled 270,662 Mt C in Australia.



1.32 Case study

Carbon accounting in Australia – case study

This table illustrates the distribution of Australian biocarbon and geocarbon according to type of ecosystem.

Explore the table to find out more by hovering over the highlighted boxes!

Primary reservoir	Geocarbon (Mt C)	Hectares (million)	Biomass carbon (Mt C)	Soil organic carbon (Mt C)	Total biocarbon (Mt C)
Geocarbon					
Fossil fuel					
Black coal	97,400				
Brown coal	58,100				
Crude oil ^a	145				
LPG ^a	90				
Natural gas	1,559				
Shale oil	82,287				
Total fossil fuel	239,581				
Carbonate rocks					
Limestone	n.r.				
Other carbonate rocks	n.r.				
Total carbonate rocks	n.r.				
Other (includes methane clathrates)	n.r.				

Primary reservoir	Geocarbon (Mt C)	Hectares (million)	Biomass carbon (Mt C)	Soil organic carbon (Mt C)	Total biocarbon (Mt C)
Biocarbon					
Natural ecosystems					
Rangelands		596.3	6,374	6,603	12,977
Non rangelands					
Eucalypt native forests		16.7	4,671	3,753	8,424
Shrub lands & woodlands		14.7	500	636	1,137
Grass, shrub & heath lands		1.6	37	51	87
Rainforests		2.3	1,225	252	1,477
Other		0.7	15	16	32
Marine ecosystems		1.8	114	1,084	1,198
Fresh water ecosystems		9.9	4	7	11
Total Natural ecosystems	644.0	12,941	12,402	25,343	
Semi-natural ecosystems					
Highly modified rangelands		50.0	750	1,500	2,250
Grazing in modified pastures outside rangelands		32.9	132	1,315	1,447
Total Semi-natural ecosystems	82.9	882	2,815	3,697	
Agricultural ecosystems					
Cropping		25.5	102	1,022	1,124
Irrigated agriculture		2.6	12	105	117
Plantation wood		2.4	177	120	296
Reservoir/dam		0.6	1	6	7
Other		6.3	120	244	363
Total Agriculture ecosystems	37.4	412	1,497	1,907	
Settlements		2.6	30	70	108
Other		0.5	7	19	26
Total Settlements and Other	3.1	37	98	134	
Total biocarbon^a	767.4	14,270	16,811	31,081	

Source: Australian National University, 2014.

Layer 1 (Slide Layer)

Carbon accounting in Australia – case study

This table illustrates the distribution of Australian biocarbon and geocarbon according to type of ecosystem.

Explore the table to find out more by hovering over the highlighted boxes!

Primary reservoir	Geocarbon (Mt C)	Hectares (million)	Biomass carbon (Mt C)	Soil organic carbon (Mt C)	Total biocarbon (Mt C)
Geocarbon					
Fossil fuel					
Black coal	97,400				
Brown coal	58,100				
Crude oil ^a	145				
LPG ^a	90				
Natural gas	1,559				
Shale oil	82,287				
Total fossil fuel	239,581				
Carbonate rocks					
Limestone	n.r.				
Other carbonate rocks	n.r.				
Total carbonate rocks	n.r.				
Other (includes methane clathrates)	n.r.				

Primary reservoir	Geocarbon (Mt C)	Hectares (million)	Biomass carbon (Mt C)	Soil organic carbon (Mt C)	Total biocarbon (Mt C)
Biocarbon					
Natural ecosystems					
Rangelands		596.3	6,374	6,603	12,977
Non rangelands					
Eucalypt native forests		16.7	4,671	3,753	8,424
Shrub lands & woodlands		14.7	500	636	1,137
Grass, shrub & heath lands		1.6	37	51	87
Rainforests		2.3	1,225	252	1,477
Other		0.7	15	16	32
Marine ecosystems		1.8	114	1,084	1,198
Fresh water ecosystems		9.9	4	7	11
Total Natural ecosystems	644.0	12,941	12,402	25,343	
Semi-natural ecosystems					
Highly modified rangelands		50.0	750	1,500	2,250
Grazing in modified pastures outside rangelands		32.9	132	1,315	1,447
Total Semi-natural ecosystems	82.9	882	2,815	3,697	
Agricultural ecosystems					
Cropping		25.5	102	1,022	1,124
Irrigated agriculture		2.6	12	105	117
Plantation wood		2.4	177	120	296
Reservoir/dam		0.6	1	6	7
Other		6.3	120	244	363
Total Agriculture ecosystems	37.4	412	1,497	1,907	
Settlements		2.6	30	70	108
Other		0.5	7	19	26
Total Settlements and Other	3.1	37	98	134	
Total biocarbon^a	767.4	14,270	16,811	31,081	

Source: Australian National University, 2014.

Layer 2 (Slide Layer)

Carbon accounting in Australia – case study

This table illustrates the distribution of Australian biocarbon and geocarbon according to type of ecosystem.

Explore the table to find out more by hovering over the highlighted boxes!

Primary reservoir	Geocarbon (Mt C)	Hectares (million)	Biomass carbon (Mt C)	Soil organic carbon (Mt C)	Total biocarbon (Mt C)
Geocarbon					
Fossil fuel					
Black coal	97,400				
Brown coal	58,100				
Crude oil ^a	145				
LPG ^a	90				
Natural gas	1,559				
Shale oil	82,287				
Total fossil fuel	239,581				
Carbonate rocks					
Limestone	n.r.				
Other carbonate rocks	n.r.				
Total carbonate rocks	n.r.				
Other (includes methane clathrates)	n.r.				

Primary reservoir	Geocarbon (Mt C)	Hectares (million)	Biomass carbon (Mt C)	Soil organic carbon (Mt C)	Total biocarbon (Mt C)
Biocarbon					
Natural ecosystems					
Rangelands		596.3	6,374	6,603	12,977
Non rangelands					
Eucalypt native forests		16.7	4,671	3,753	8,424
Shrub lands & woodlands		14.7	500	636	1,137
Grass, shrub & heath lands		1.6	37	51	87
Rainforests		2.3	1,225	252	1,477
Other		0.7	15	16	32
Marine ecosystems		1.8	114	1,084	1,198
Fresh water ecosystems		9.9	4	7	11
Total Natural ecosystems	644.0	12,941	12,402	25,343	
Semi-natural ecosystems					
Highly modified rangelands		50.0	750	1,500	2,250
Grazing in modified pastures outside rangelands		32.9	132	1,315	1,447
Total Semi-natural ecosystems	82.9	882	2,815	3,697	
Agricultural ecosystems					
Cropping		25.5	102	1,022	1,124
Irrigated agriculture		2.6	12	105	117
			177	120	296
			1	6	7
			120	294	363
			30	20	108
Other		0.5	7	19	26
Total Settlements and Other	3.1	37	98	134	
Total biocarbon^a	767.4	14,270	16,811	31,081	

Source: Australian National University, 2014.

1.33 Case study

Carbon accounting in Australia – case study

So, here are the key points:

It is **possible** to construct carbon stock accounts for Australia with information currently available.

Having comparable information on carbon stocks in fossil fuels and ecosystems (terrestrial and marine) linked to economic information enables the assessment of **past policies** and **future policy options** (including scenario analysis).

Different parts of government and academia can successfully **work together** to assess the usefulness and feasibility of producing environmental or ecosystem accounts.

Click on each point to learn more.

Explanation 1 (Slide Layer)

MODULE 6: CARBON ACCOUNTING, UNIT 3: DATA PROVIDERS

Page 33 / 39  SEEA

Carbon accounting in Australia – case study

So, here are the key points:

It is **possible** to construct carbon stock accounts for Australia with information currently available.

Gaps and deficiencies in information and methodologies exist but these have been identified and can be addressed. The data has already been updated since the first release. The resources required for an on-going production of carbon stock accounts are modest.

Having comparable information on carbon stocks in fossil fuels and ecosystems (terrestrial and marine) linked to economic information enables the assessment of **past policies and future policy options** (including scenario analysis).


Different parts of government and academia can successfully **work together** to assess the usefulness and feasibility of producing environmental or ecosystem accounts.

Click on each point to learn more.



Explanation 2 (Slide Layer)

MODULE 6: CARBON ACCOUNTING, UNIT 3: DATA PROVIDERS

Page 33 / 39  SEEA

Carbon accounting in Australia – case study

So, here are the key points:





It is **possible** to construct carbon stock accounts for Australia with information currently available.

Having comparable information on carbon stocks in fossil fuels and ecosystems (terrestrial and marine) linked to economic information enables the assessment of **past policies and future policy options** (including scenario analysis).

Different parts of government and academia can successfully **work together** to assess the usefulness and feasibility of producing environmental or ecosystem accounts.

For example, the economic and employment impacts of different climate mitigation options, as well as the limits to the amount of storage possible in biocarbon, can both be estimated.

Click on each point to learn more.



Explanation 3 (Slide Layer)

MODULE 6: CARBON ACCOUNTING, UNIT 3: DATA PROVIDERS

Page 33 / 39  SEEA

Carbon accounting in Australia – case study

So, here are the key points:

It is **possible** to construct carbon stock accounts for Australia with information currently available.

Having comparable information on carbon stocks in fossil fuels and ecosystems (terrestrial and marine) linked to economic information enables the assessment of **past policies and future policy options** (including scenario analysis).

Different parts of government and academia can successfully **work together** to assess the usefulness and feasibility of producing environmental or ecosystem accounts.


Producing an experimental account provided a reason and focus for cooperation. The skills, knowledge and networks of each of the partner agencies (ANU, ABS, DoE) were essential.

Click on each point to learn more.



1.34 Module units

MODULE 6: CARBON ACCOUNTING

Page 34 / 39  SEEA

Great! You have finished Units 1, 2, and 3. Let's move on to the **quiz section (unit 4)** to review the carbon accounting knowledge you've learned in this module.

**Unit 1:
Carbon accounting**

- What is it?
- Why do we need it?
- What does it look like?
- Expertise and data required.

**Unit 2:
Compilers**





- Basic concepts of carbon accounting.
- Steps behind compiling a carbon stock accounts.

**Unit 3:
Data providers**

- Concepts
- Carbon cycle, flows and balance.
- Data options, examples and issues.

**Unit 4:
Review**

- Quiz
- Summary



1.35 Quiz

(Multiple Response, 10 points, 1 attempt permitted)

MODULE 6: CARBON ACCOUNTING, UNIT 4: QUIZ AND SUMMARY

Page 35 / 39

SEEA

Quiz 1

In your country, what are some important land cover types for carbon sequestration?

Check all the answers you think are correct!

☒ Forest

☒ Wetlands

☒ Mangroves

☒ Tundra





☒ Estuaries

☒ Parkland

☒ Cropland

☒ Rice paddies

OK



Correct	Choice
X	Forest
X	Wetlands
X	Mangroves
X	Tundra
X	Estuaries
X	Parkland
X	Cropland
X	Rice paddies

Feedback when correct:


All answers are correct.

Feedback when incorrect:

All answers are correct.

Correct (Slide Layer)

MODULE 6: CARBON ACCOUNTING, UNIT 4: QUIZ AND SUMMARY

Page 35 / 39  SEEA

Quiz 1

In your country, what are some important land cover types for carbon sequestration?

Check all the answers you think are correct!

- ☒ Forest
- ☒ Wetlands
- ☒ Mangroves
- ☒ Tundra
- ☒ Estuaries
- ☒ Parkland
- ☒ Cropland
- ☒ Rice paddies

Very good!

All answers are correct.

Continue

Incorrect (Slide Layer)

MODULE 6: CARBON ACCOUNTING, UNIT 4: QUIZ AND SUMMARY

Page 35 / 39

SEEA

Quiz 1

In your country, what are some important land cover types for carbon sequestration?

Check all the answers you think are correct!

- ☒ Forest
- ☒ Wetlands
- ☒ Mangroves
- ☒ Tundra
- ☒ Estuaries
- ☒ Parkland
- ☒ Cropland
- ☒ Rice paddies

Not quite right.

All answers are correct.

Continue

1.36 Quiz

(Multiple Response, 10 points, 1 attempt permitted)

MODULE 6: CARBON ACCOUNTING, UNIT 4: QUIZ AND SUMMARY

Page 36 / 39

SEEA

Quiz 2

In your country, what are some important changes in land cover for carbon sequestration?

Check all the answers you think are correct!





Reductions

- ☒ Conversion to artificial surfaces, cropland, and infrastructure
- ☒ Degradation by pollution
- ☒ Biodiversity Loss

Additions

- ☒ Natural regrowth
- ☒ Conversion to forest and wetlands
- ☒ Restoration of biodiversity

OK



Correct	Choice
X	Conversion to artificial surfaces, cropland, and infrastructure
X	Degradation by pollution
X	Biodiversity Loss
X	Natural regrowth
X	Conversion to forest and wetlands
X	Restoration of biodiversity

Feedback when correct:


All answers are correct.

Feedback when incorrect:

All answers are correct.

Correct (Slide Layer)

MODULE 6: CARBON ACCOUNTING, UNIT 4: QUIZ AND SUMMARY

Page 36 / 39  SEEA

Quiz 2

In your country, what are some important changes in land cover for carbon sequestration?

Check all the answers you think are correct!

Reductions

- ☒ Conversion to artificial surfaces, cropland, and infrastructure
- ☒ Degradation by pollution
- ☒ Biodiversity Loss

Additions

- ☒ Natural regrowth
- ☒ Conversion to forest and wetlands
- ☒ Restoration of biodiversity


Very good!

All answers are correct.

Continue

Incorrect (Slide Layer)

MODULE 6: CARBON ACCOUNTING, UNIT 4: QUIZ AND SUMMARY

Page 36 / 39  SEEA

Quiz 2

In your country, what are some important changes in land cover for carbon sequestration?

Check all the answers you think are correct!

Reductions

- ☒ Conversion to artificial surfaces, cropland, and infrastructure
- ☒ Degradation by pollution
- ☒ Biodiversity Loss

Additions

- ☒ Natural regrowth
- ☒ Conversion to forest and wetlands
- ☒ Restoration of biodiversity

Not quite right.

All answers are correct.

Continue

1.37 Quiz

(Multiple Response, 10 points, 1 attempt permitted)

MODULE 6: CARBON ACCOUNTING, UNIT 4: QUIZ AND SUMMARY

Page 37 / 39

SEEA

Quiz 3

What could be the national data sources to help determine the extent of change in ecosystem types (land cover types for carbon sequestration)?

Check all the answers you think are correct!

☒

Land inventories

☒

Land cover maps

☒

Ecosystem assessments





☒

State of environment reports

☒

IPCC reports

OK



Correct	Choice
X	Land inventories
X	Land cover maps
X	Ecosystem assessments
X	State of environment reports
X	IPCC reports

Feedback when correct:


All answers are correct.

Feedback when incorrect:

All answers are correct.

Correct (Slide Layer)

MODULE 6: CARBON ACCOUNTING, UNIT 4: QUIZ AND SUMMARY

Page 37 / 39  SEEA

Quiz 3

What could be the national data sources to help determine the extent of change in ecosystem types (land cover types for carbon sequestration)?

Check all the answers you think are correct!

- ☒ Land inventories
- ☒ Land cover maps
- ☒ Ecosystem assessments
- ☒ State of environment reports
- ☒ IPCC reports


Very good!

All answers are correct.

Continue

Incorrect (Slide Layer)

MODULE 6: CARBON ACCOUNTING, UNIT 4: QUIZ AND SUMMARY

Page 37 / 39  SEEA

Quiz 3

What could be the national data sources to help determine the extent of change in ecosystem types (land cover types for carbon sequestration)?

Check all the answers you think are correct!

- ☒ Land inventories
- ☒ Land cover maps
- ☒ Ecosystem assessments
- ☒ State of environment reports
- ☒ IPCC reports

Not quite right.

All answers are correct.

Continue

1.38 Summary

Summary

Now that you've reached the end of this module, you've been equipped with the knowledge and skills to ...

- understand why carbon accounting is important!
- understand how carbon accounting fits into the SEEA.
- compile a "carbon stock account".
- understand the basics of carbon cycles and pools.
- understand the data options and sources for carbon accounting.

Further Information:

- System of Environmental-Economic Accounting 2012 – Experimental Ecosystem Accounting (SEEA EEA).
- System of Environmental-Economic Accounting 2012 – Central Framework (SEEA CF).



1.39 References

References

- Ajani J., Keith H., Blakers M., Mackey B.G., King H.P. 2013, Comprehensive carbon stock and flow accounting: A national framework to support climate change mitigation policy. *Ecological Economics* 89, 61–72. <http://www.sciencedirect.com/science/article/pii/S092180091300030X>
- Archer D., Eby M., Brovkin V. et al. 2009, Atmospheric lifetime of fossil fuel carbon dioxide, *Annu. Rev. Earth Planet Sci.* 37:117-134. http://climatemodels.uchicago.edu/geocarb/archer.2009.ann_rev_tail.pdf
- Comisari P., Ajani J. and Vardon M. 2013, Carbon stock accounting: A report on progress in Australia and estimates of geocarbon. Report to the 19th London Group Meeting. https://unstats.un.org/unsd/envaccounting/londongroup/meeting19/LG19_16_3.pdf
- Steffen W. and Hughes H. 2013, *The Critical Decade 2013. Climate Change Science, Risks and Responses*. Climate Commission Australia. <http://www.climatecouncil.org.au/uploads/b7e53b20a7d6573e1ab269d36bb9b07c.pdf>
- European Communities, International Monetary Fund, Organisation for Economic Co-operation and Development, United Nations and World Bank 2009, *System of National Accounts 2008*, <http://unstats.un.org/unsd/nationalaccount/docs/SNA2008.pdf>
- Feely R.A., Sabine C.L., Lee K., Berelson W., Kleyvas J., Fabry V.J., Millero F.J., 2004, Impact of anthropogenic CO₂ in the CaCO₃ system in the oceans, *Science* 305, 362- 366. <http://science.sciencemag.org/content/305/5682/362.long>
- Global Carbon Project, *Global Carbon Budget 2012* <http://www.globalcarbonproject.org/carbonbudget/>
- Holmém, K. 2000. The global carbon cycle. Chapter 11 in: Jacobson M.C., Charlson R.J., Rodhe H., Orians G.H., (Eds), *Earth System Science: From Biogeochemical Cycles to Global Change*, Academic Press, London.
- Lal R., 2004. Soil carbon sequestration impact on global climate change and food security, *Science* 304, 1623-1627. <http://science.sciencemag.org/content/304/5677/1623>
- Sterman J.D.:2000, *Business Dynamics: Systems Thinking and Modeling for a Complex World*, Irwin McGraw-Hill

