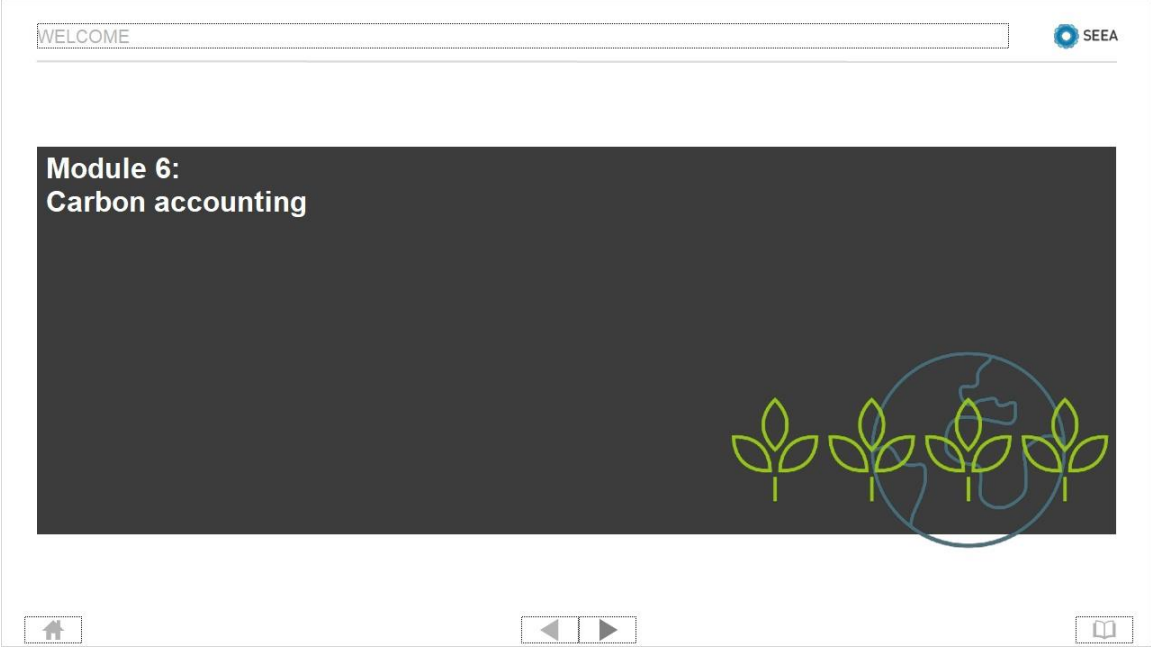
# SEEA_EnvAcc_M6_EN

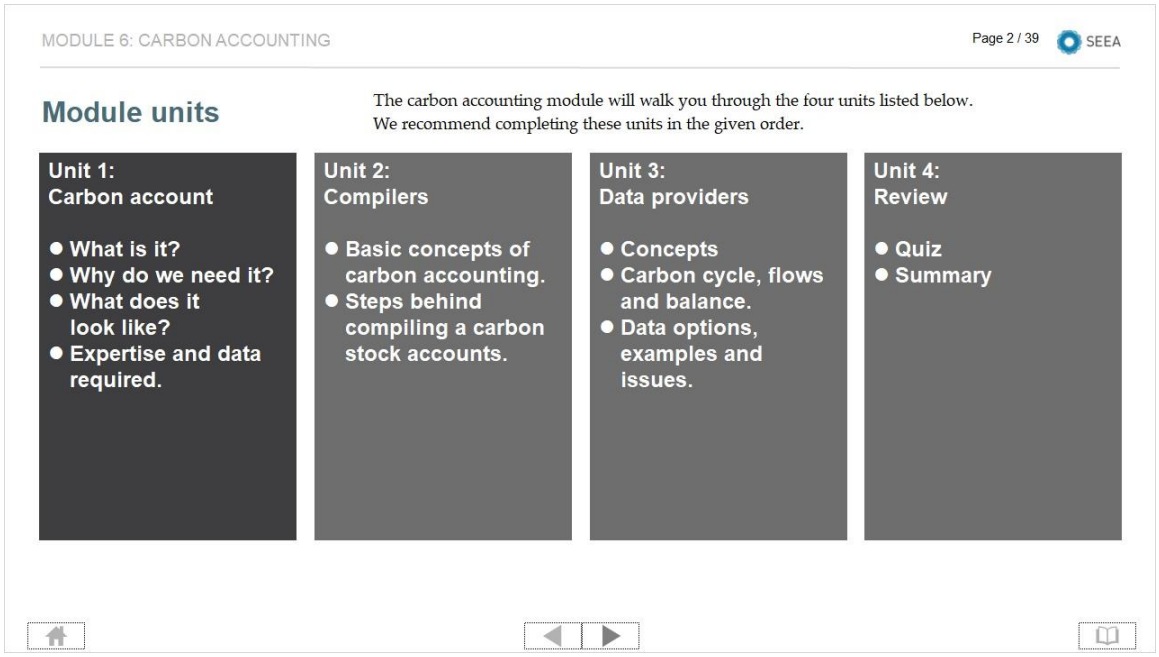
## 1. Module 1 - Introduction

### *1.1 Welcome*

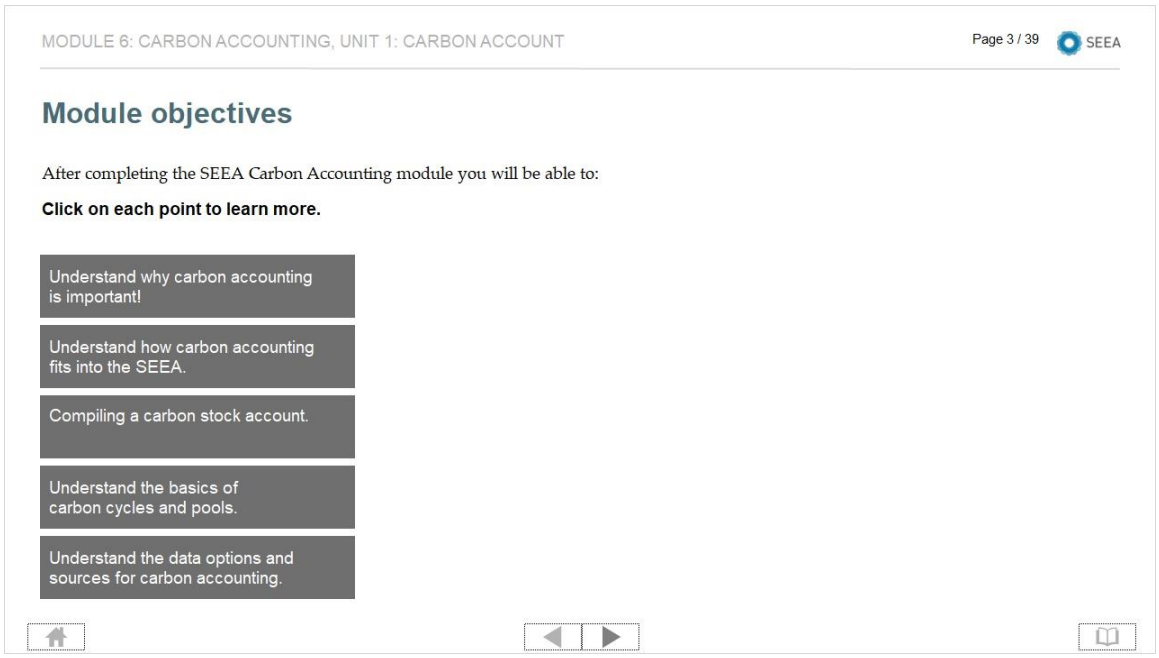



**Notes:**

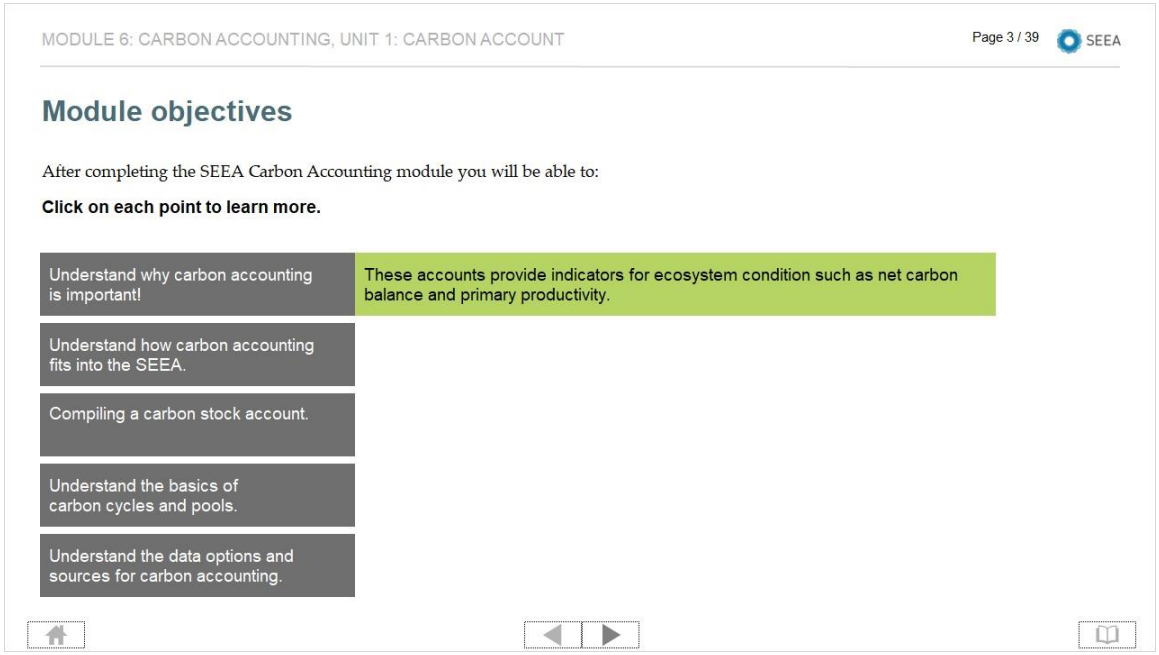
## *1.2 Module units*




## *1.3 Module objectives*



## Explanation 1 (Slide Layer)

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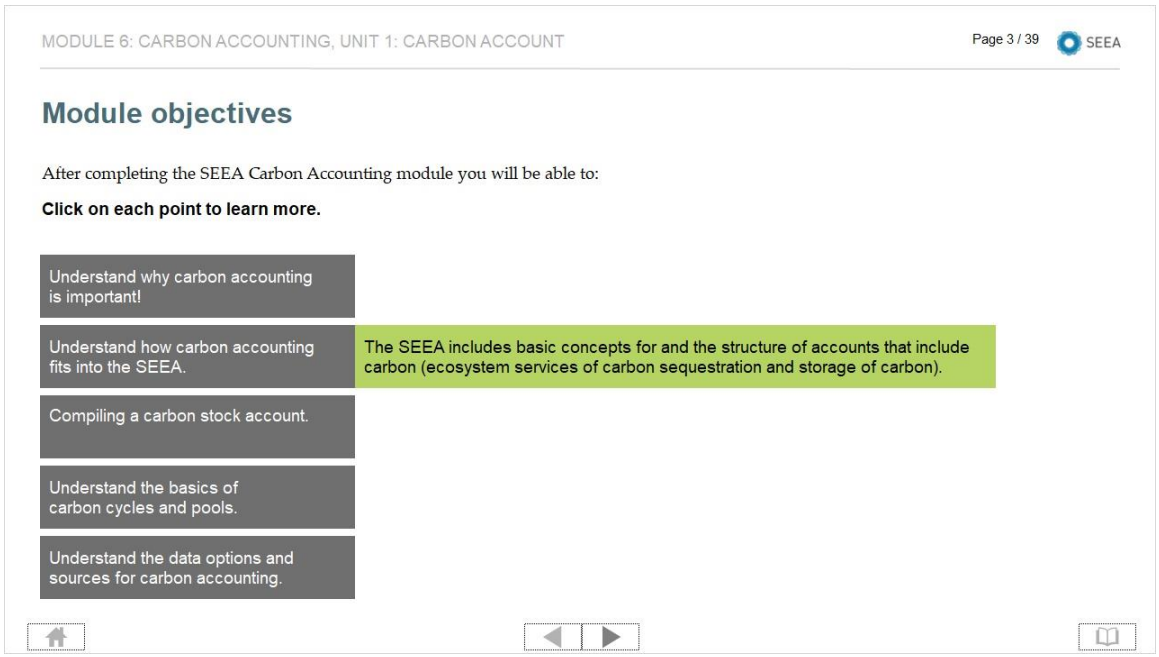

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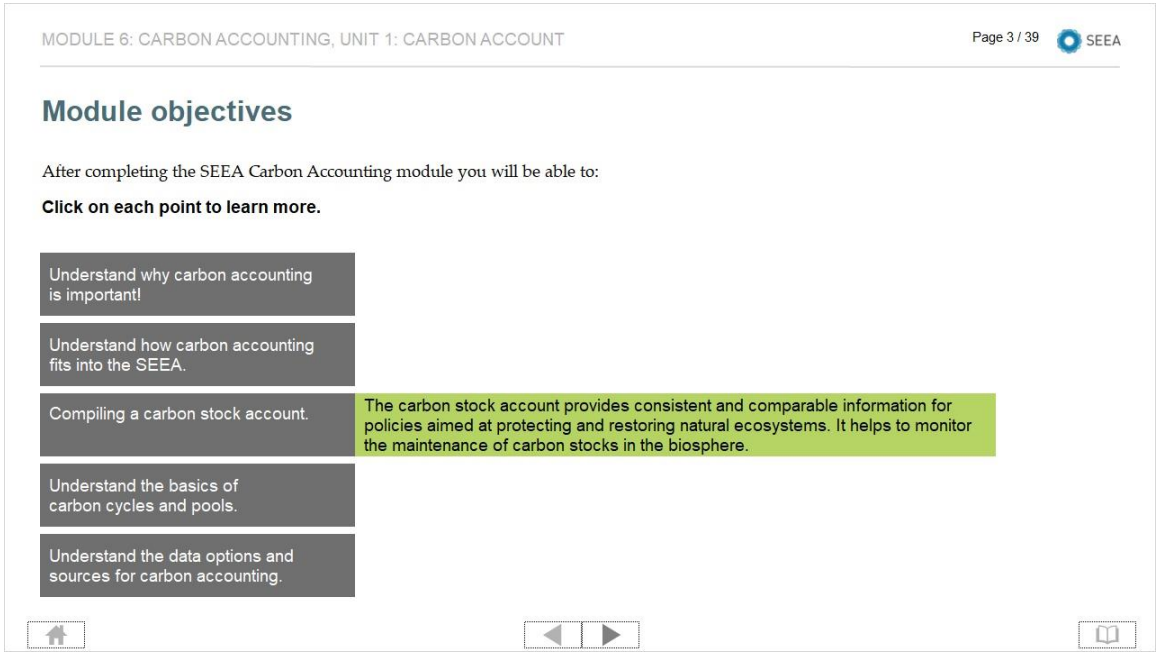


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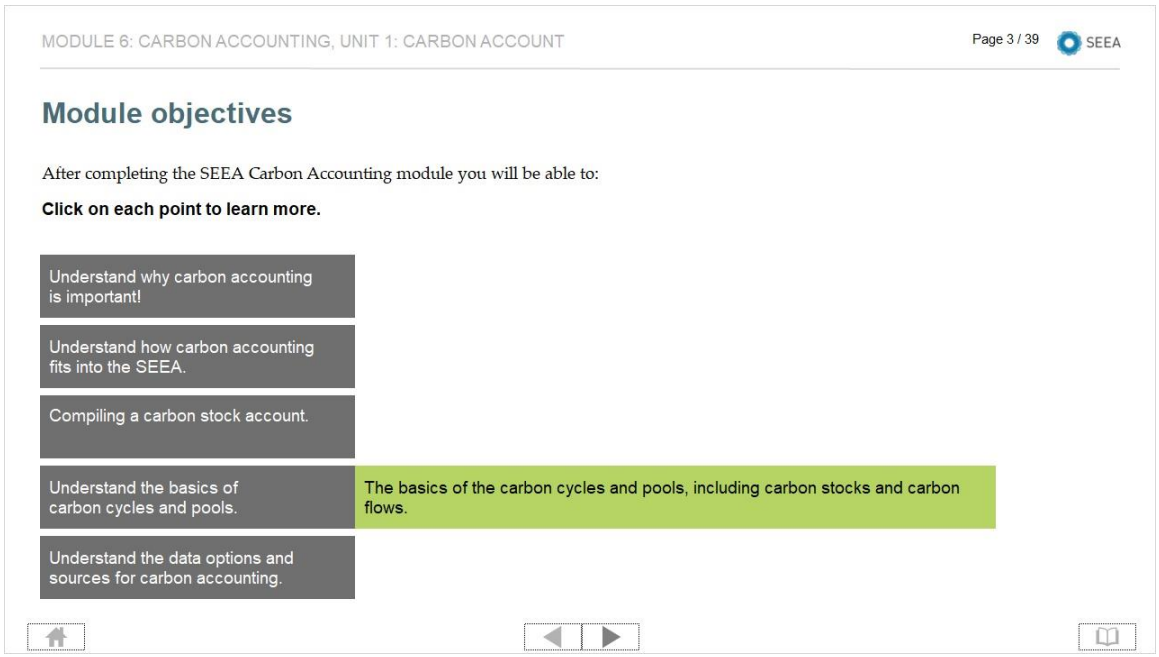
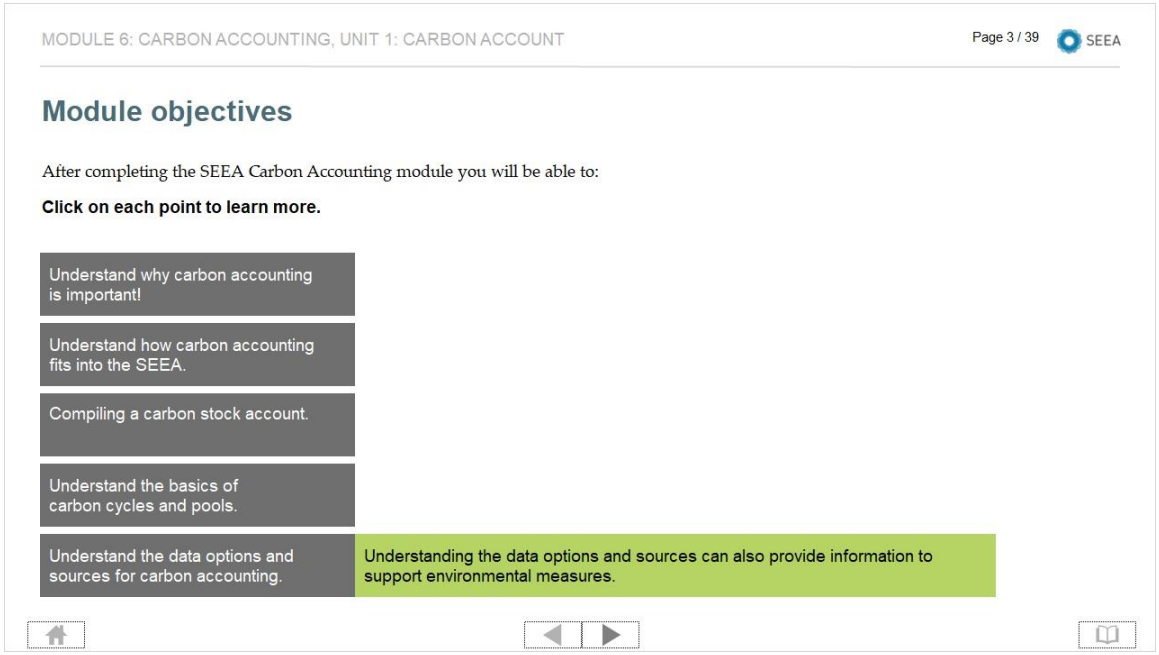
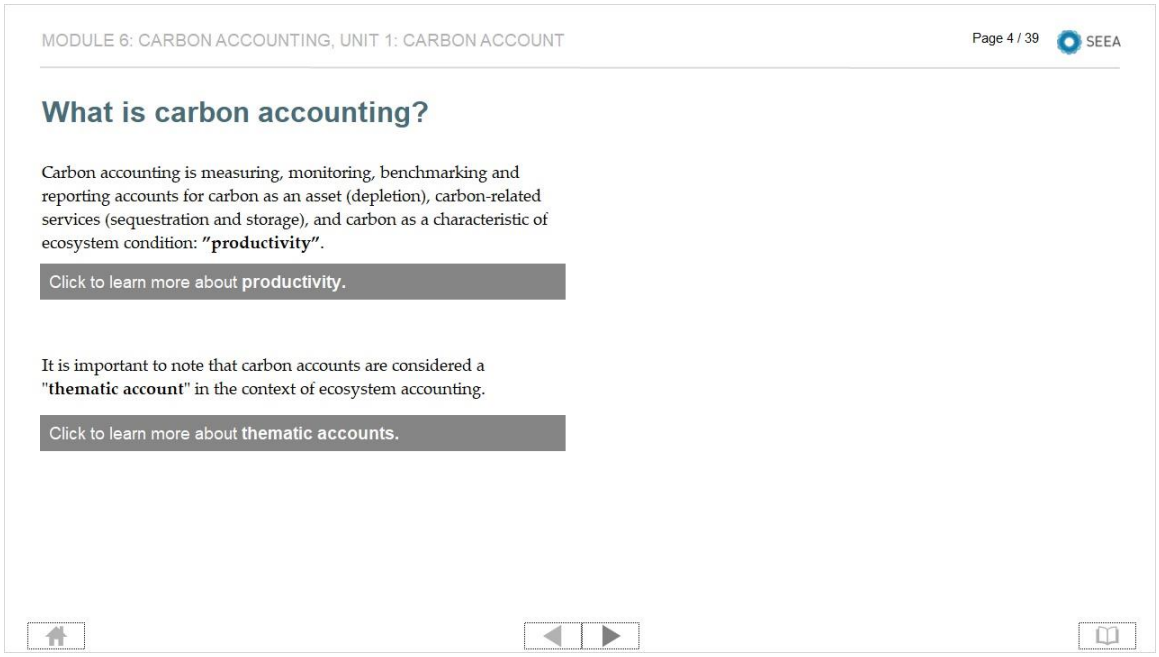


## Explanation 5 (Slide Layer)




## *1.4 What is Carbon Accounting?*



## *1.5 What is Carbon Accounting?*

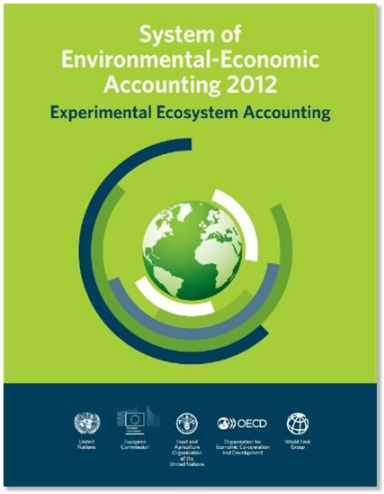


### What is carbon accounting?

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*



### Importance of carbon accounting

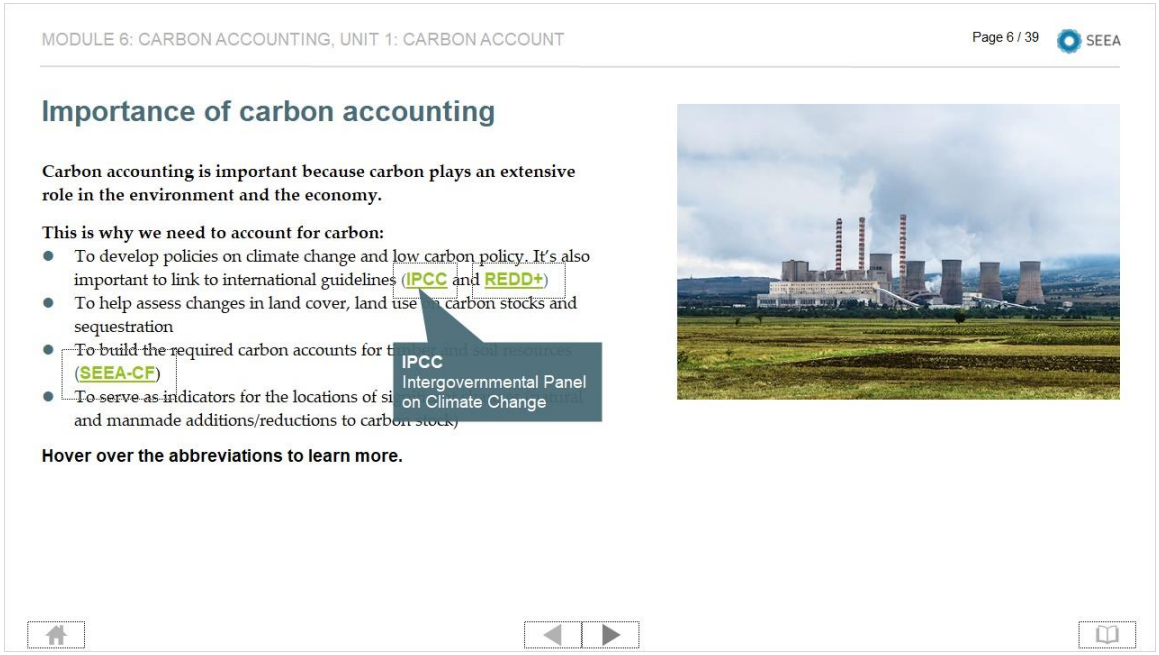
**Carbon accounting is important because carbon plays an extensive role in the environment and the economy.**

**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)

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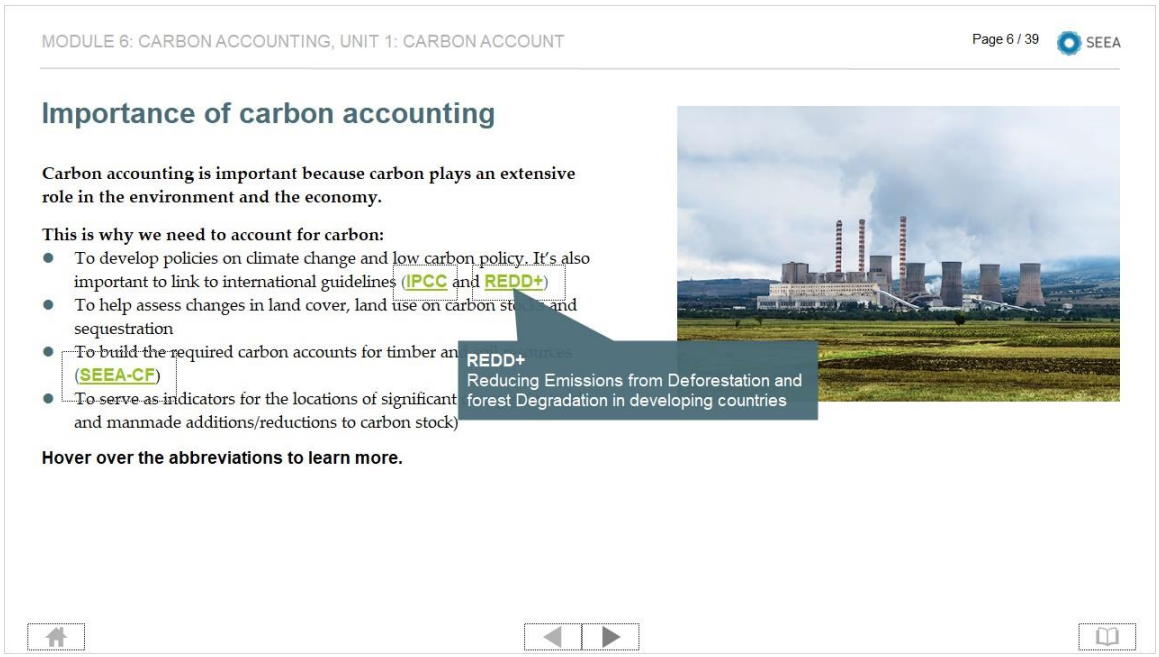
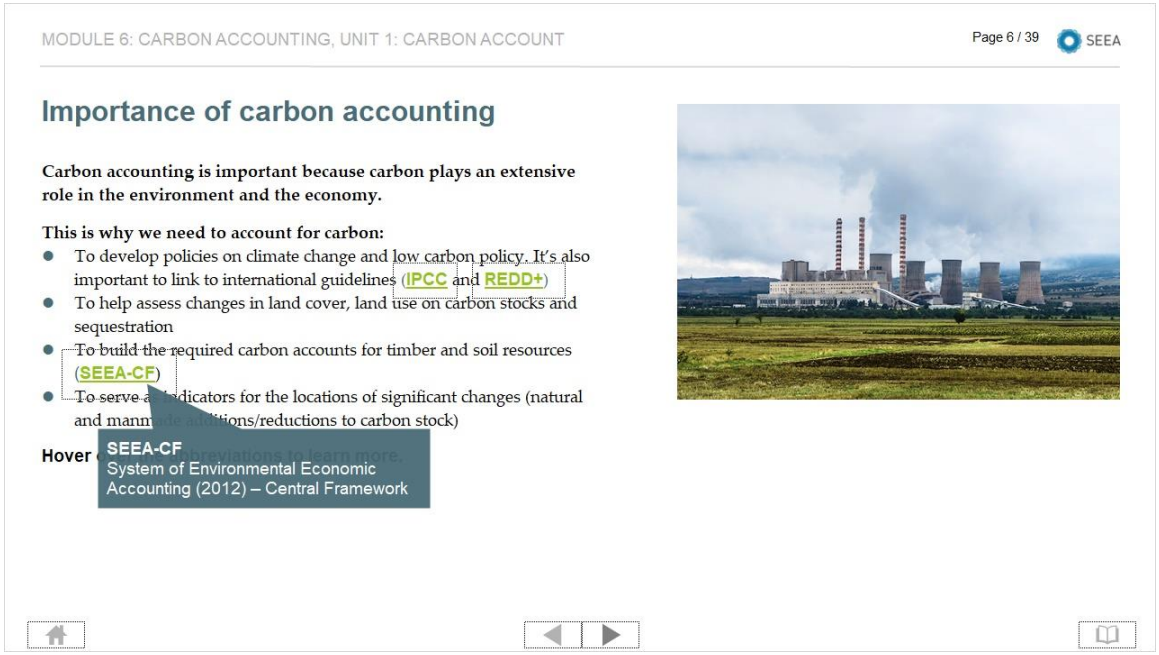
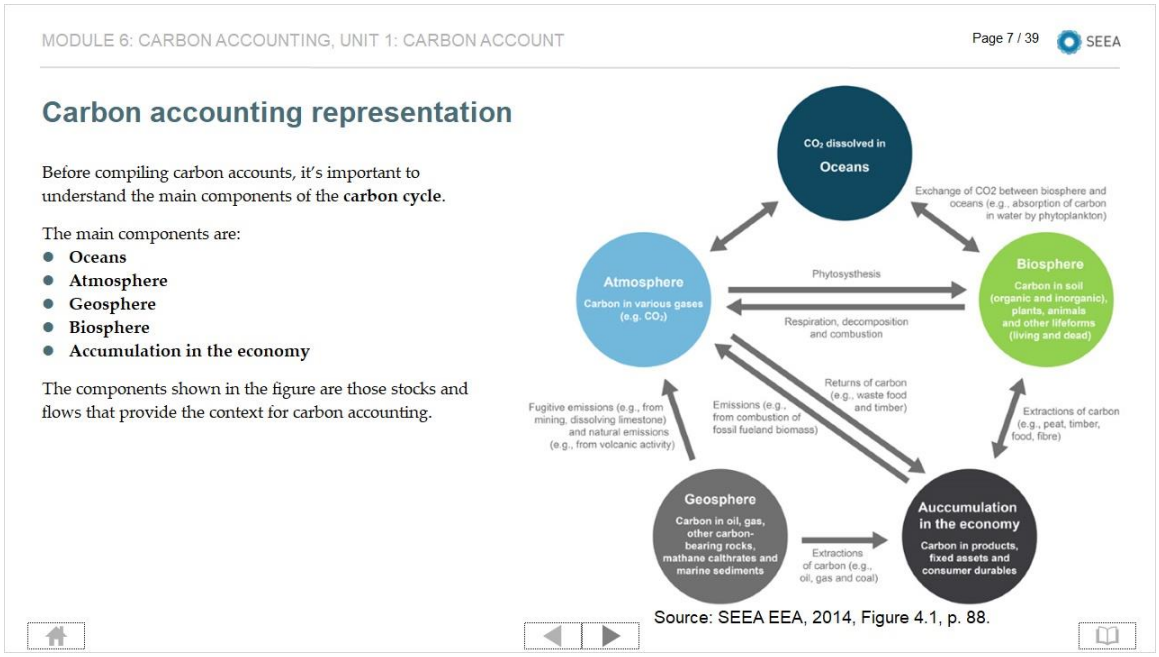


## Explanation 3 (Slide Layer)




## *1.7 Carbon Accounting Representation*



## *1.8 Carbon Accounting Representation*



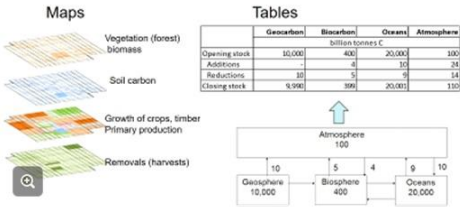
### Carbon accounting representation

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.

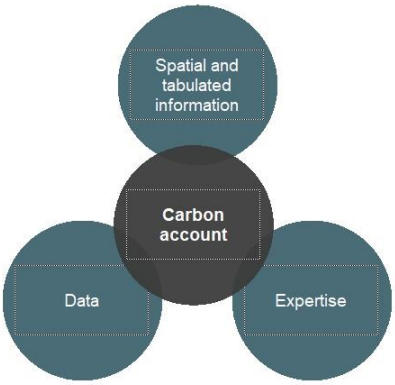
## *1.9 Carbon Account Data and Expertise Requirements*



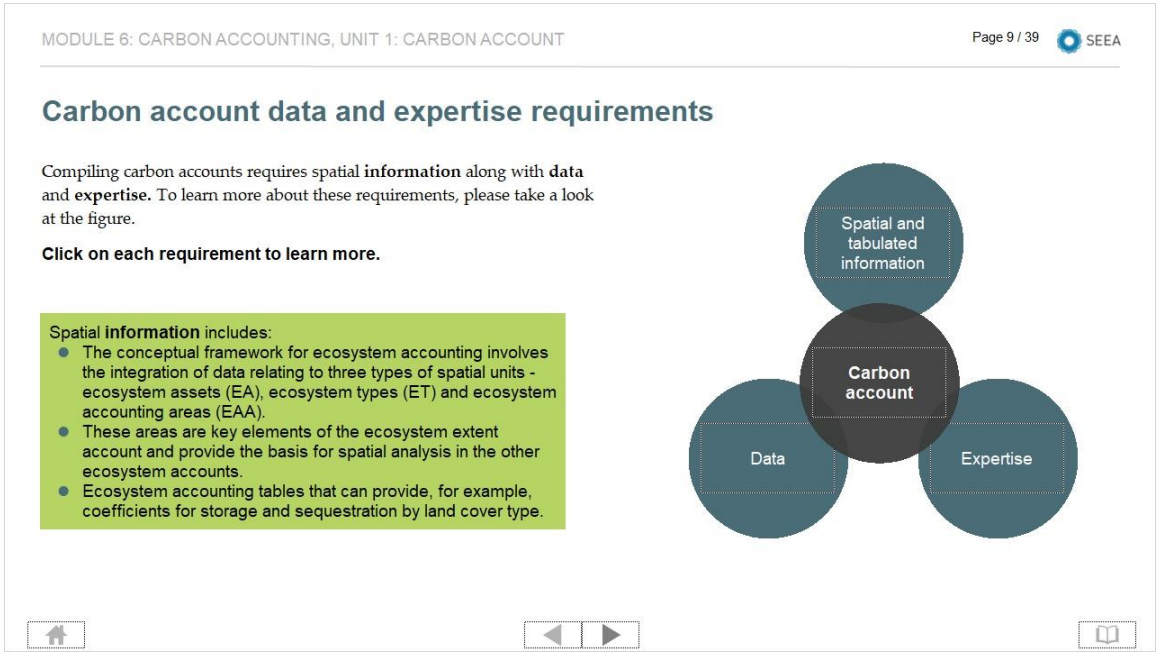
### Carbon account data and expertise requirements

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

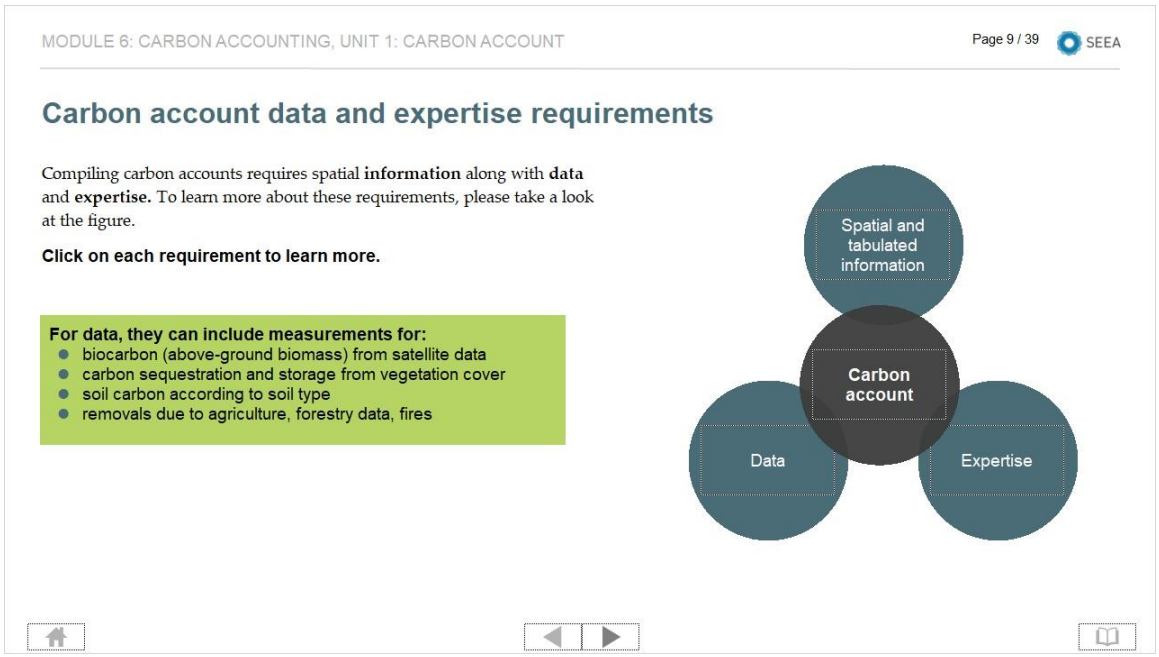
**Click on each requirement to learn more.**



## Explanation 1 (Slide Layer)




## Explanation 2 (Slide Layer)



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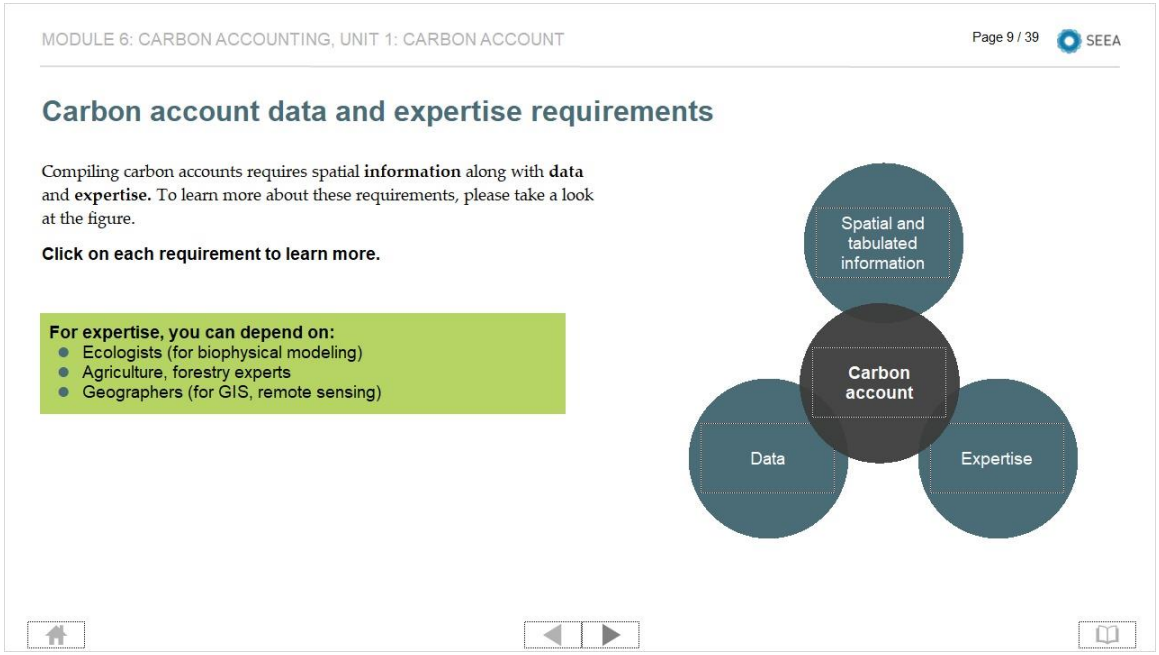
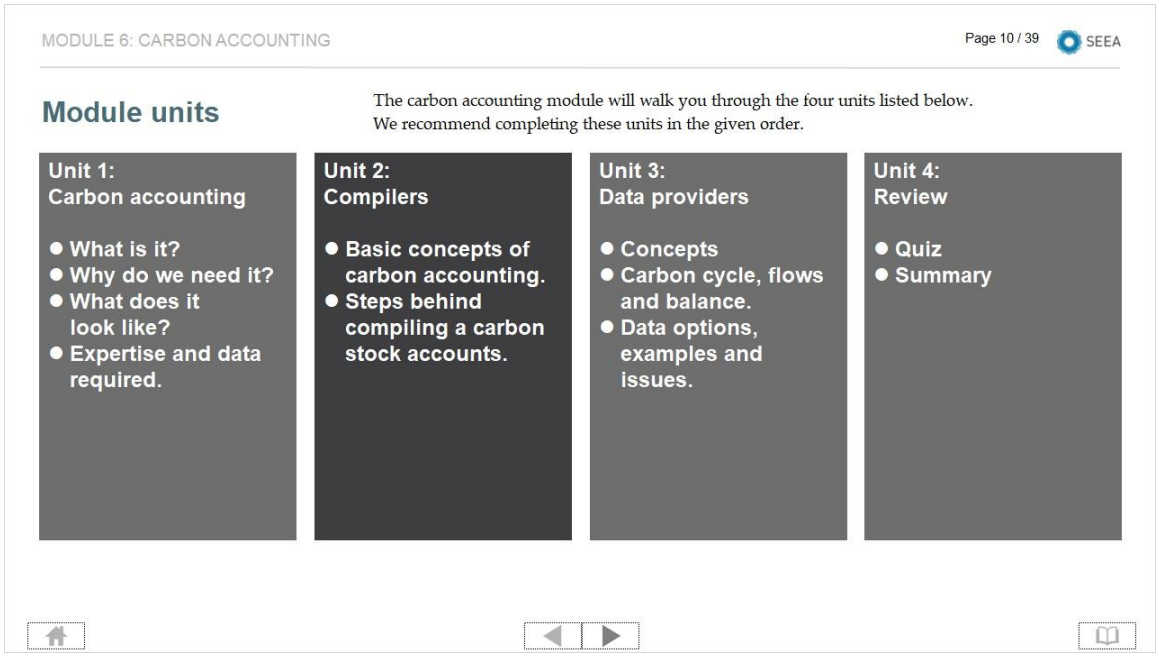
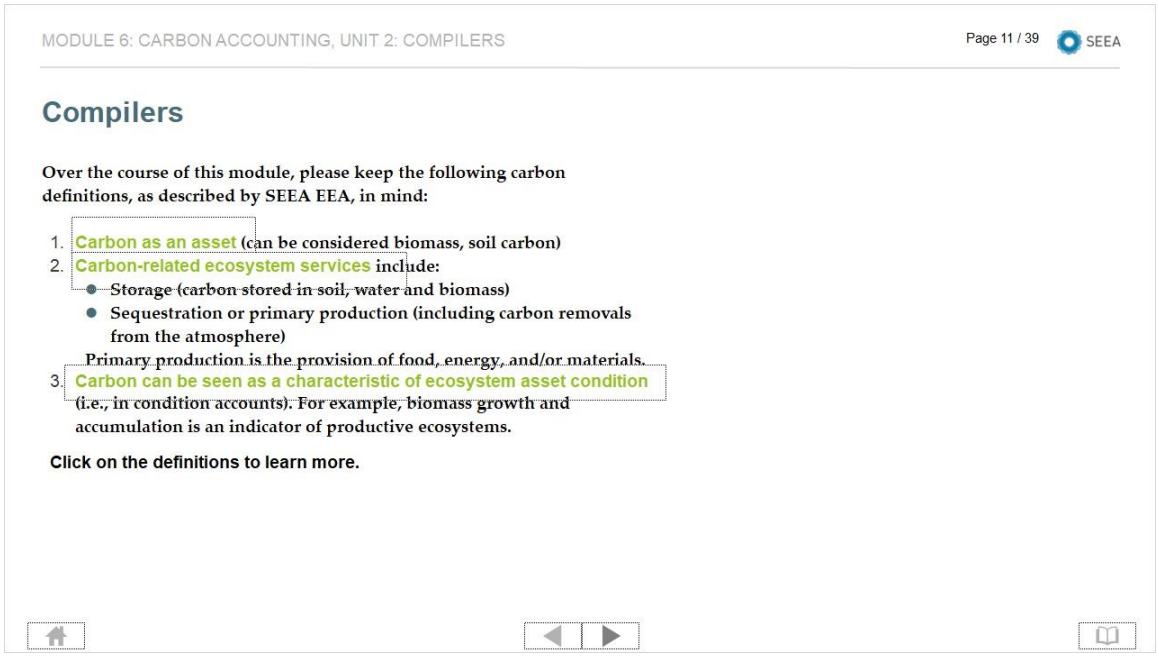


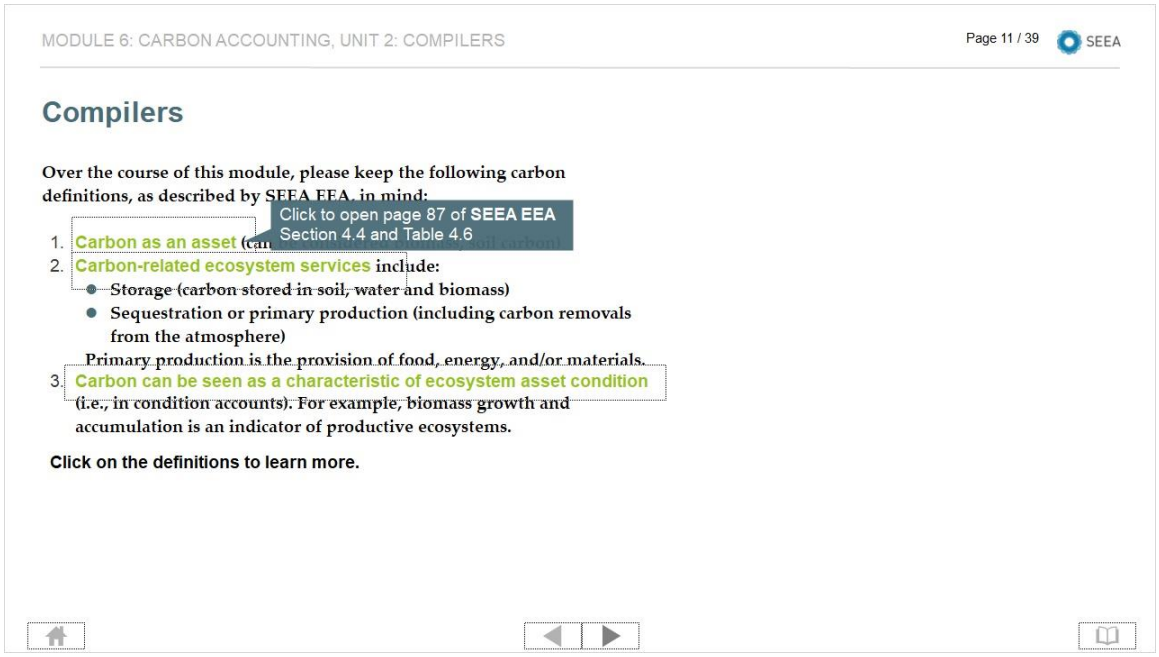

## *1.10 Module units*



## *1.11 Compilers*




## Explanation 1 (Slide Layer)



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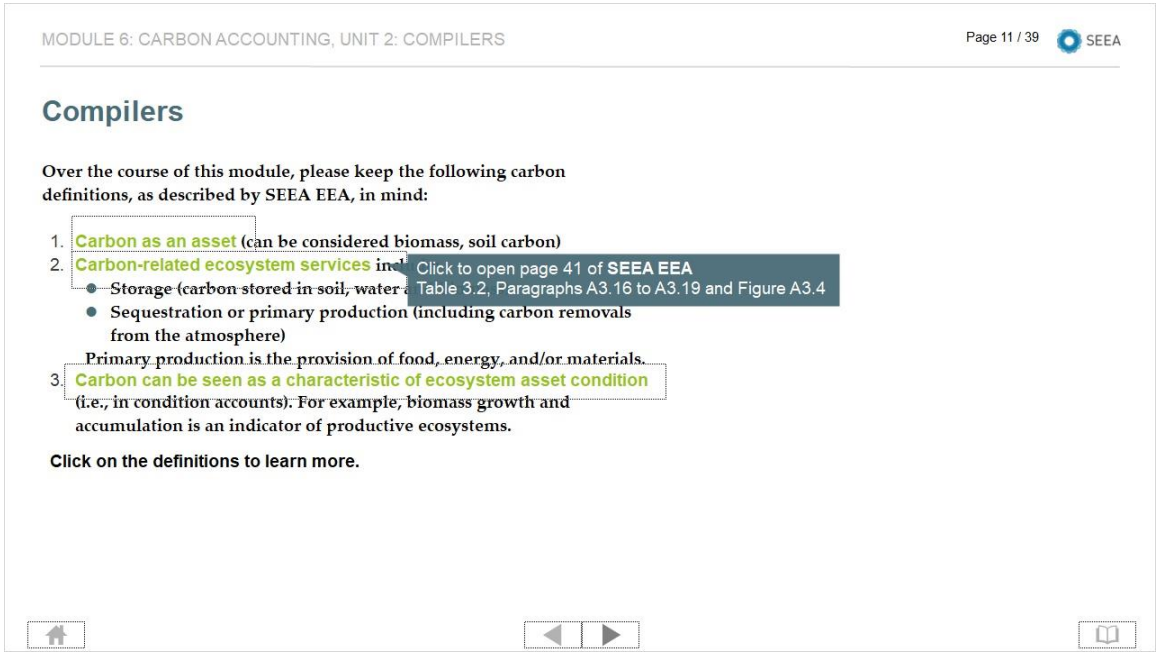


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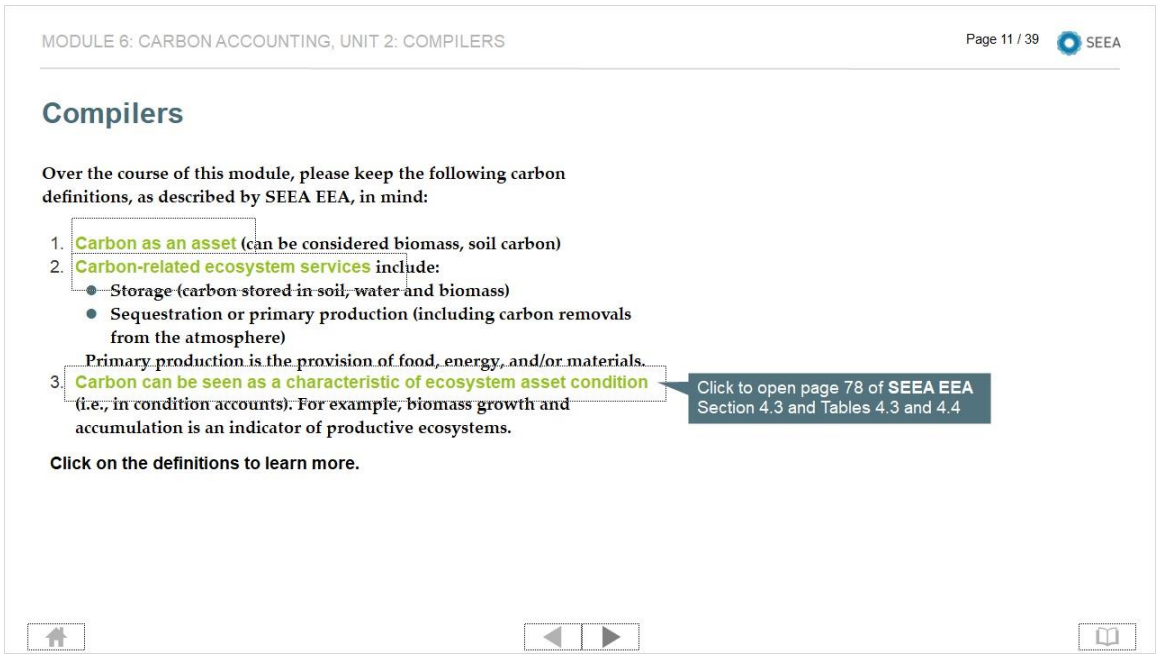
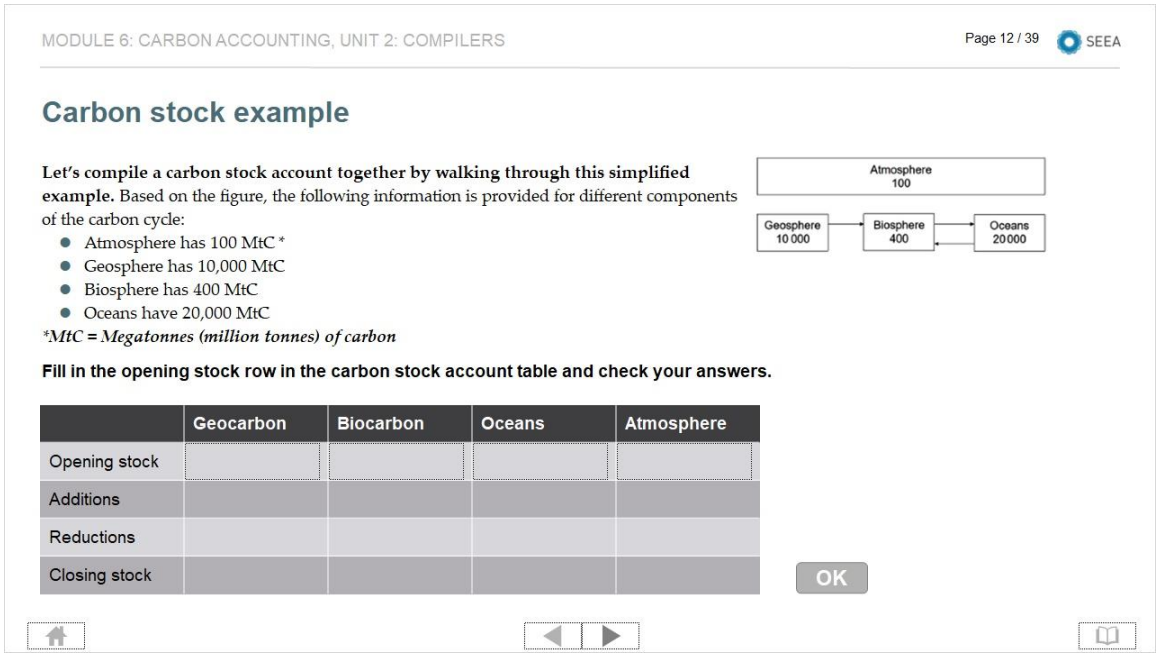
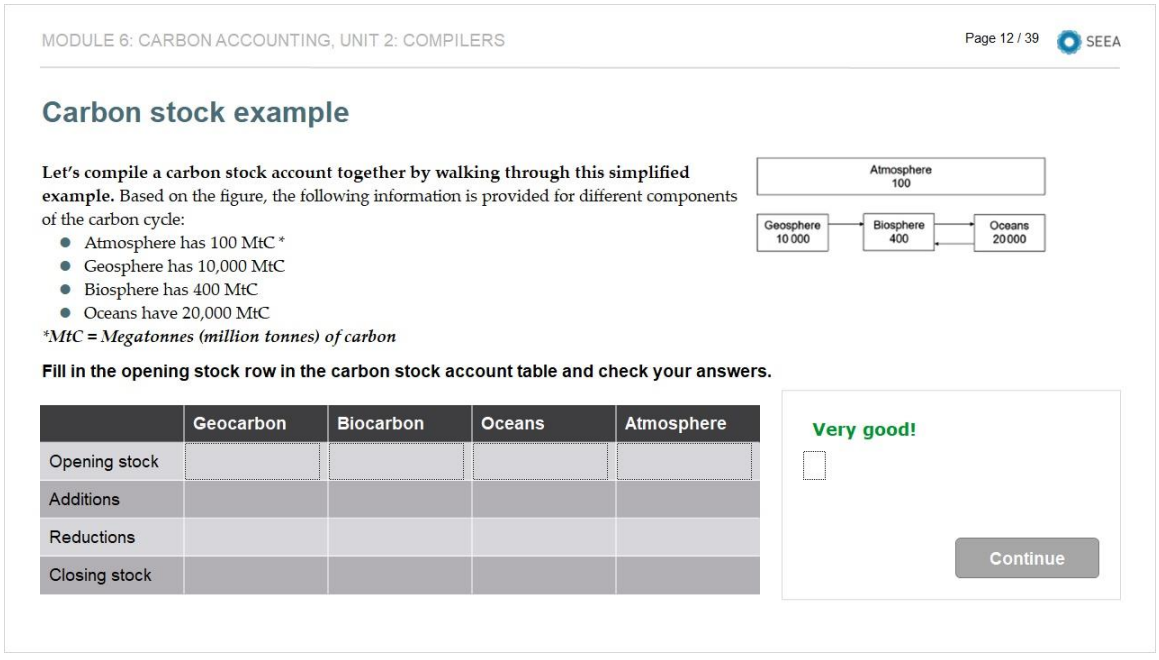


## *1.12 Carbon Stock Example*




## Correct (Slide Layer)



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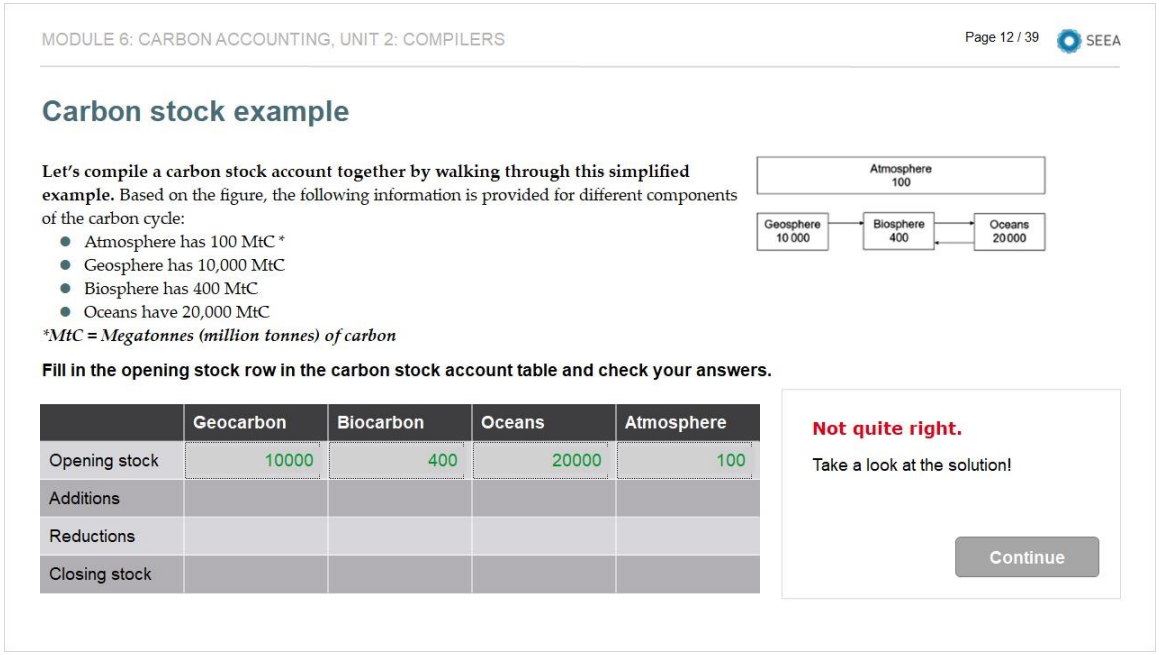
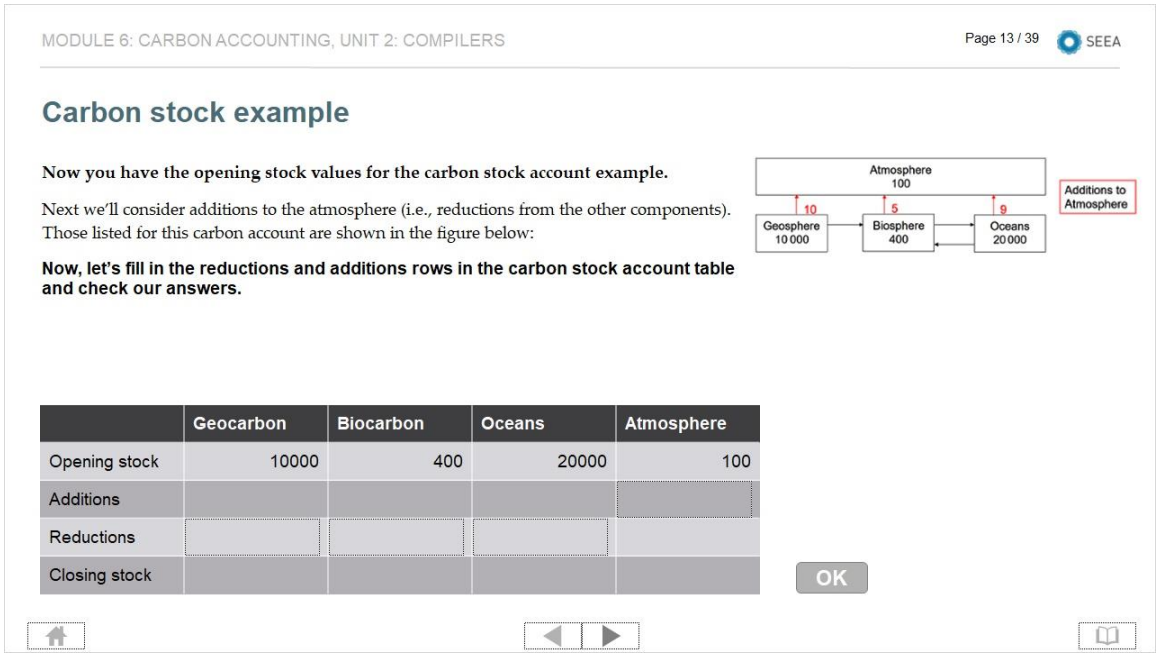
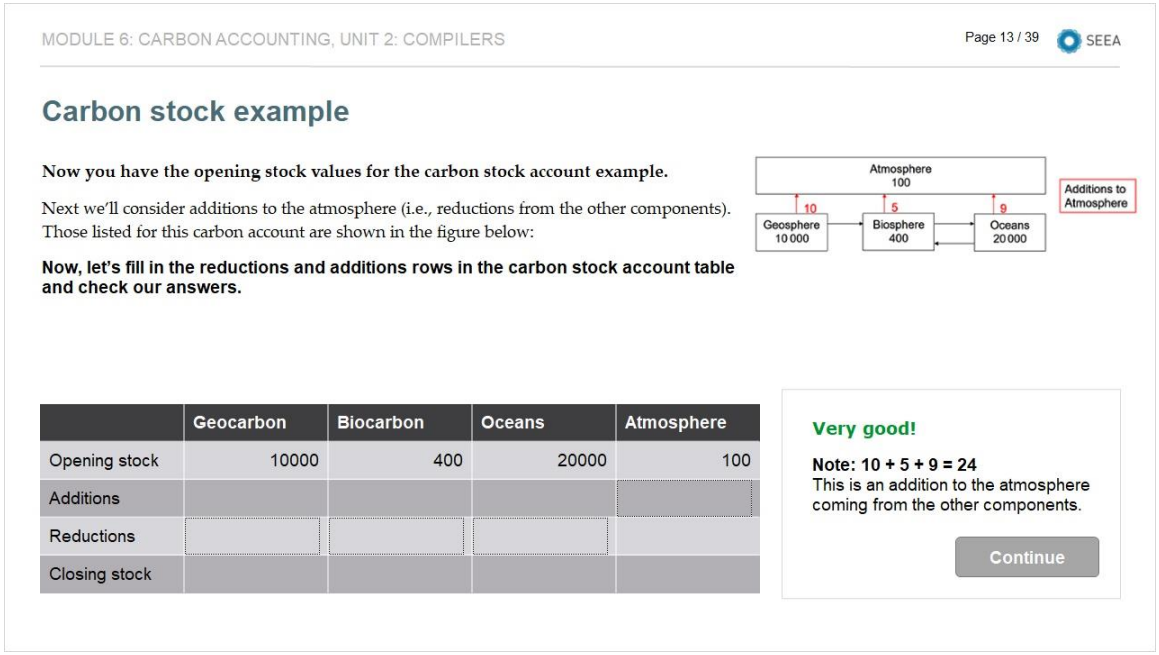



## *1.13 Carbon Stock Example*



## Correct (Slide Layer)

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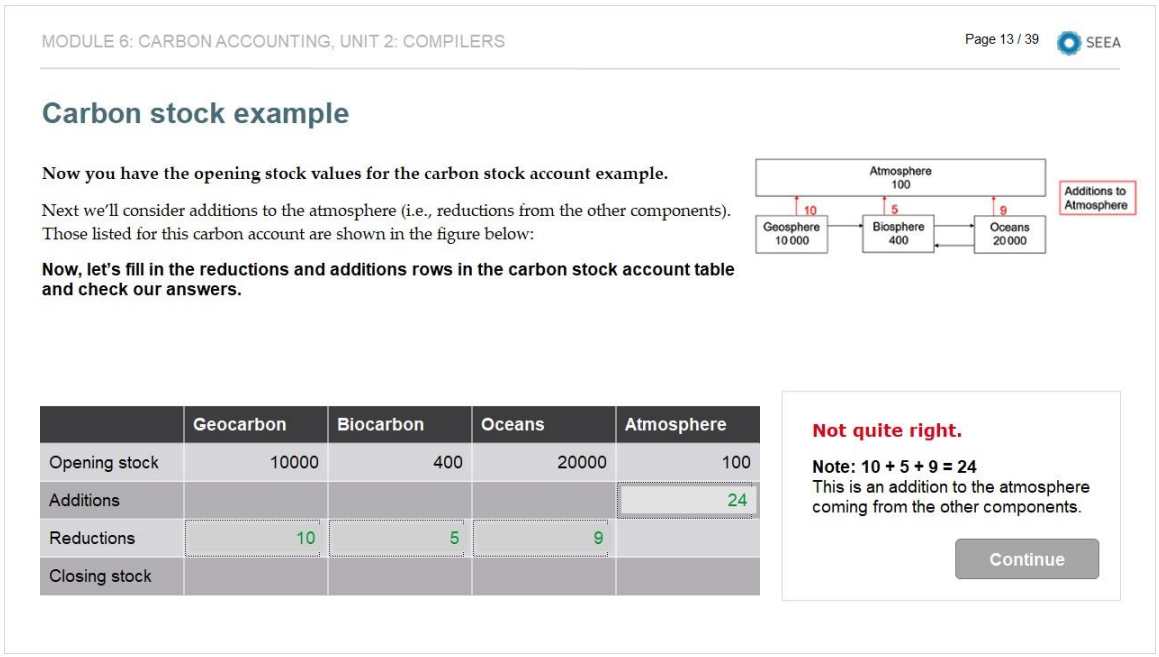
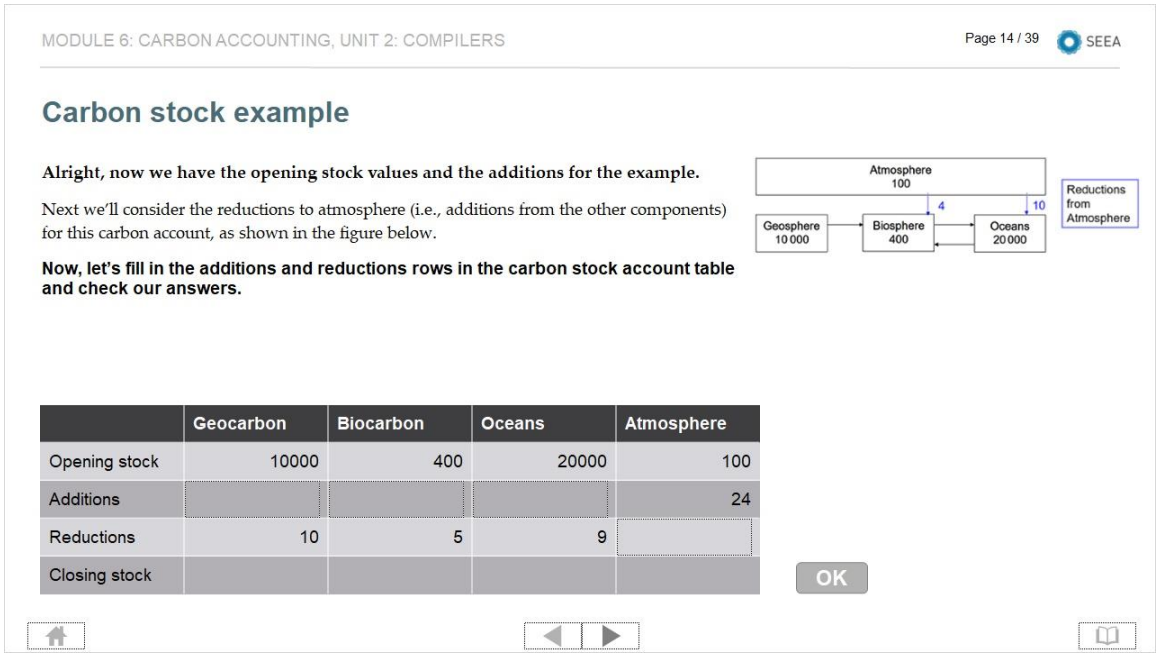


## *1.14 Carbon Stock Example*

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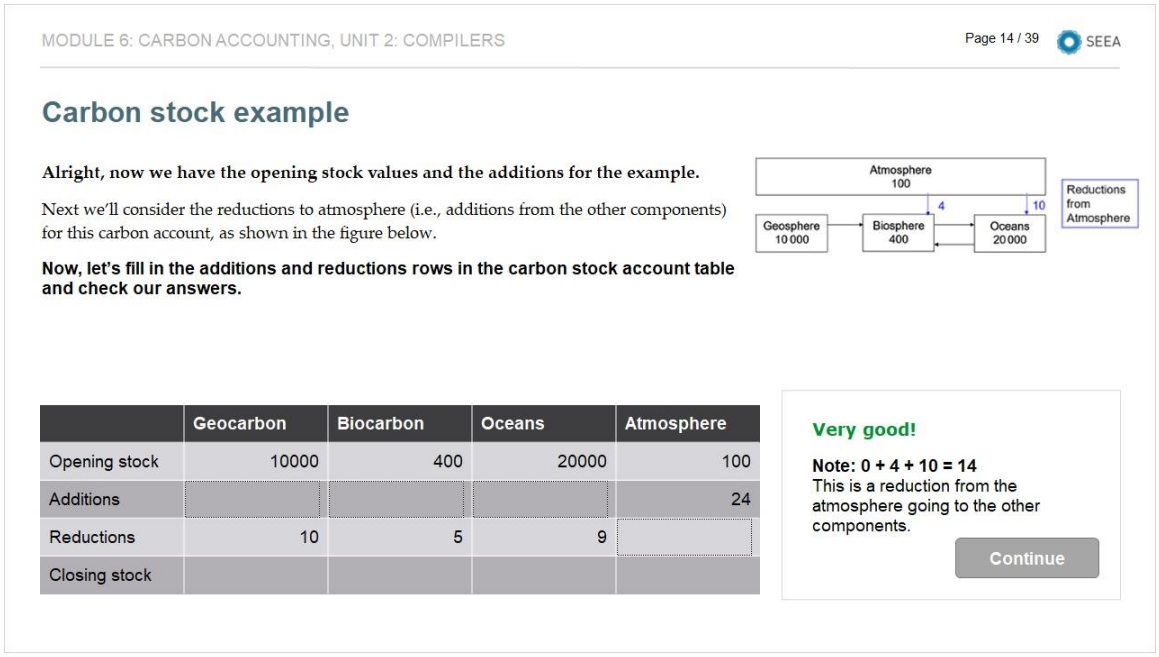

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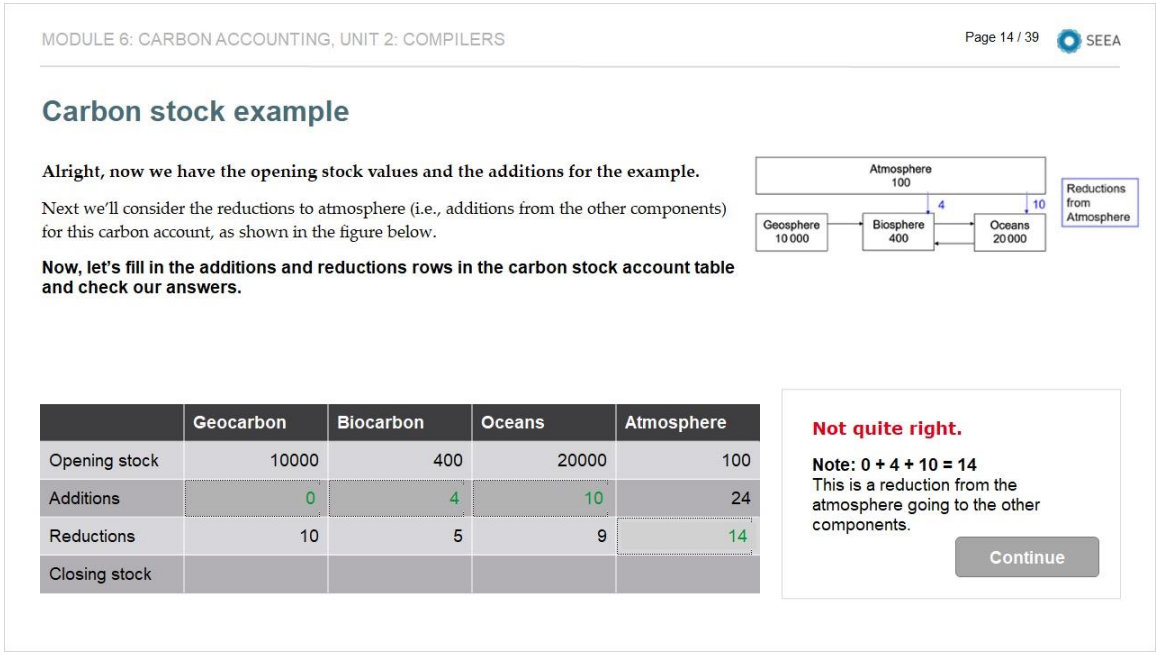
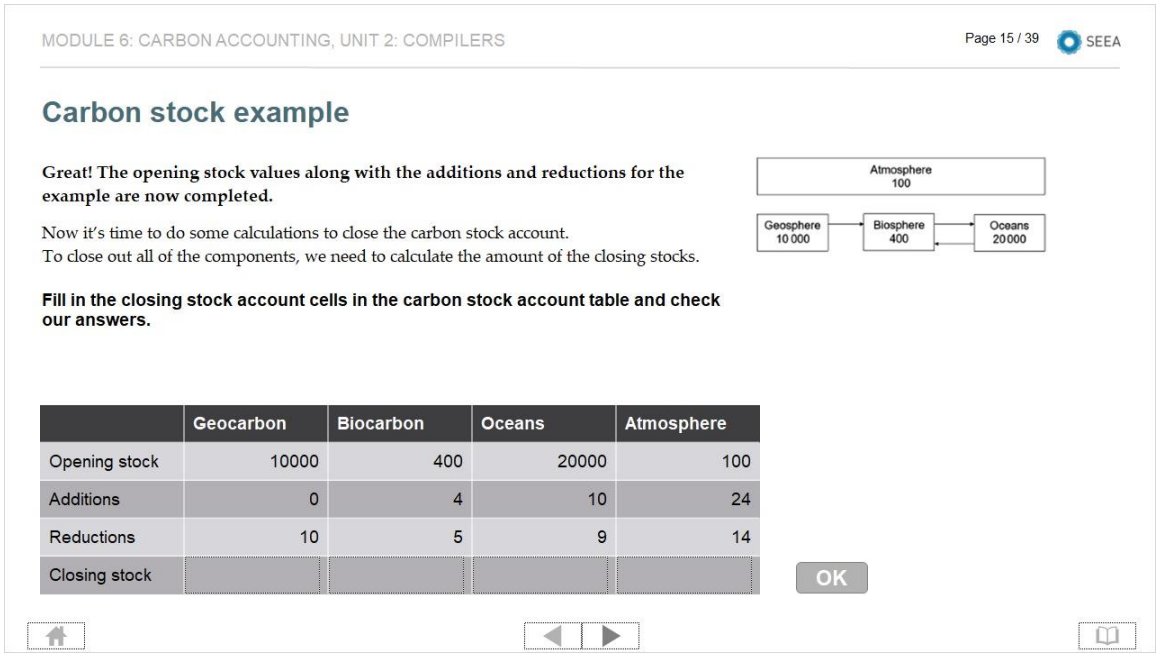



## *1.15 Carbon Stock Example*



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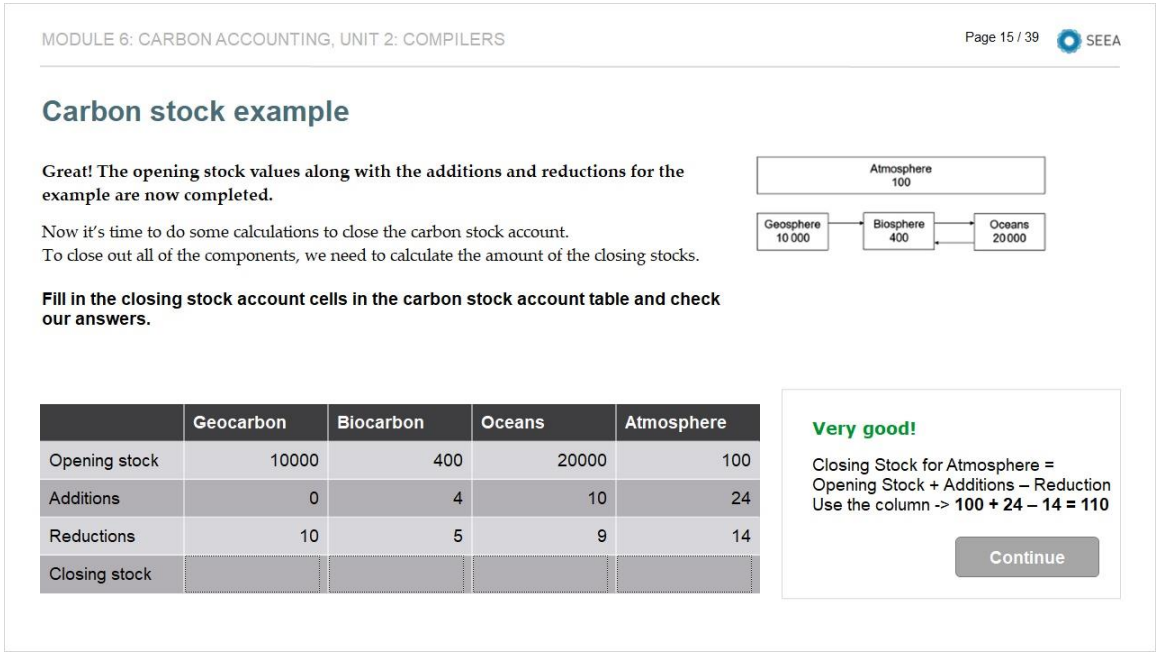
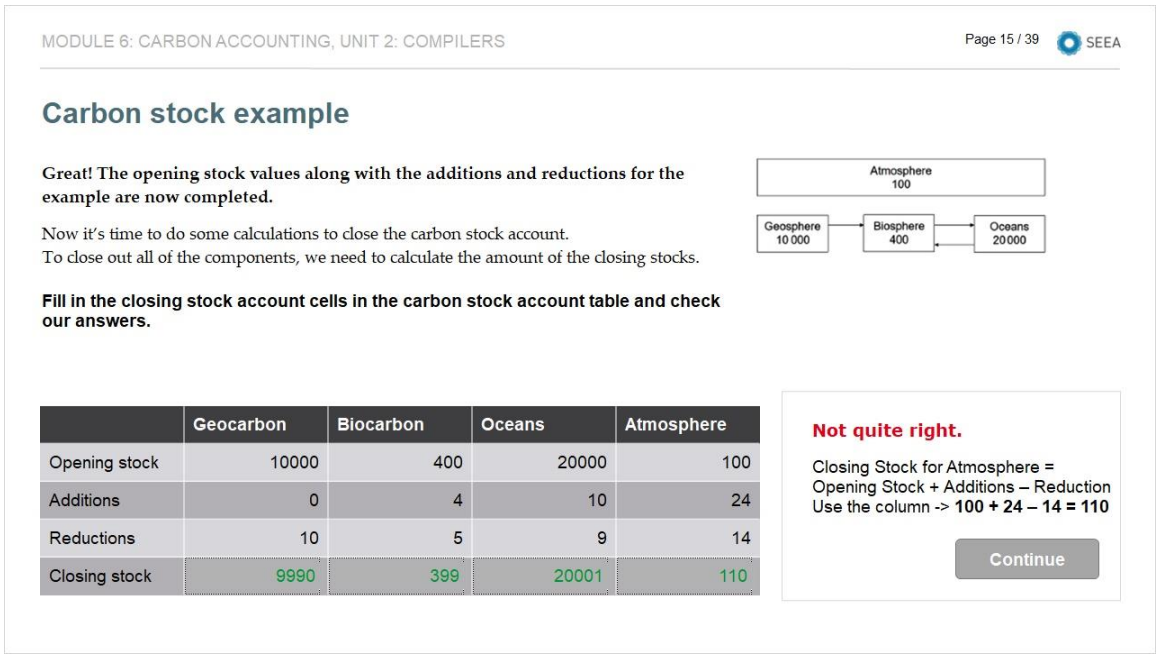



| | Geocarbon | Biocarbon | Oceans | Atmosphere |
|---|---|---|---|---|
| Opening stock | 10000 | 400 | 20000 | 100 |
| Additions | 0 | 4 | 10 | 24 |
| Reductions | 10 | 5 | 9 | 14 |
| Closing stock | | | | |

## Incorrect (Slide Layer)




| | 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 |

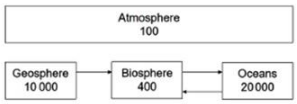
## *1.16 Carbon Stock Example*



### 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?

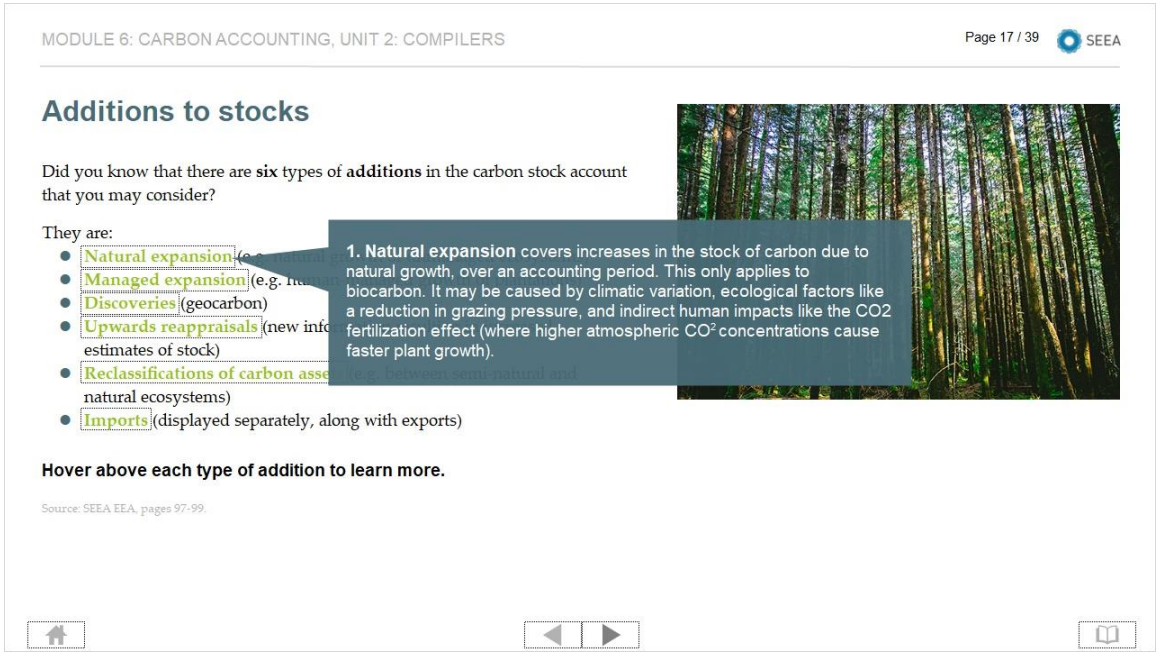
They are:

- 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)

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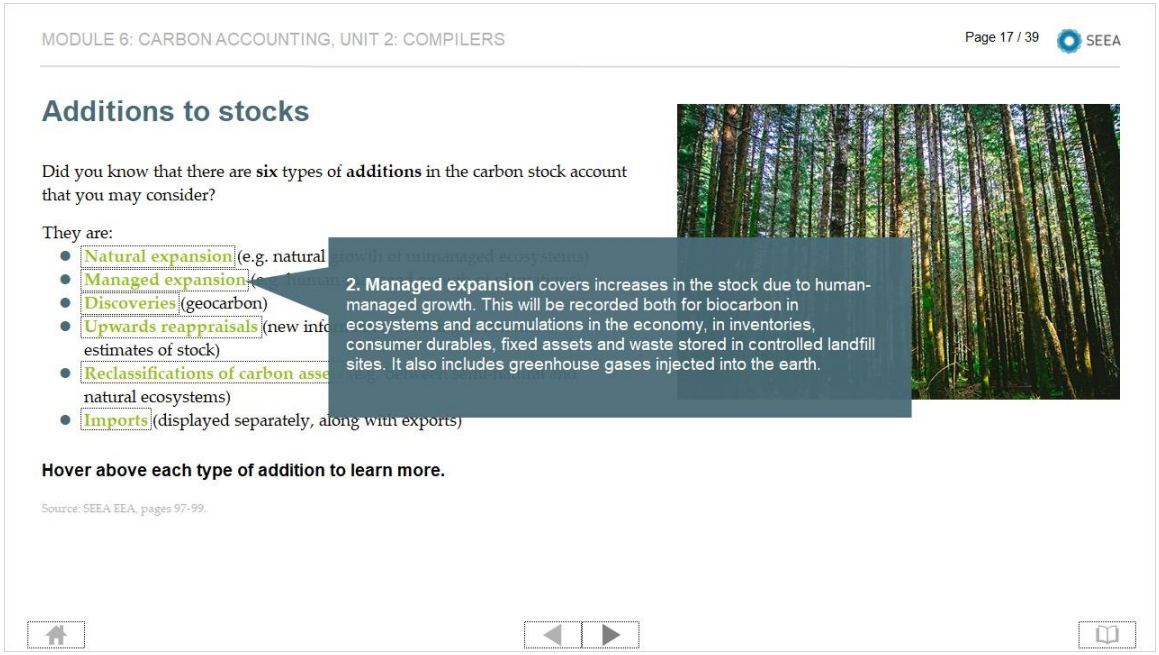
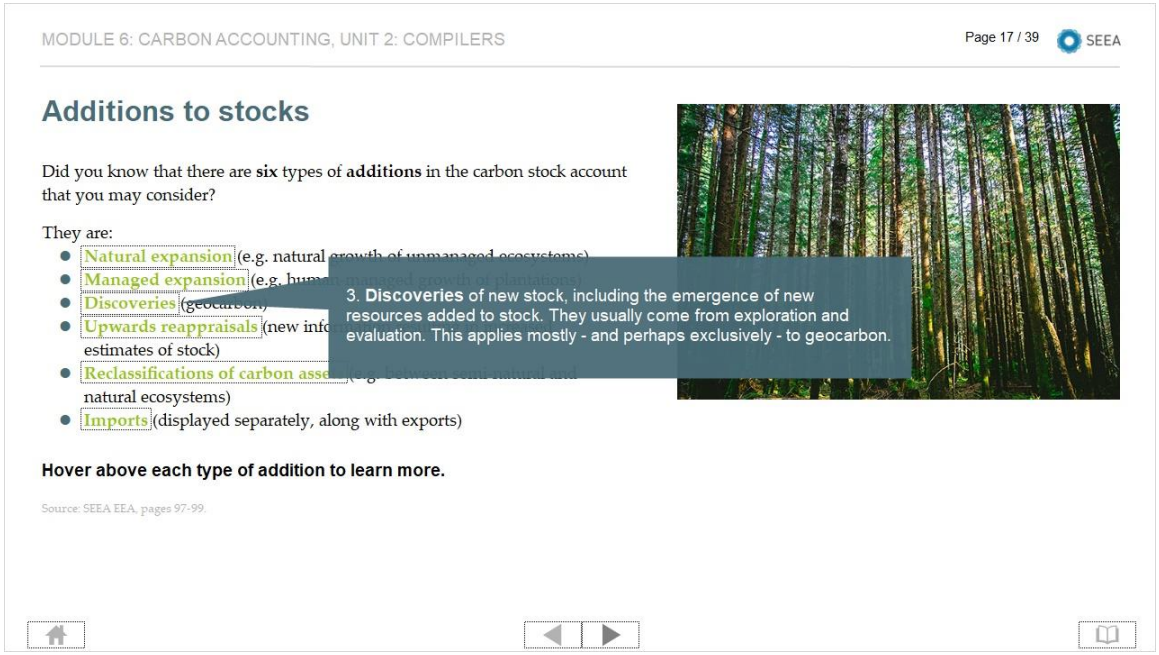
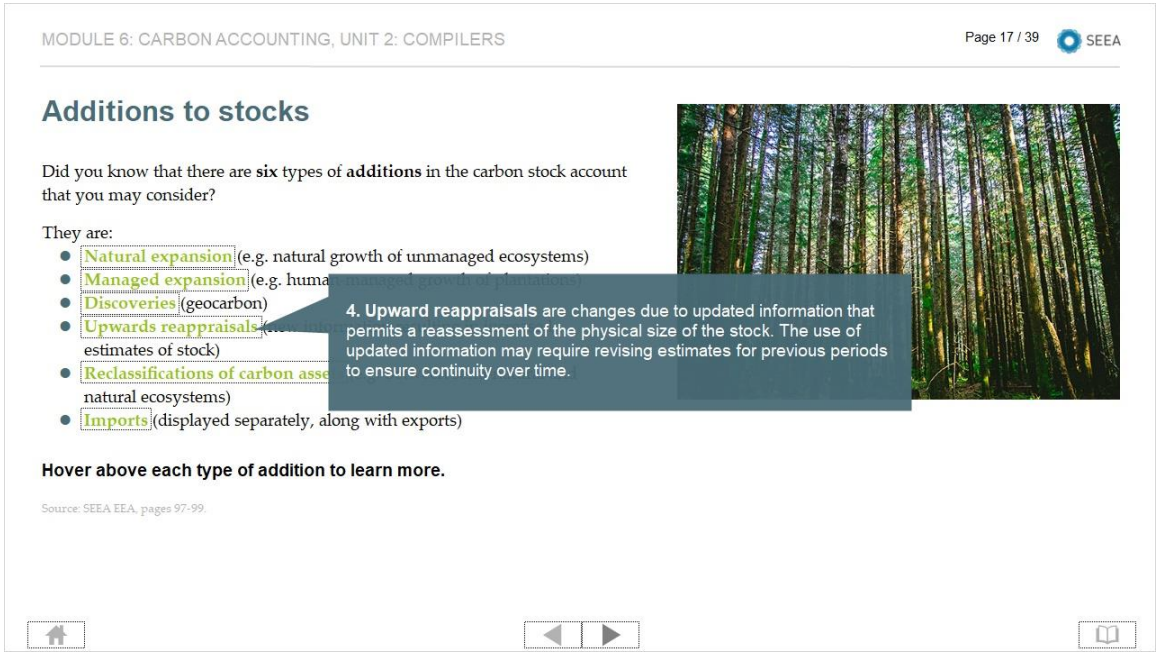


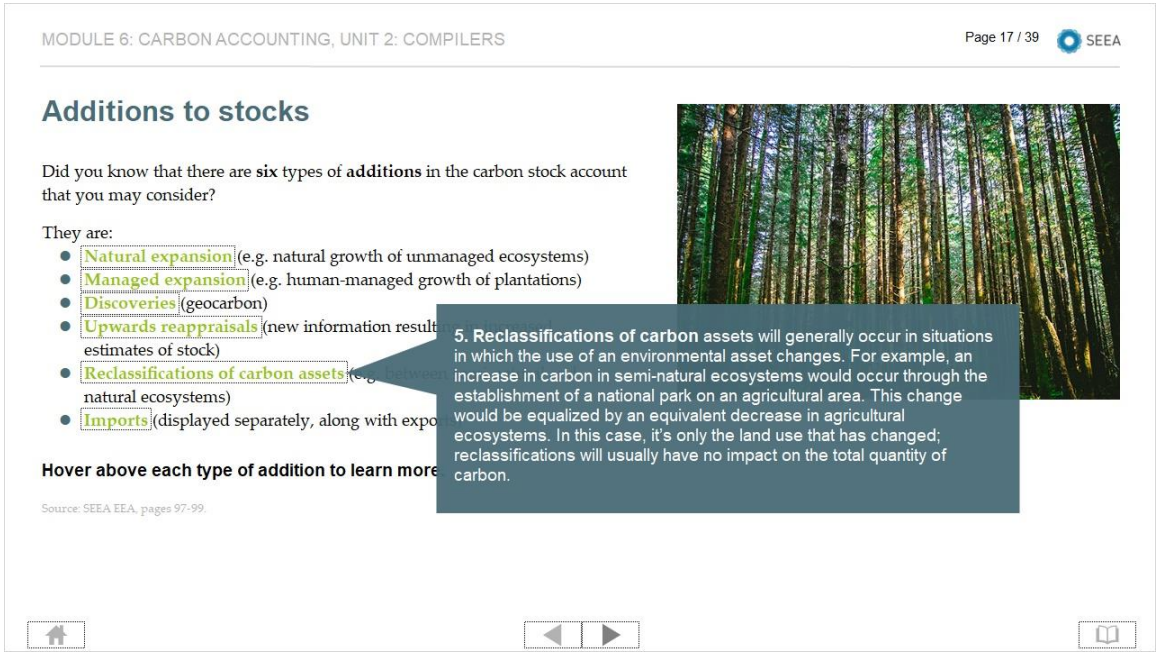
## Explanation 3 (Slide Layer)



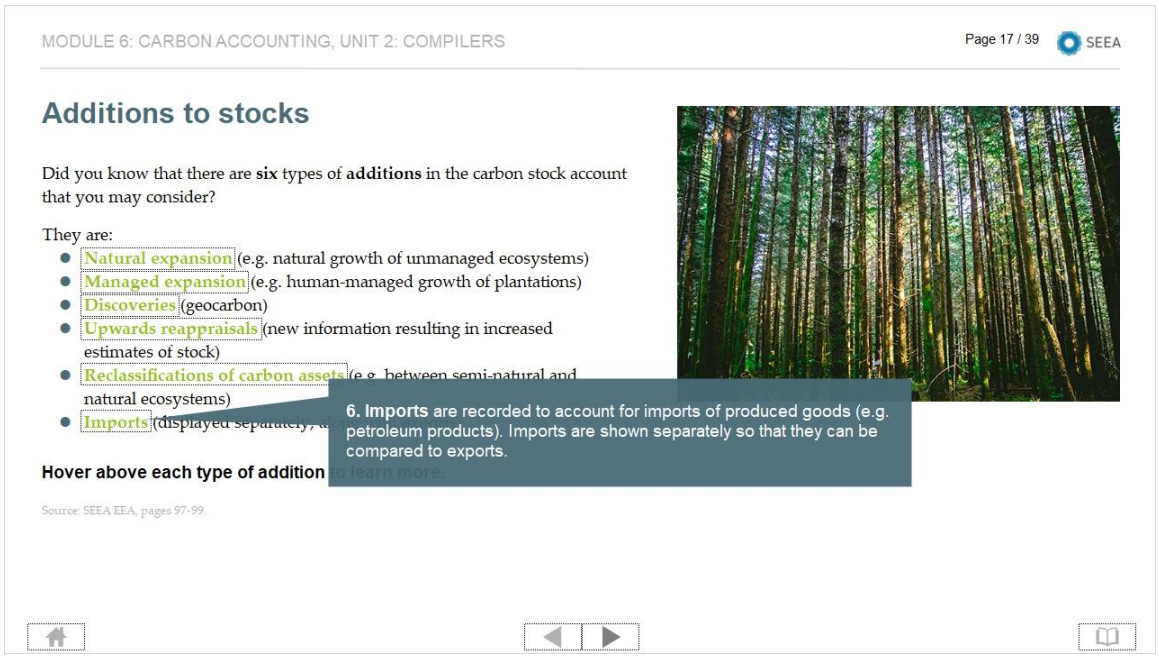

## Explanation 4 (Slide Layer)



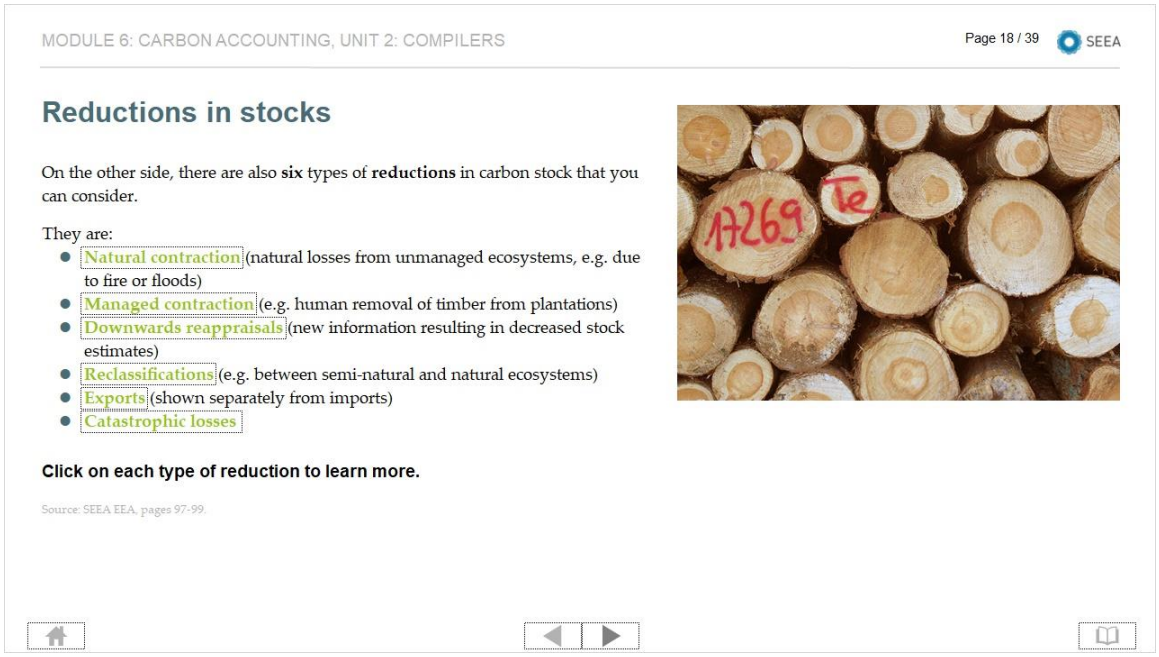
## Explanation 5 (Slide Layer)



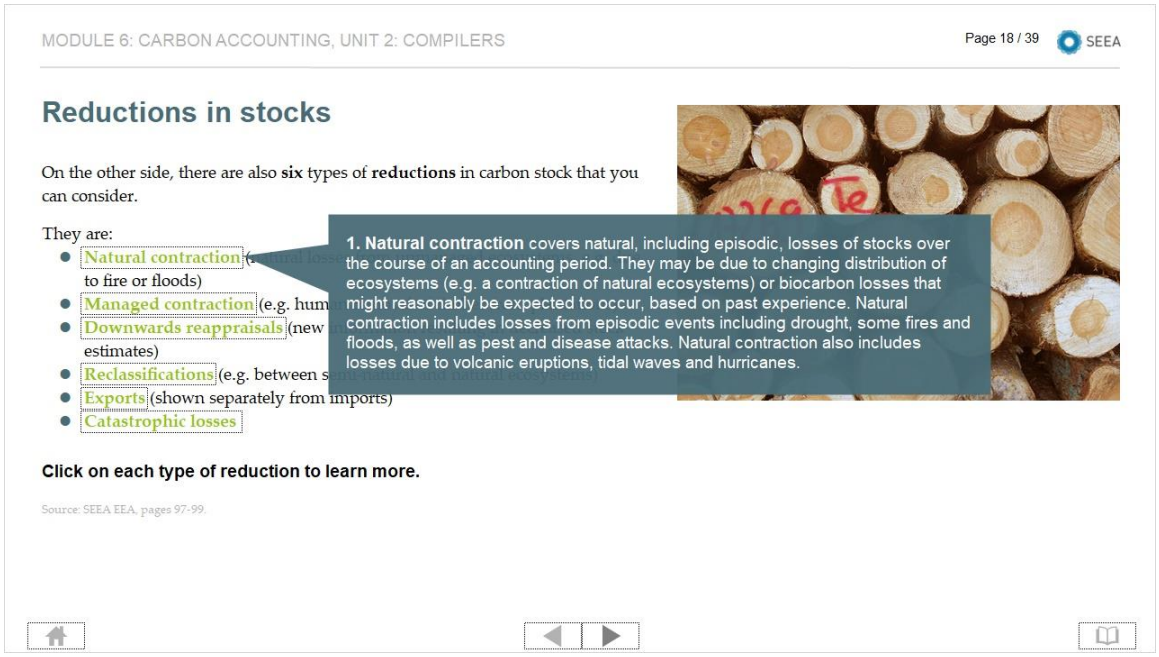

## Explanation 6 (Slide Layer)



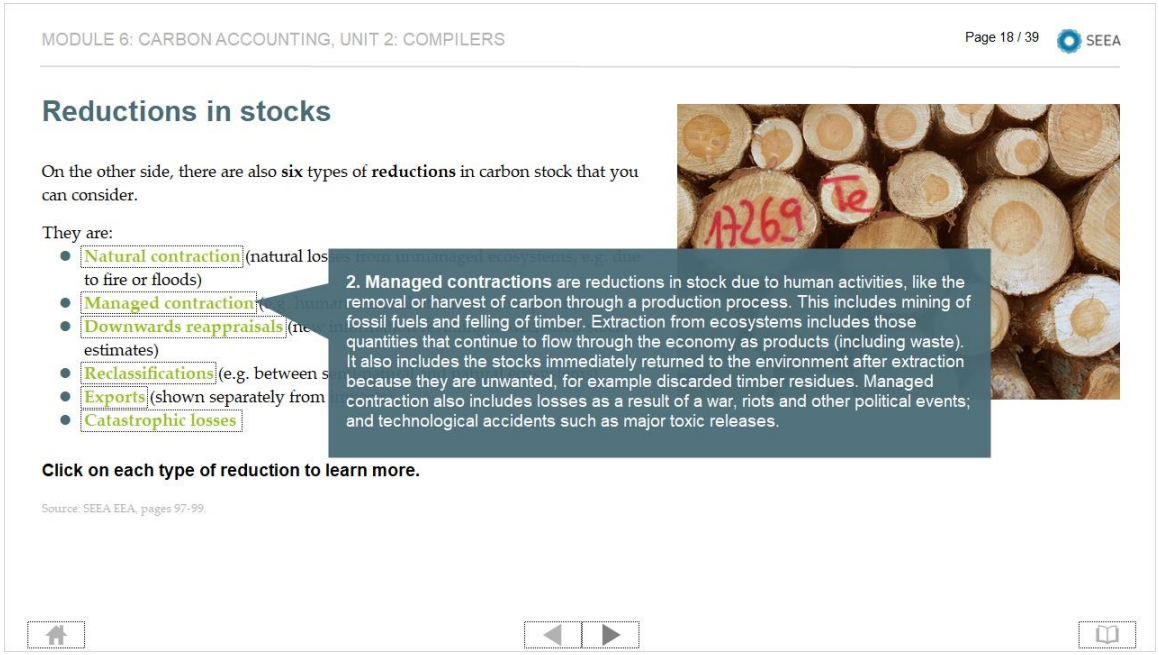
## *1.18 Reductions to Stock*



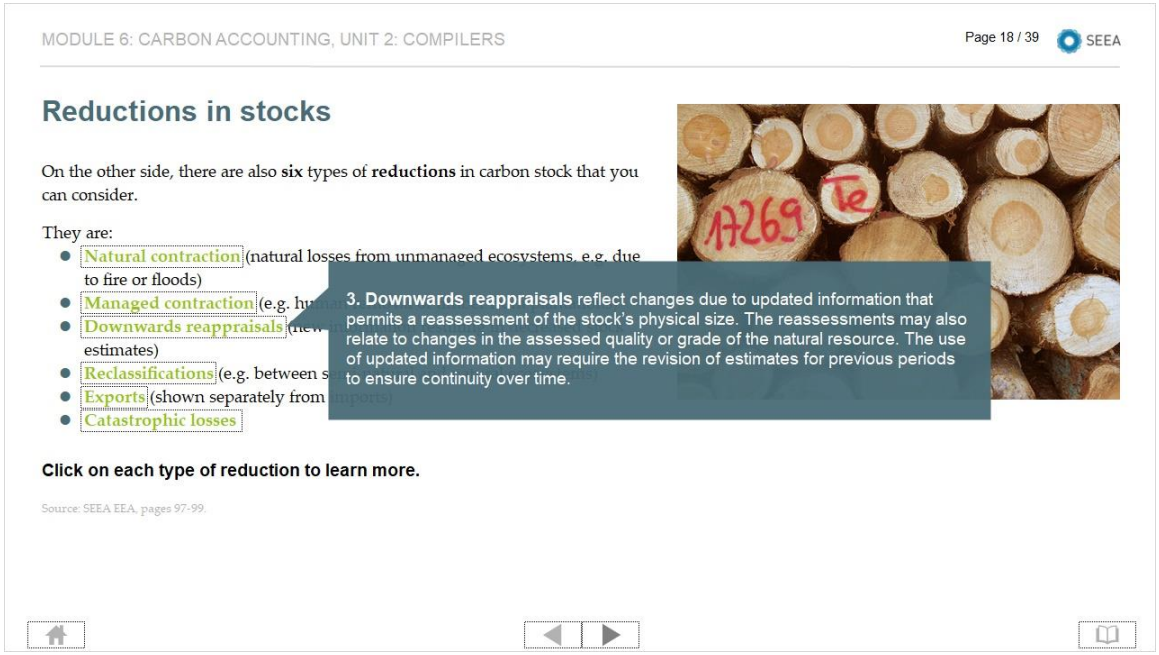

## Explanation 1 (Slide Layer)



## Explanation 2 (Slide Layer)




## Explanation 3 (Slide Layer)



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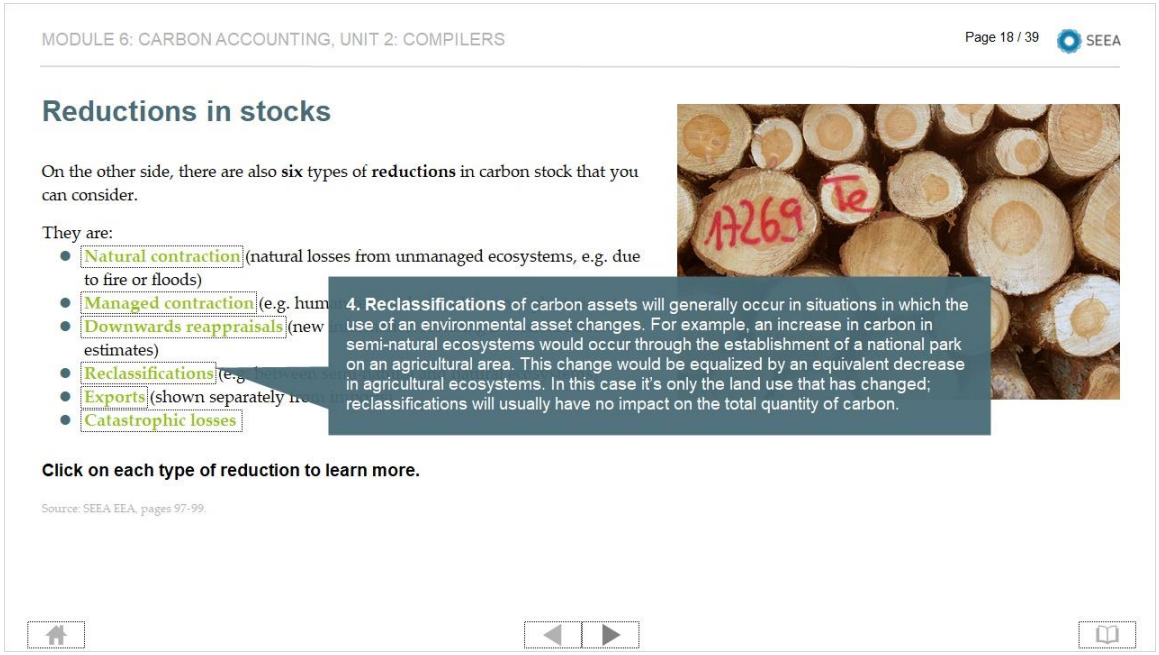
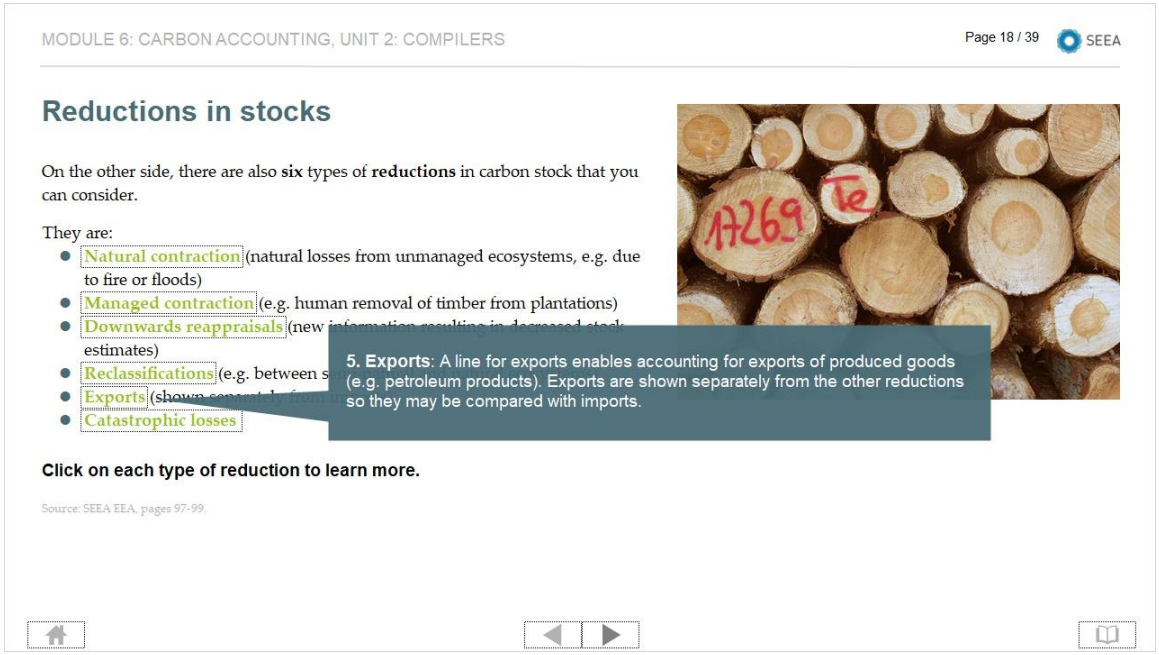
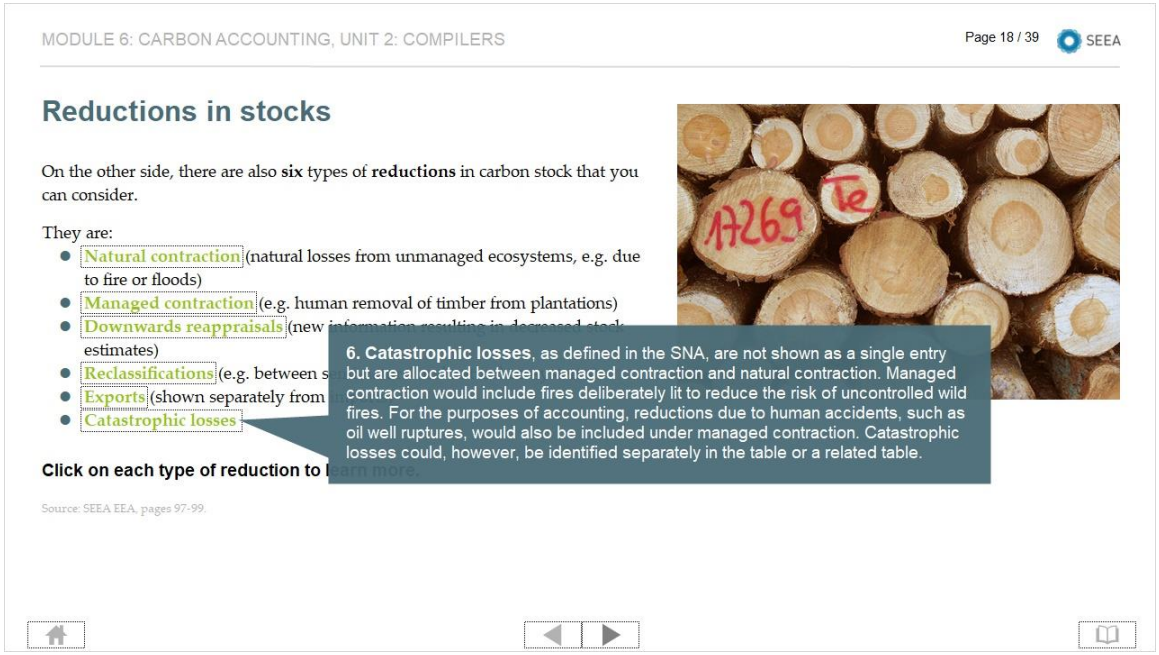



## Explanation 5 (Slide Layer)

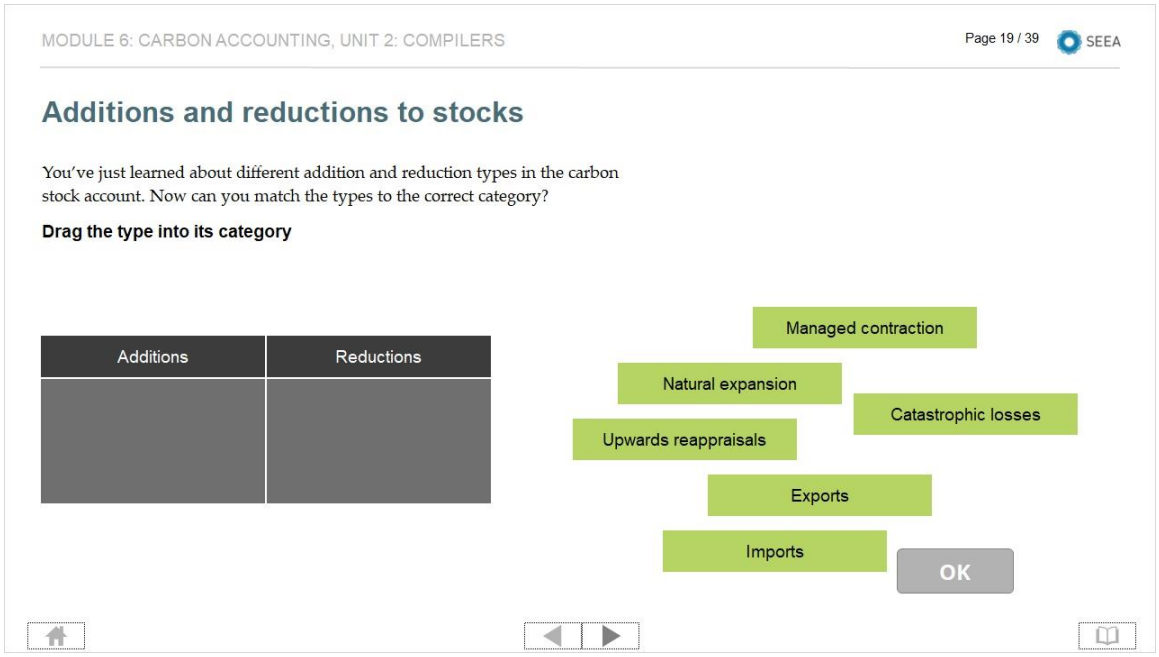


## Explanation 6 (Slide Layer)




## *1.19 Additions and Reductions to Stock*

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



| 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 |

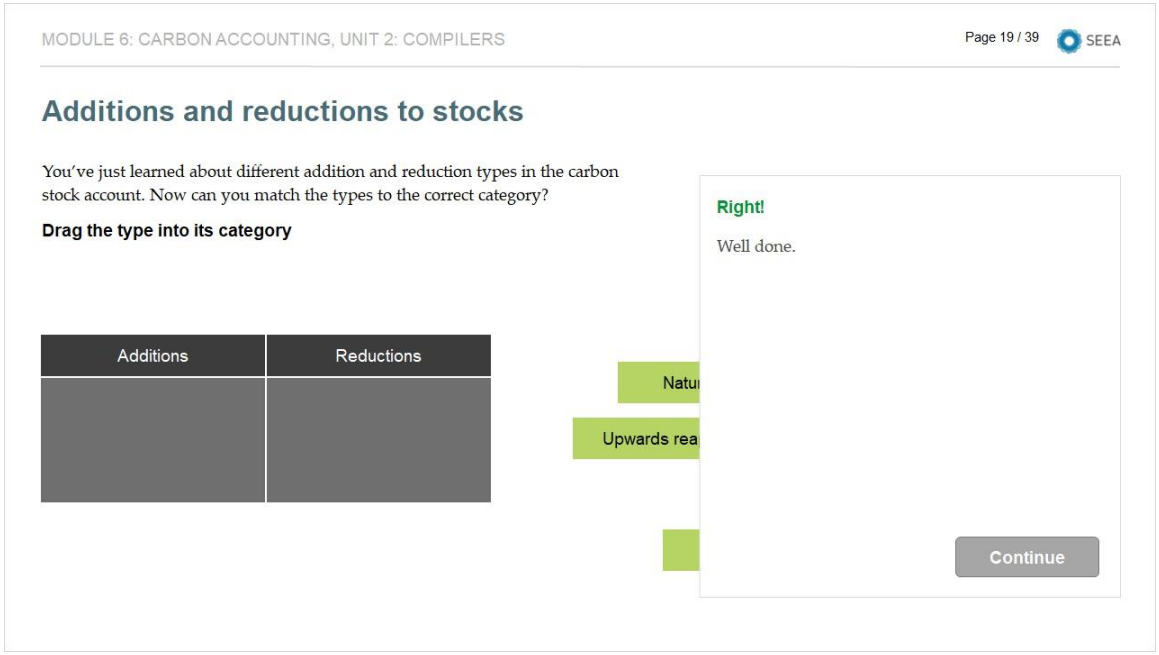
**Feedback when correct:**

Well done.

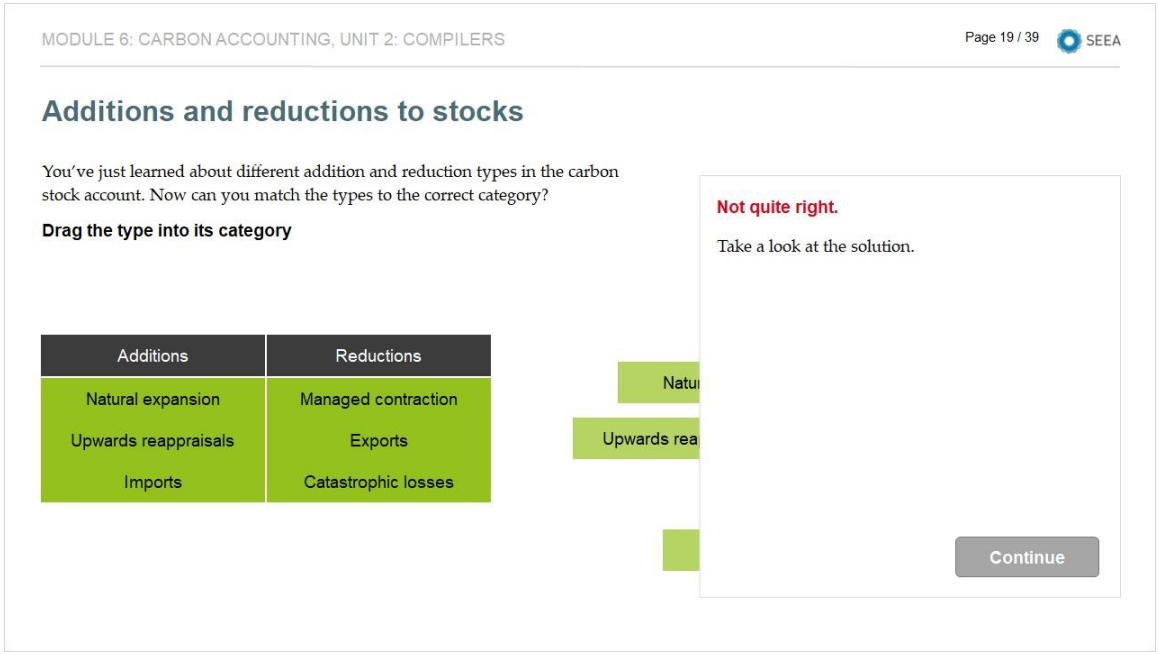
**Feedback when incorrect:**

Take a look at the solution.

## Correct (Slide Layer)




## Incorrect (Slide Layer)



## *1.20 Excercise*



### 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 Excercise*



### 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**

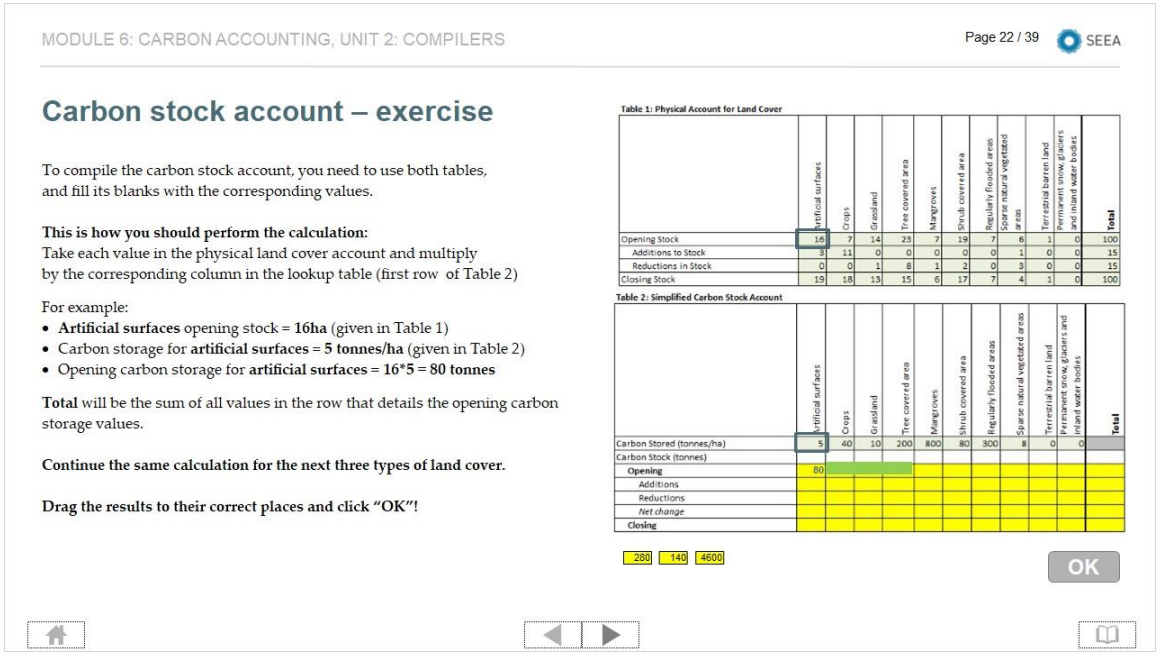
| | Artificial surfaces | Crops | Grassland | Tree covered area | Mangroves | Shrub covered area | Regularly flooded areas | Sparse natural vegetated areas | Terrestrial barren land | Permanent snow, glaciers and inland water bodies | **Total** |
|---|---|---|---|---|---|---|---|---|---|---|---|
| Carbon 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 Excercise*

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




| 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 |

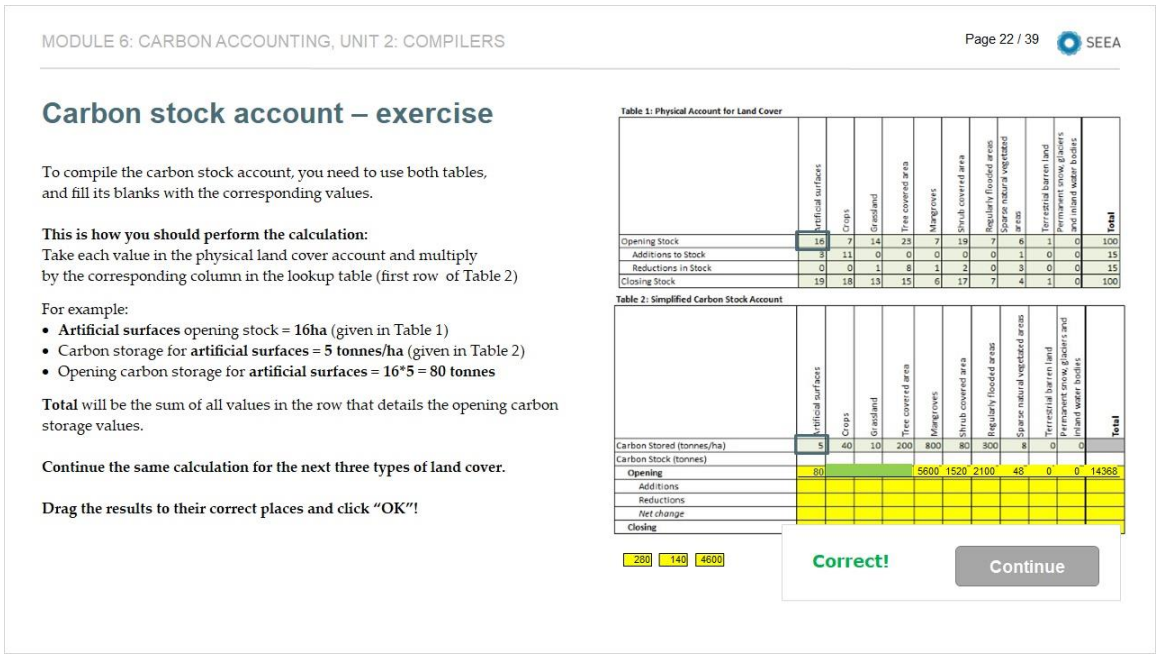
**Feedback when correct:**

Das stimmt!  Sie haben die richtige Antwort gewählt.

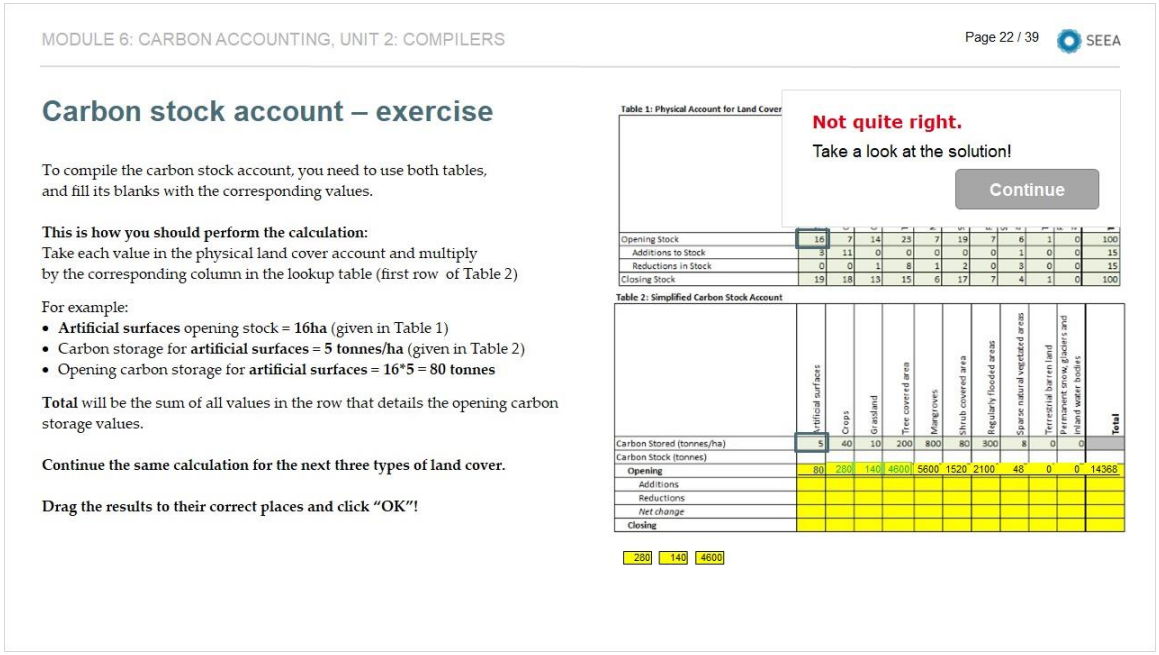
**Feedback when incorrect:**

Sie haben nicht die richtige Antwort gewählt.

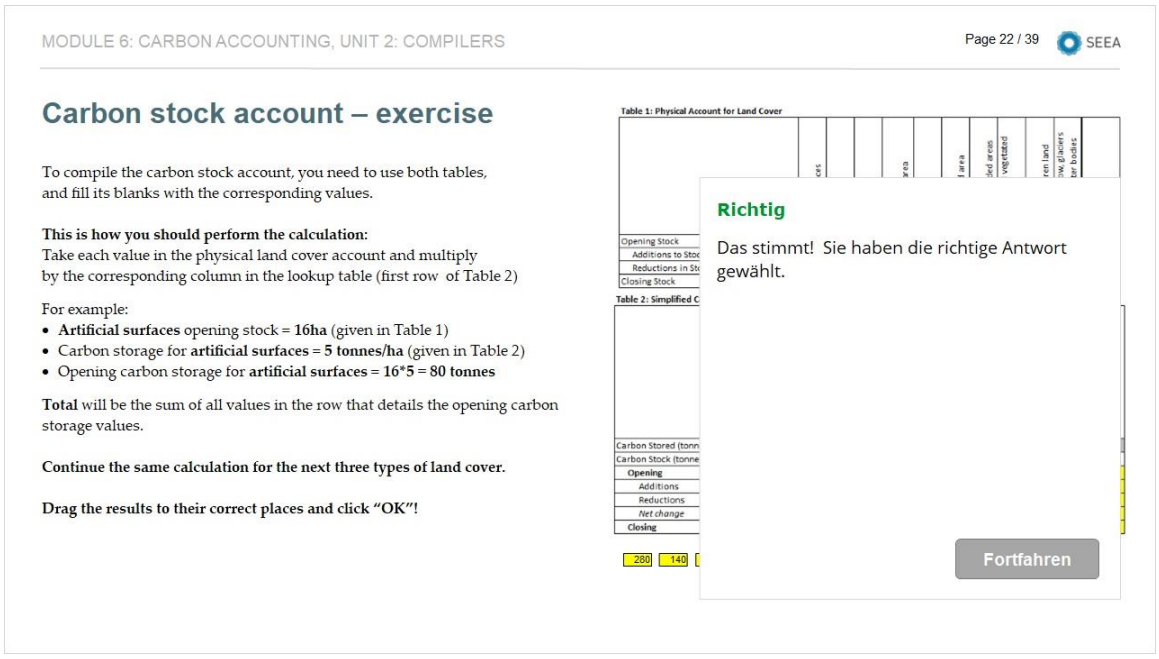
## Correct (Slide Layer)



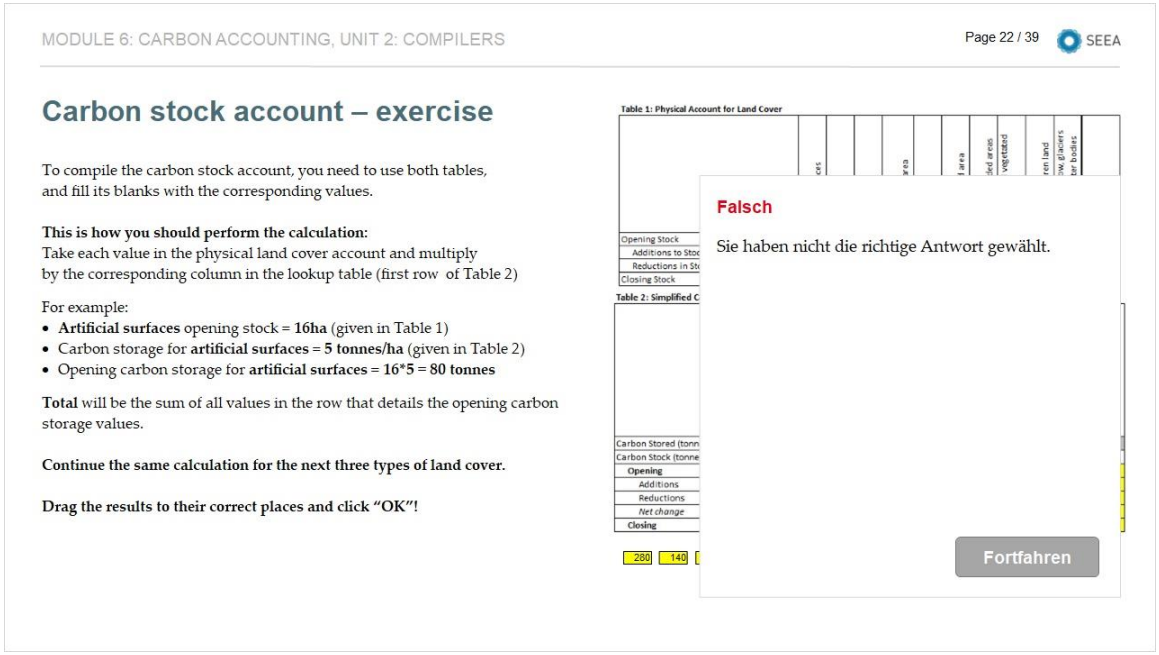
## Incorrect (Slide Layer)




## Richtig (Slide Layer)

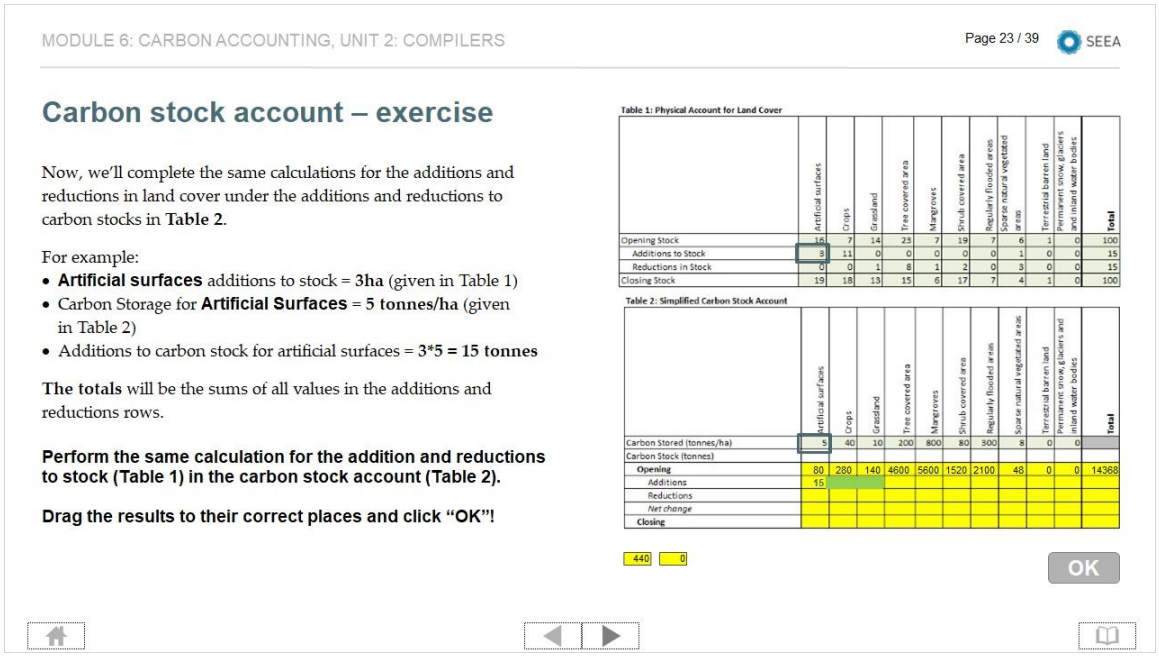


## Falsch (Slide Layer)




## *1.23 Excercise*

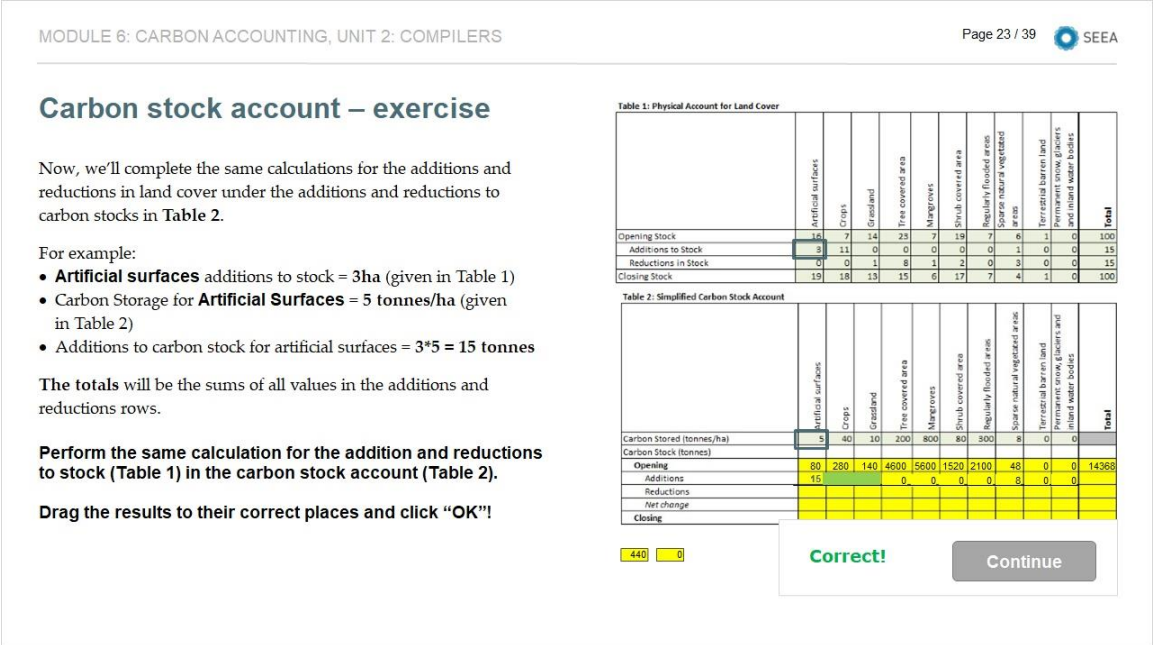
*(Drag and Drop, 10 points, 1 attempt permitted)*



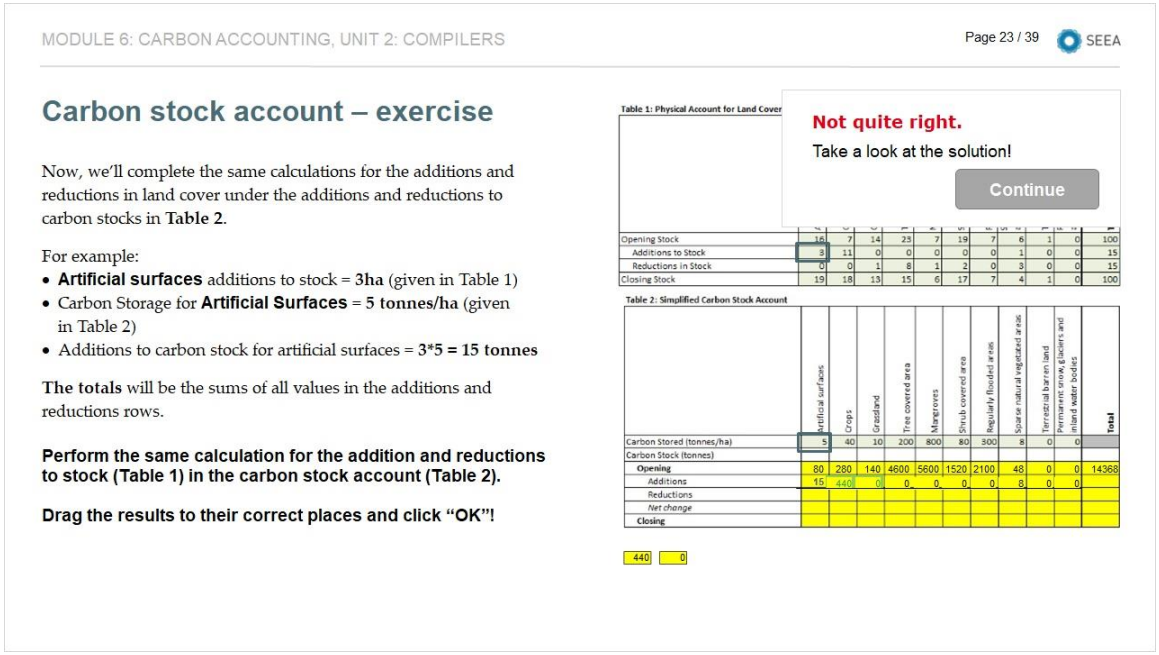
| Drag Item | Drop Target |
|---|---|
| 440 | Rectangle 3 |
| 0 | Rectangle 4 |

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

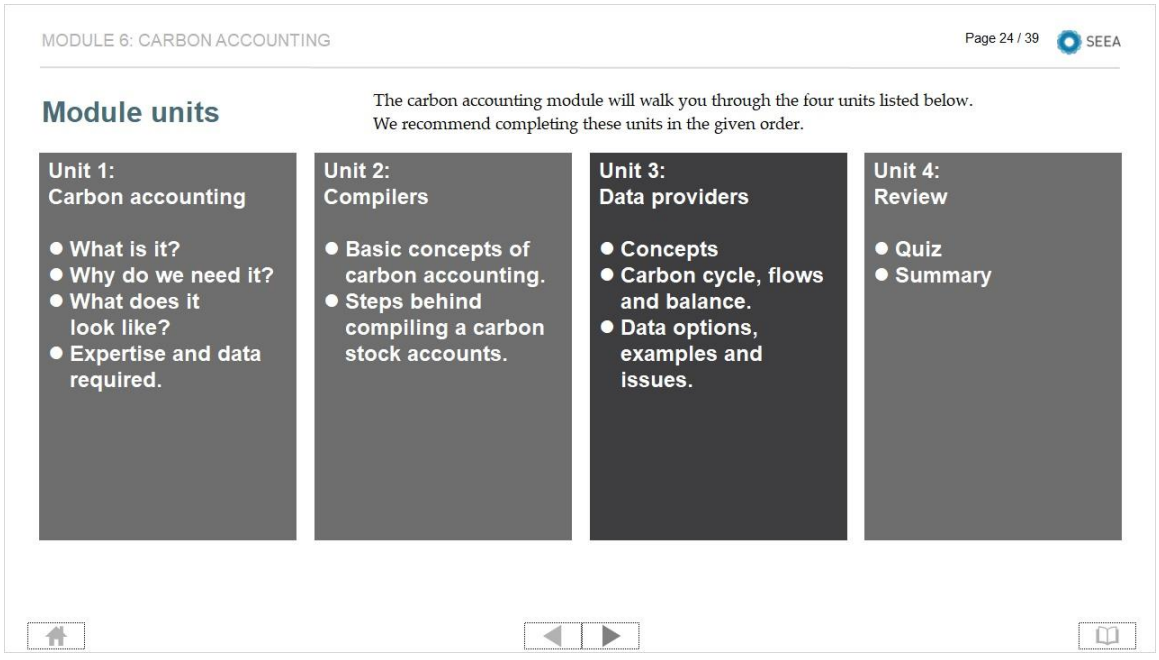
## Correct (Slide Layer)



## Incorrect (Slide Layer)




## *1.24 Module units*



## *1.25 Data providers*



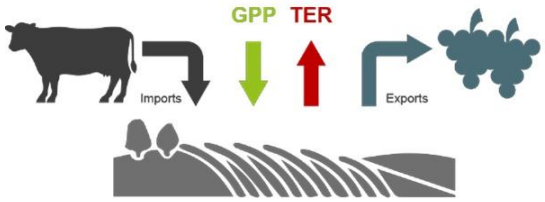
### Data providers

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*



### Data providers

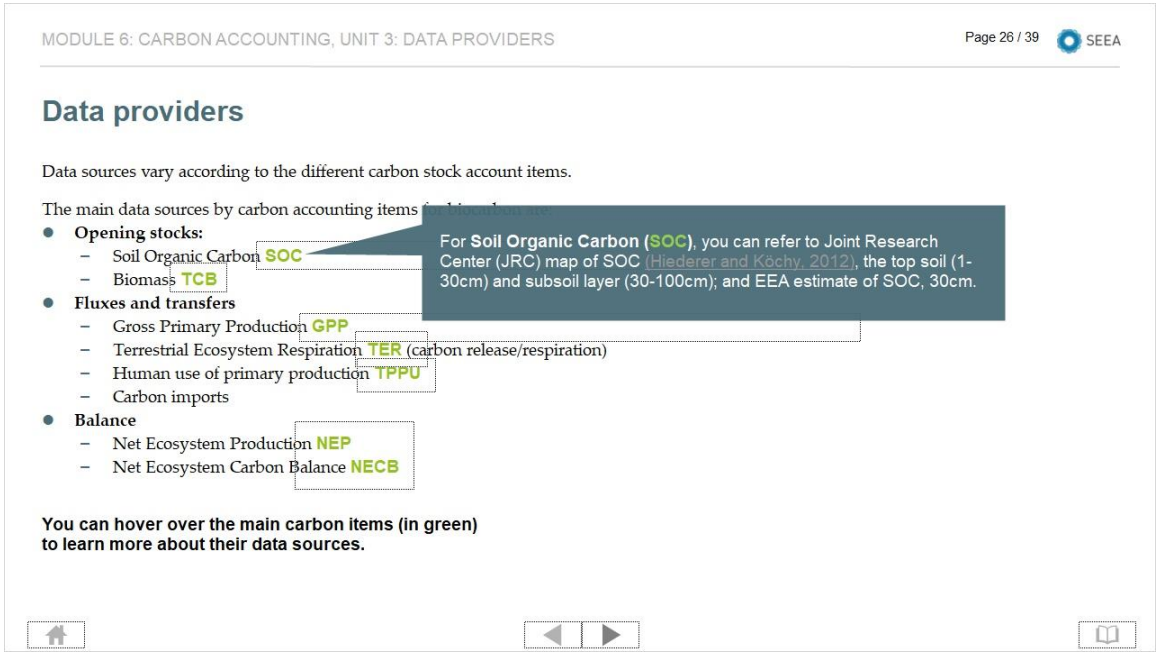
Data sources vary according to the different carbon stock account items.

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

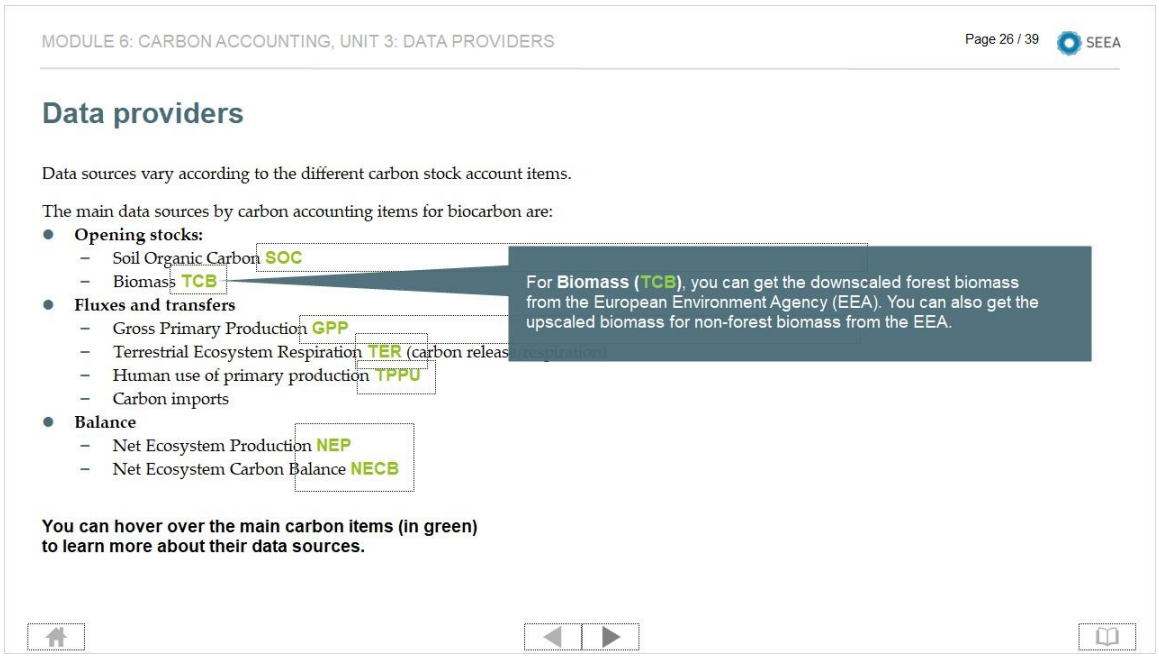
- **Opening stocks:**
  - Soil Organic Carbon **SOC**
  - Biomass **TCB**
- **Fluxes and transfers**
  - Gross Primary Production **GPP**
  - Terrestrial Ecosystem Respiration **TER** (carbon release/respiration)
  - Human use of primary production **TPPU**
  - Carbon imports
- **Balance**
  - Net Ecosystem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

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

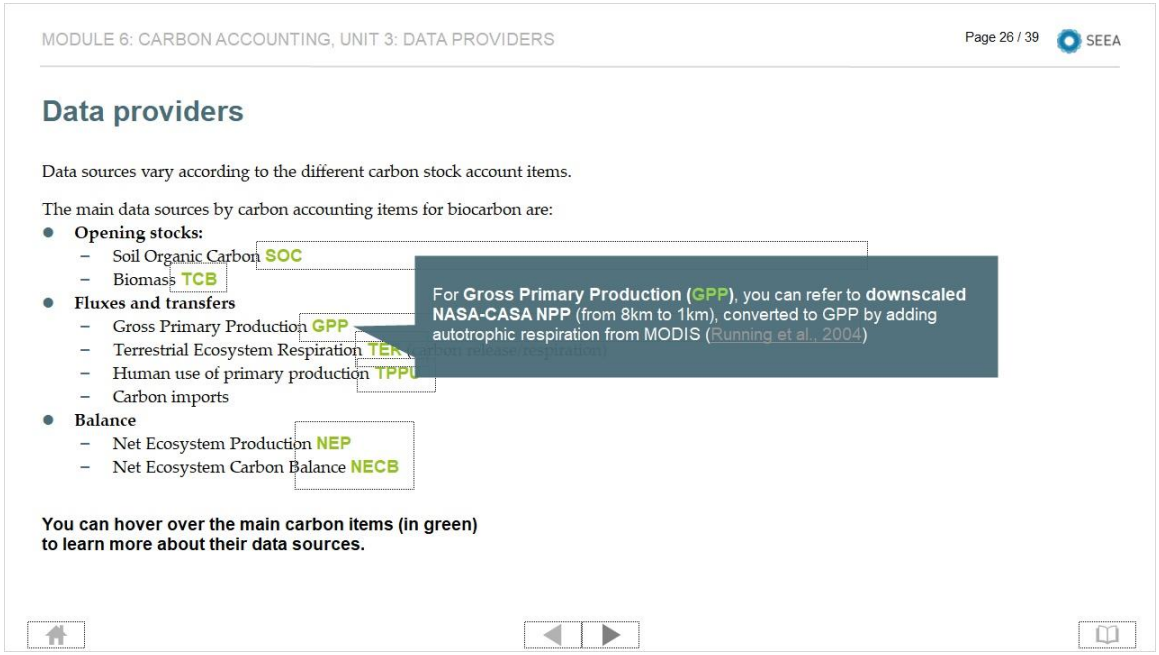
## Explanation 1 (Slide Layer)



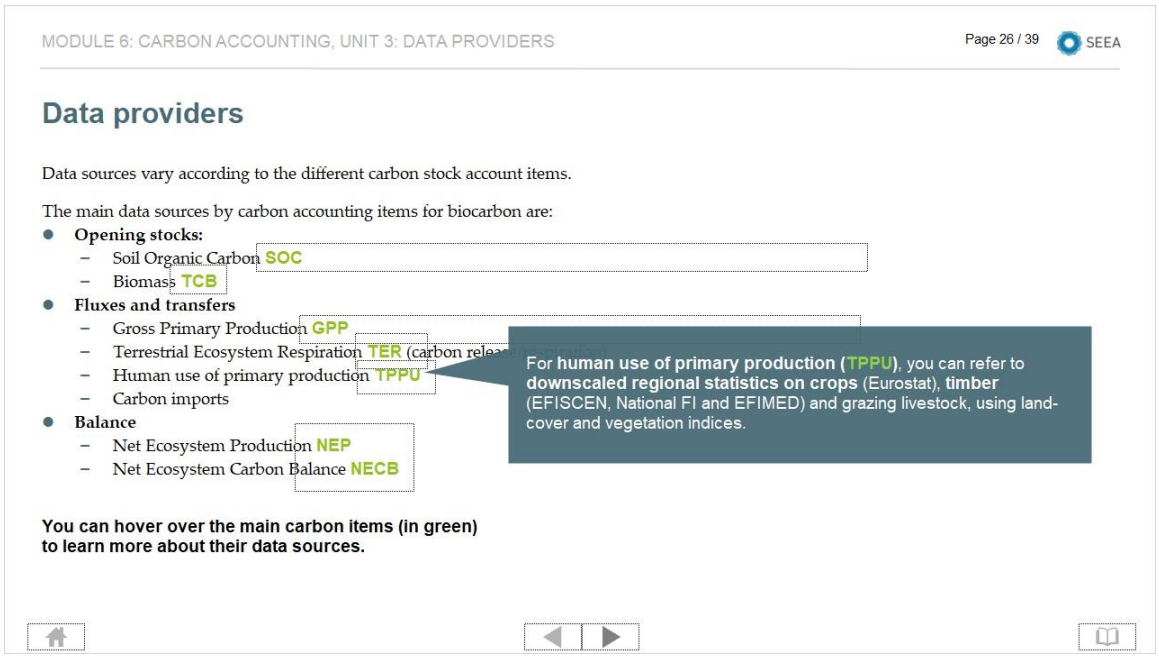

## Explanation 2 (Slide Layer)



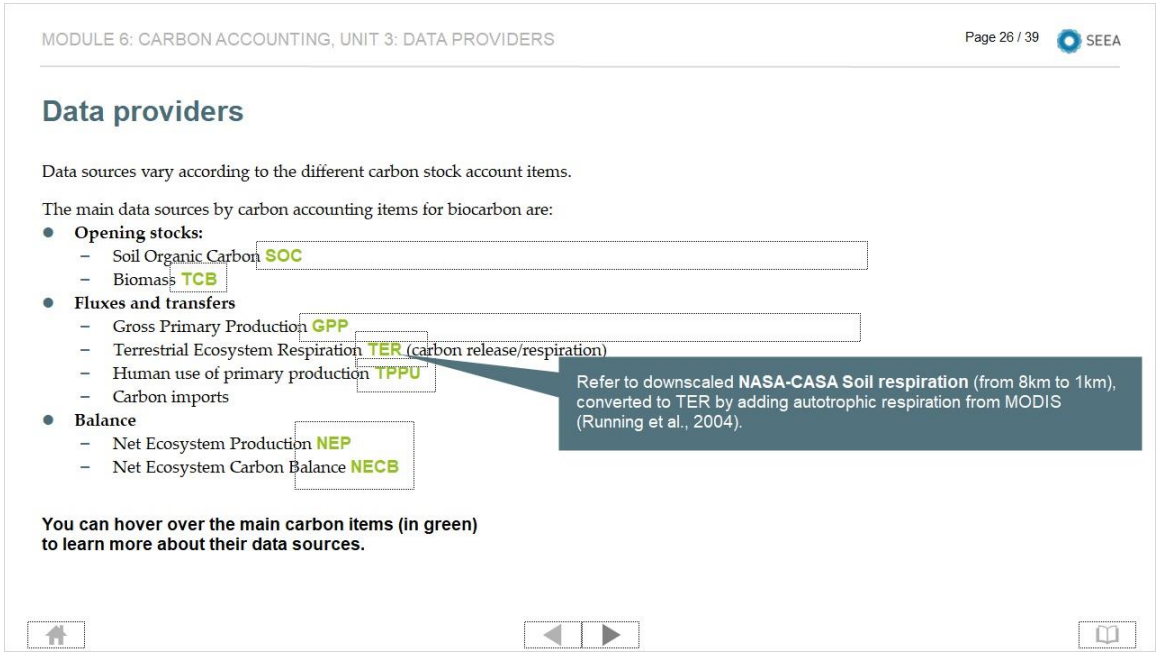
## Explanation 3 (Slide Layer)



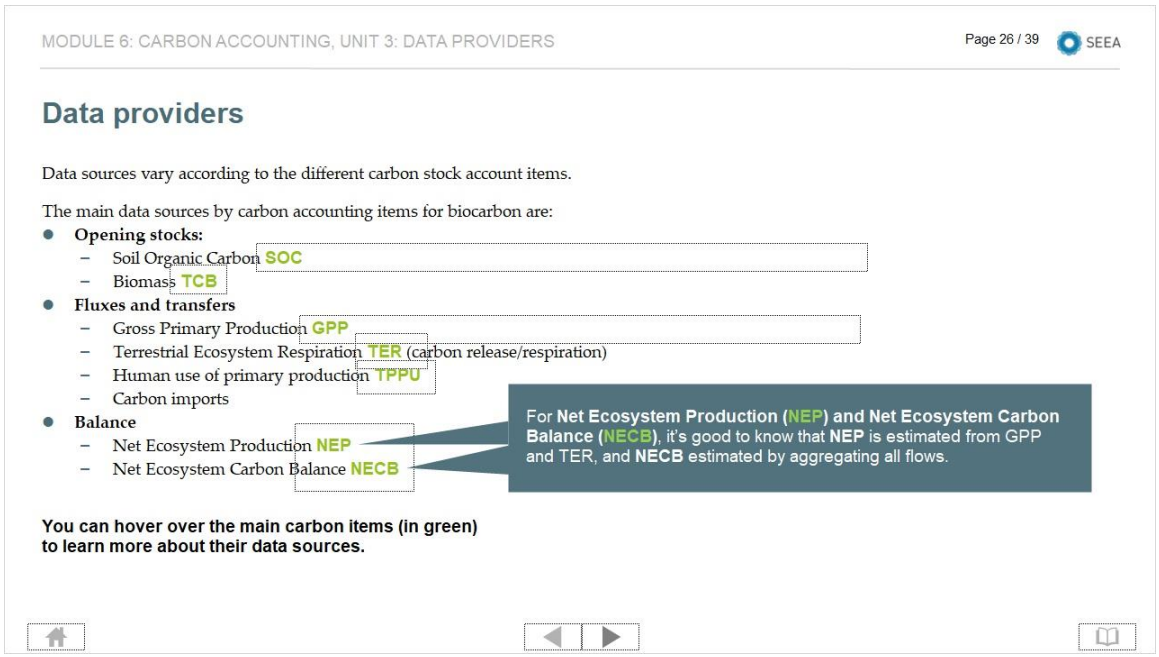

## Explanation 4 (Slide Layer)



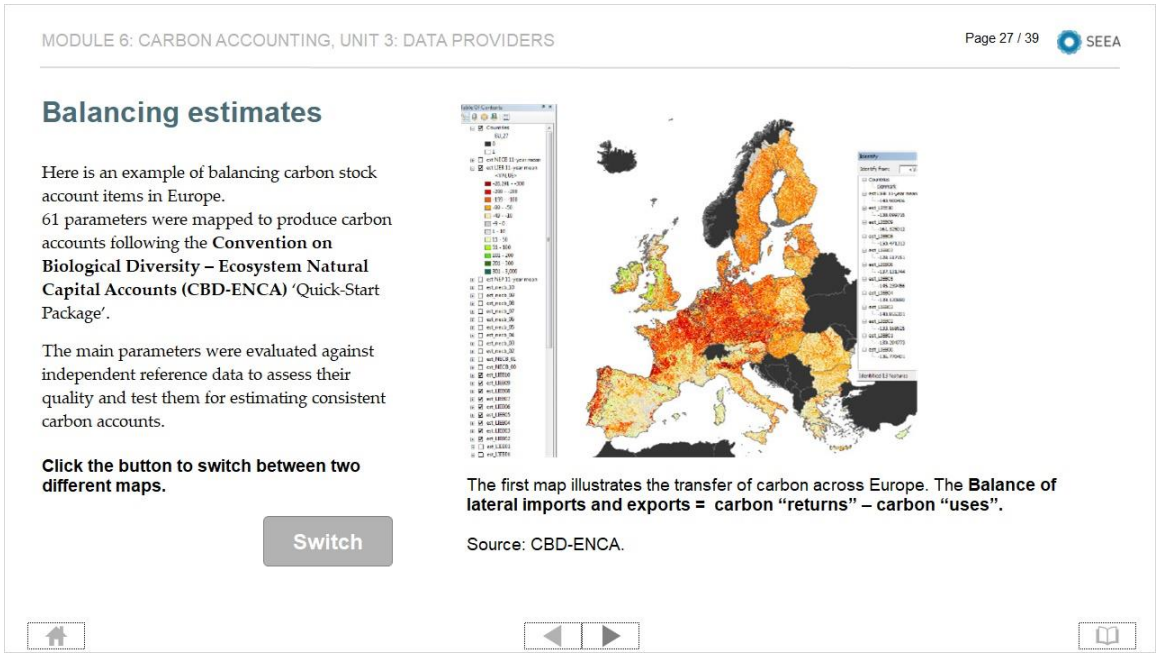
## Explanation 5 (Slide Layer)



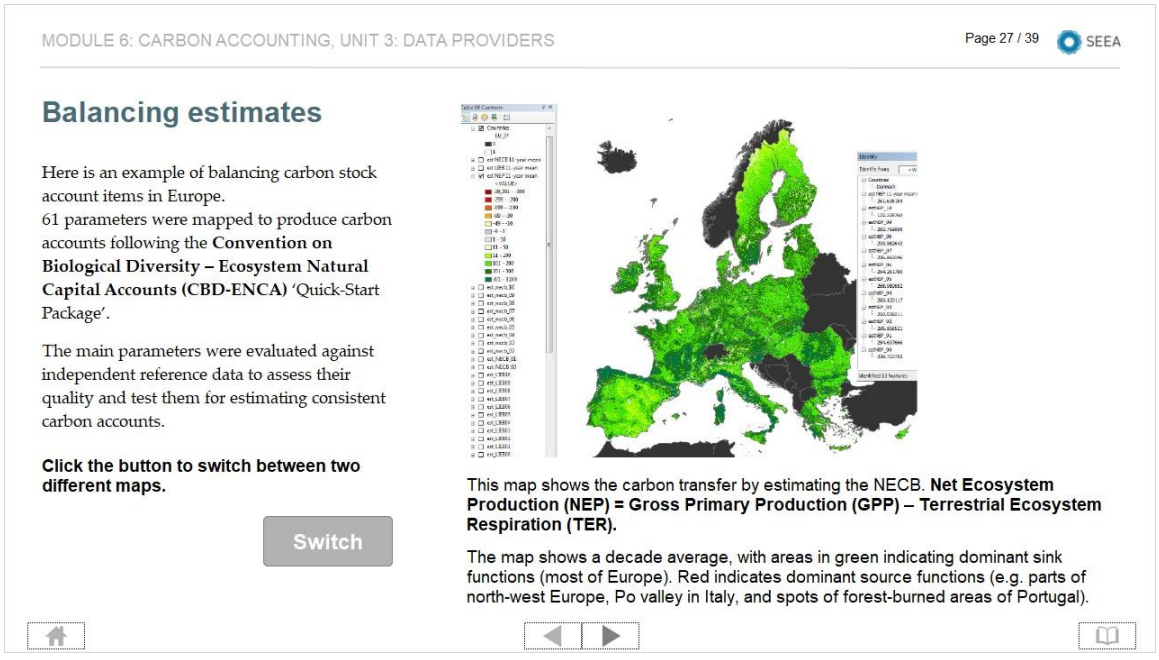

## Explanation 6 (Slide Layer)



## *1.27 Balancing estimates*




## Untitled Layer 1 (Slide Layer)



## *1.28 Data validation*

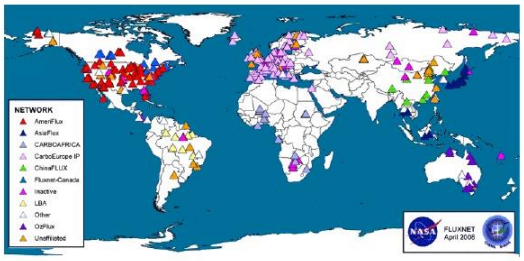


### Data validation

**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.**

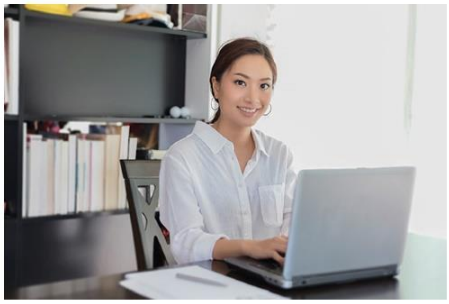
## *1.30 Data sources*



### 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*



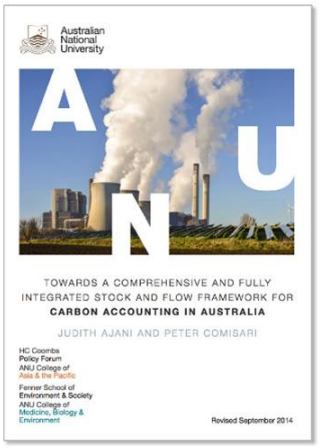
### Carbon accounting in Australia – case study

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."

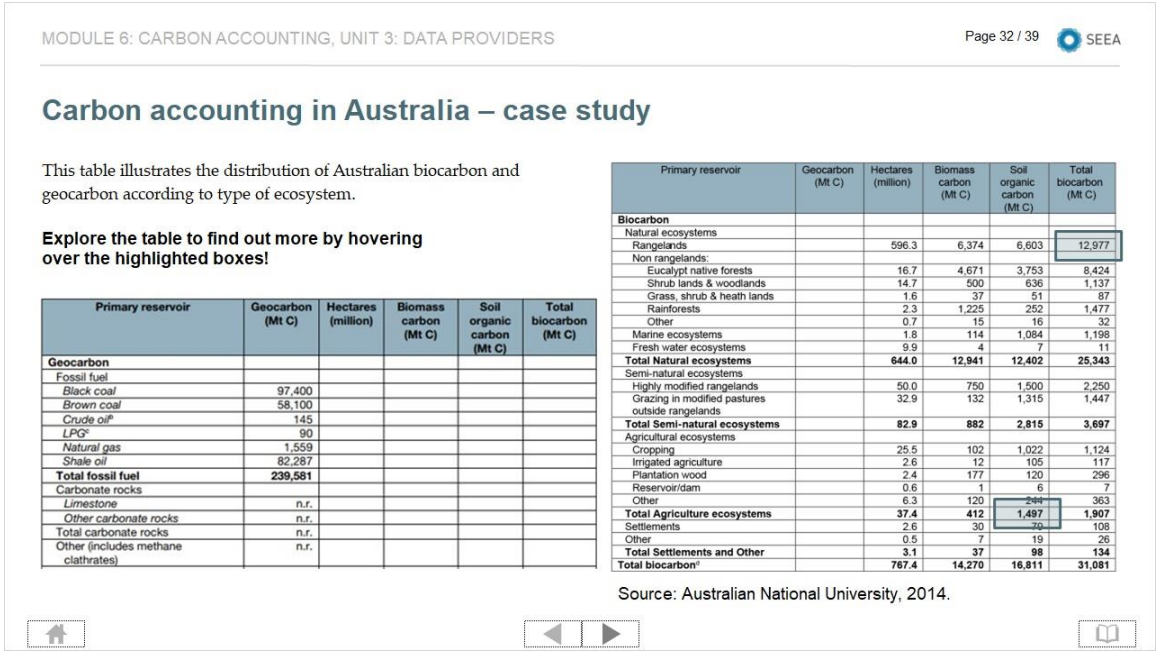
**Background:** In November 2012, the Australian Bureau of Statistics, Department of Environment and Australian National University began a project to:

- 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.

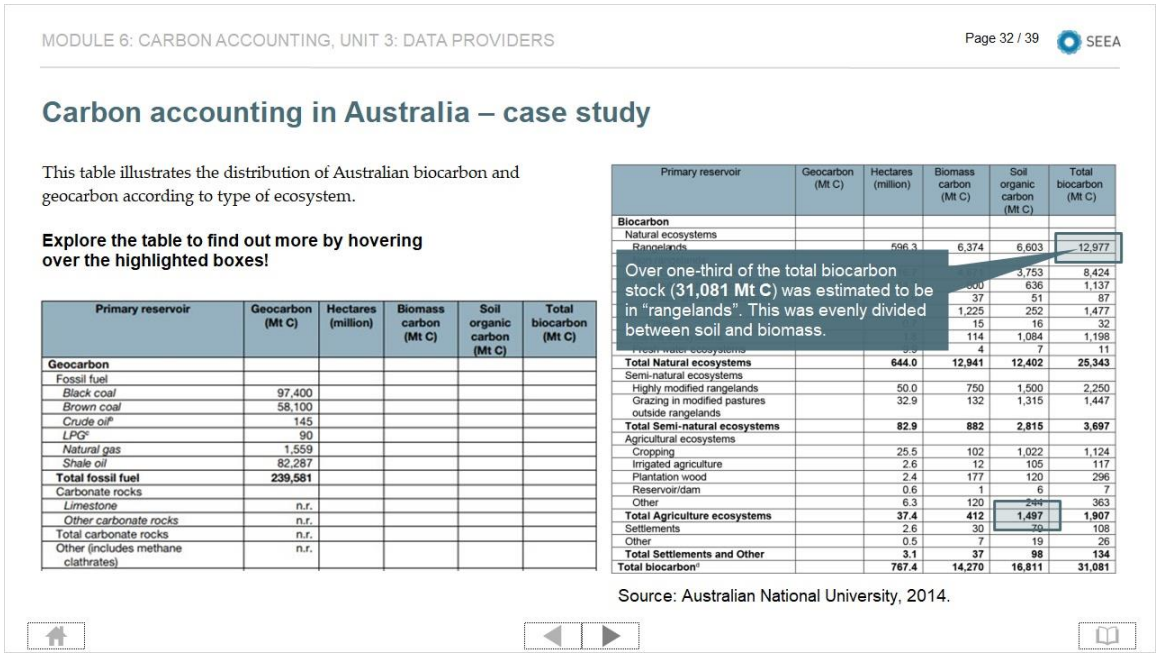
**The results** of the study showed that geocarbon (exclusively fossil fuel) makes up the overwhelming majority of the carbon stock in Australia. The study estimated that biocarbon and geocarbon levels are 11.5% and 88.5%, respectively, of the total carbon estimate. In the figures, biocarbon was estimated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



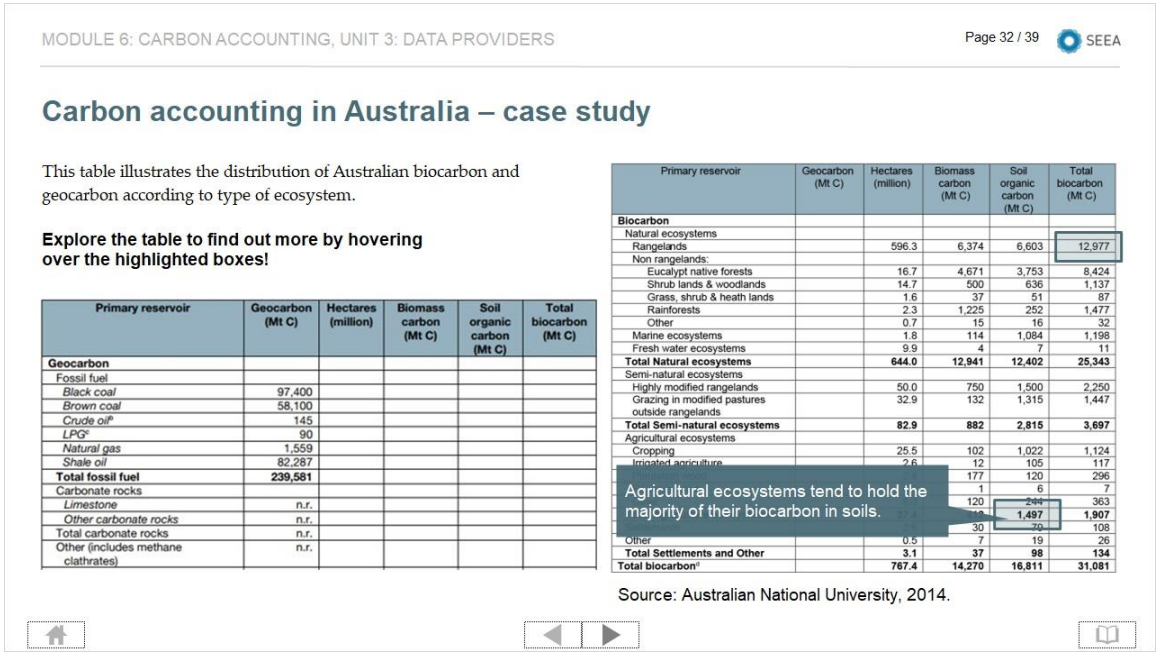
## *1.32 Case study*




## Layer 1 (Slide Layer)



## Layer 2 (Slide Layer)




| 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 | 240 | 363 |
| | | | | 1,497 | 1,907 |
| | | | 30 | 79 | 108 |
| Other | | 0.5 | 7 | 19 | 26 |
| **Total Settlements and Other** | | **3.1** | **37** | **98** | **134** |
| **Total biocarbon**[d] | | **767.4** | **14,270** | **16,811** | **31,081** |

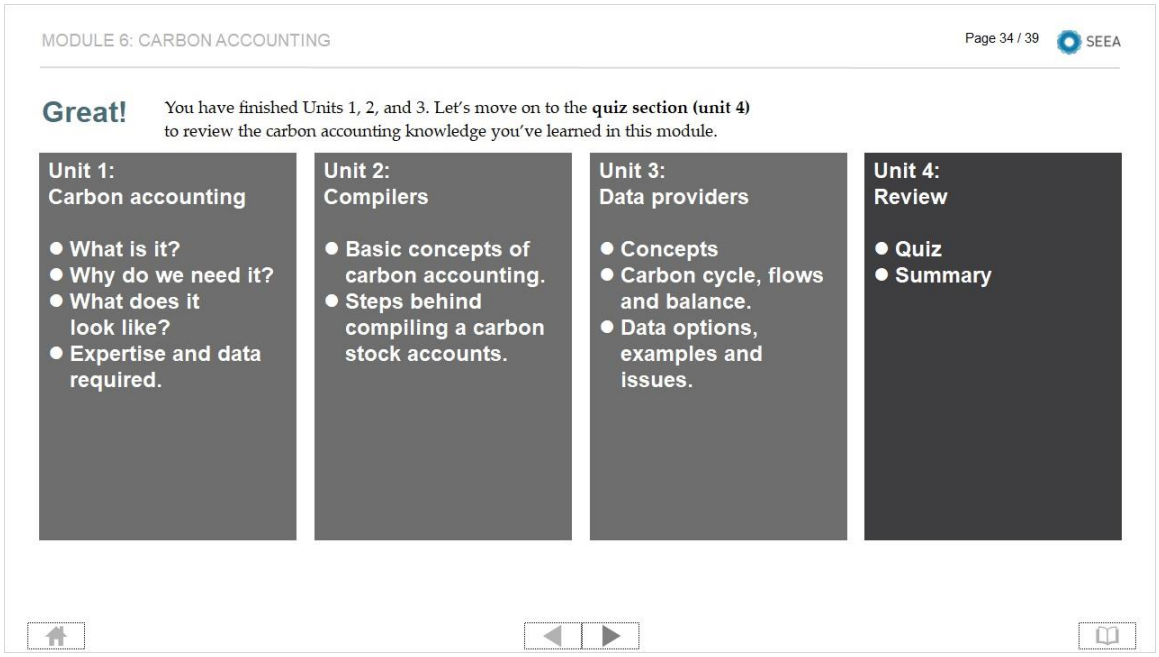
## *1.33 Case study*

## Explanation 1 (Slide Layer)


## Explanation 2 (Slide Layer)

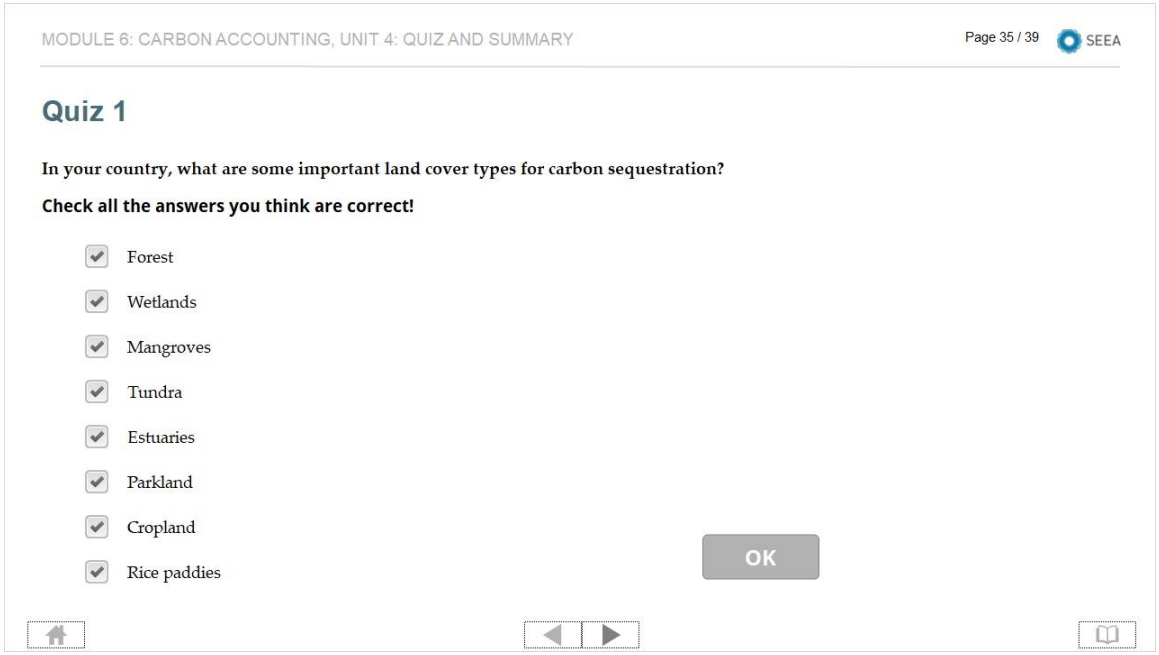
## Explanation 3 (Slide Layer)


## *1.34 Module units*



## *1.35 Quiz*

*(Multiple Response, 10 points, 1 attempt permitted)*




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

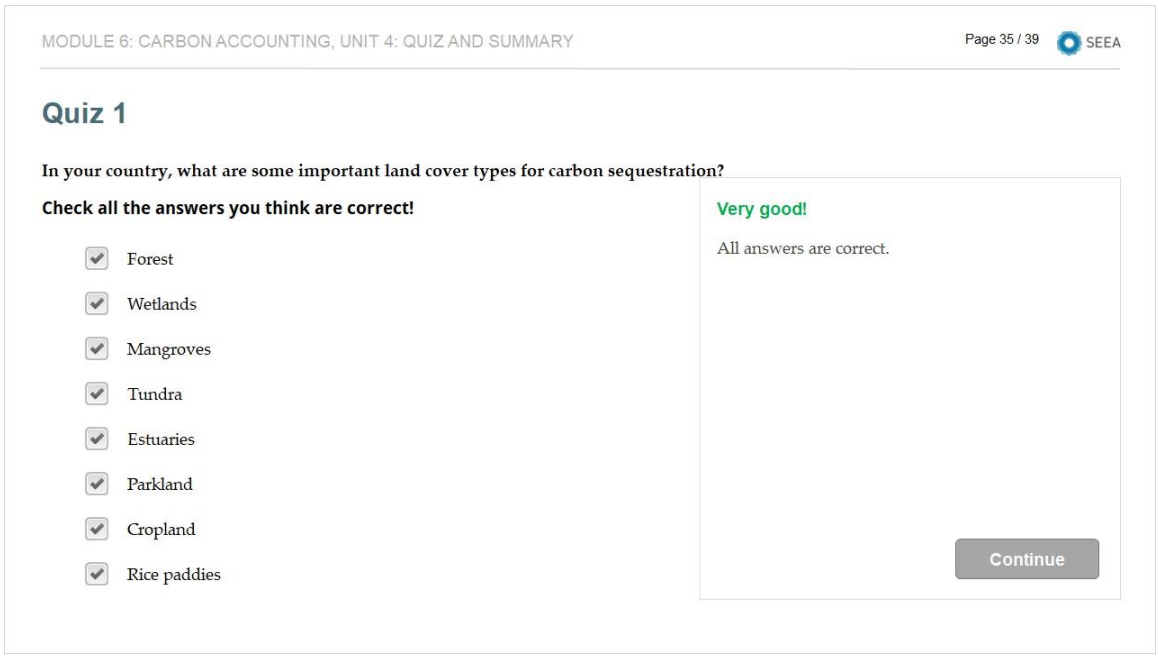
**Feedback when correct:**

All answers are correct.

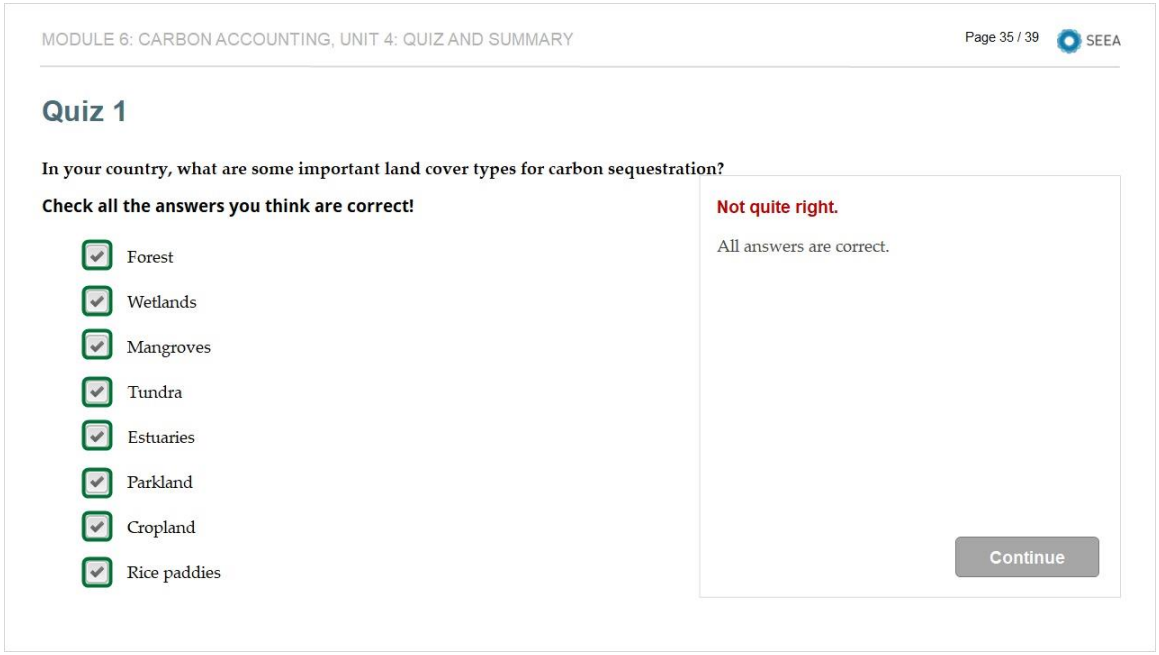
**Feedback when incorrect:**

All answers are correct.

## Correct (Slide Layer)

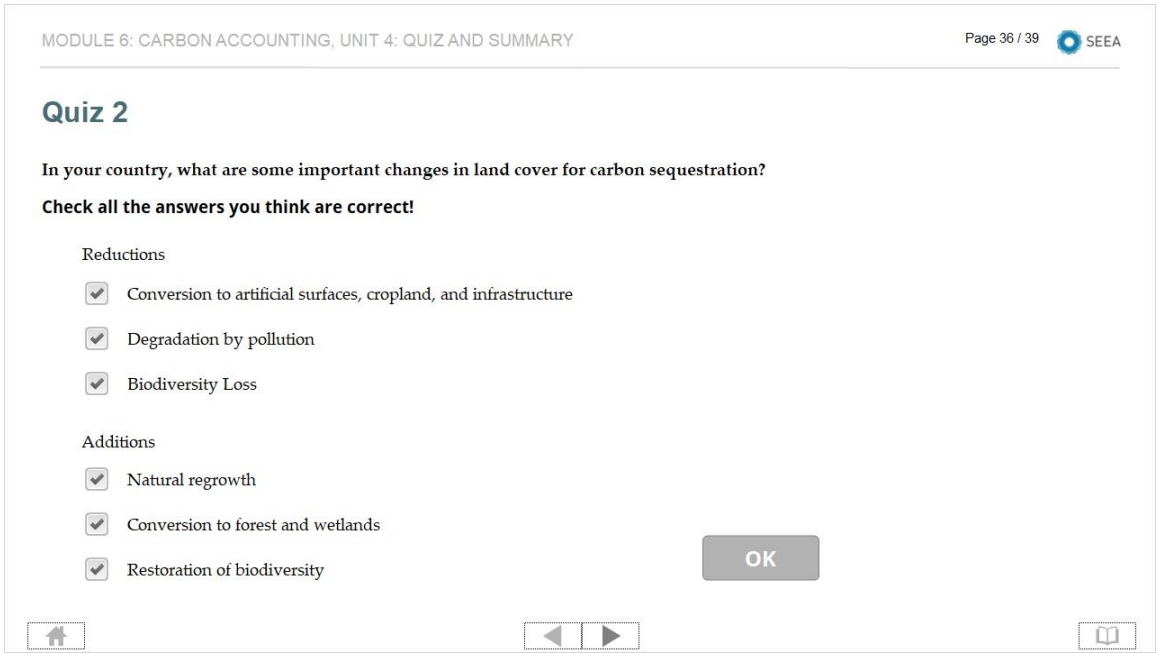


## Incorrect (Slide Layer)




## *1.36 Quiz*

*(Multiple Response, 10 points, 1 attempt permitted)*



| 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 |

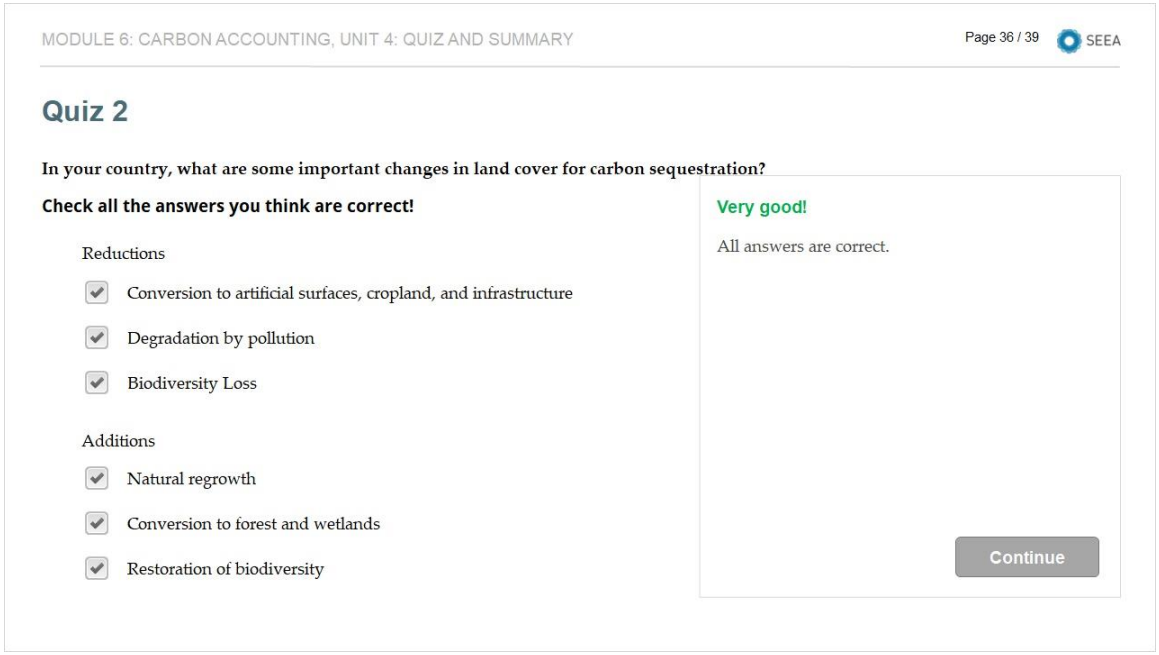
**Feedback when correct:**

All answers are correct.

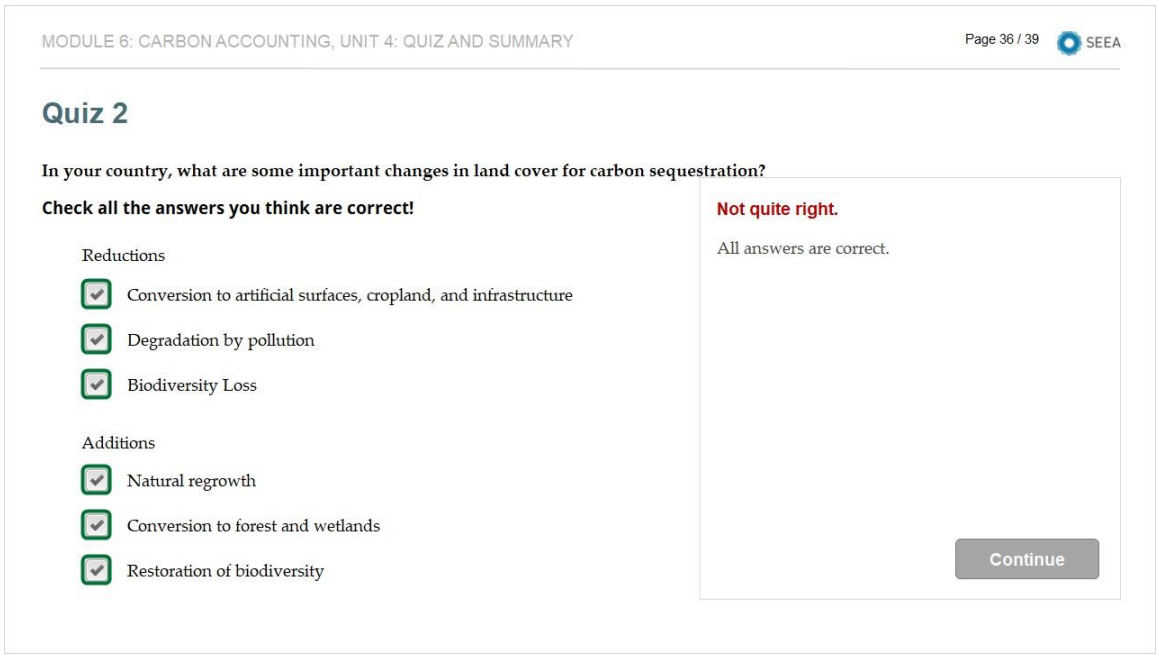
**Feedback when incorrect:**

All answers are correct.

## Correct (Slide Layer)

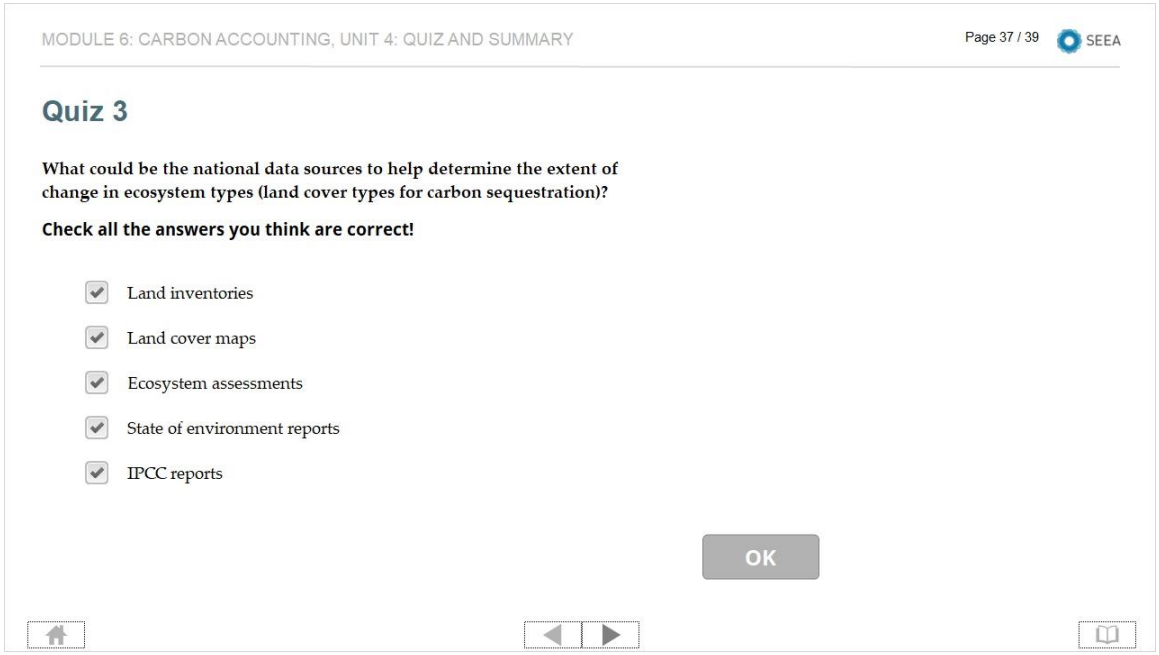



## Incorrect (Slide Layer)



## *1.37 Quiz*

*(Multiple Response, 10 points, 1 attempt permitted)*




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

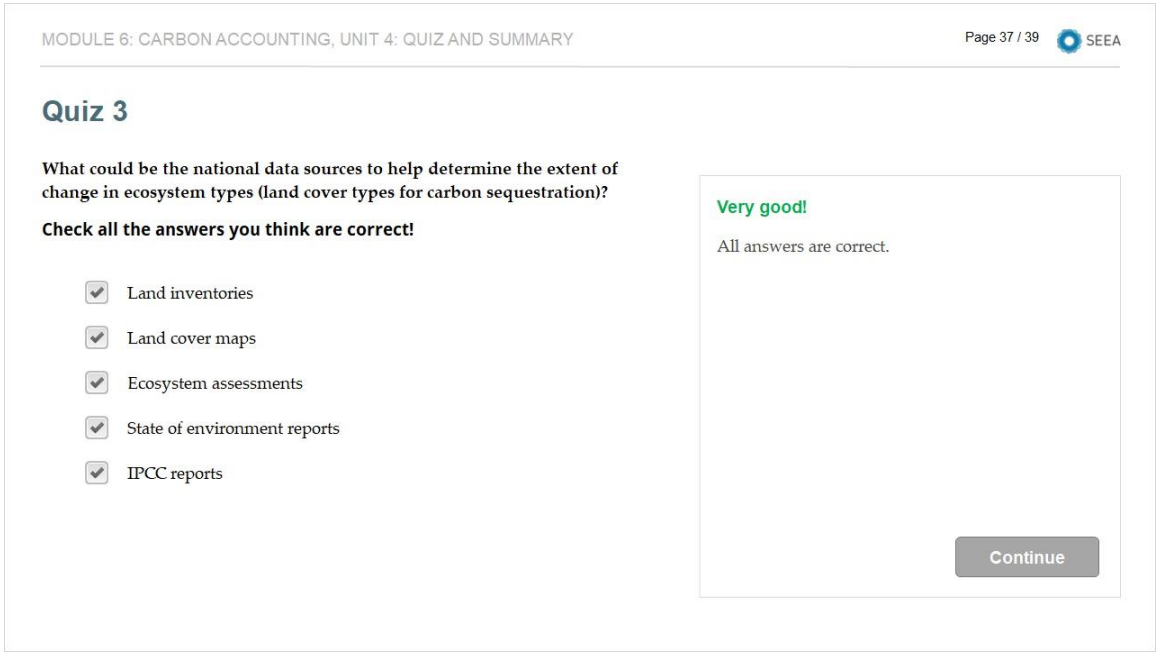
**Feedback when correct:**

All answers are correct.

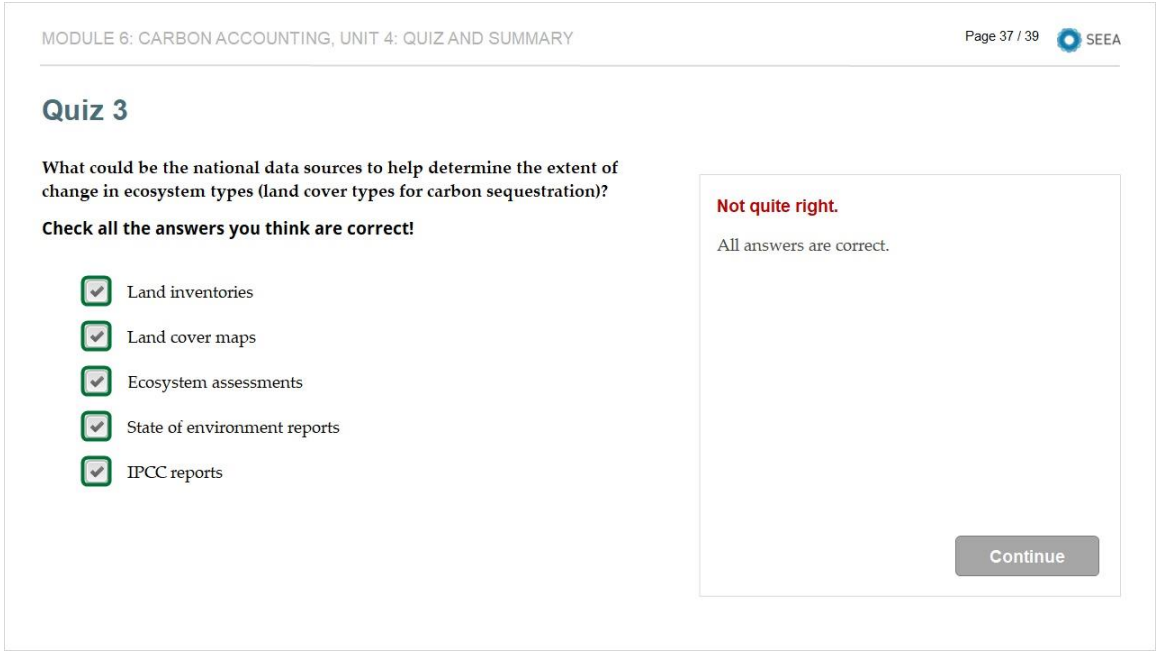
**Feedback when incorrect:**

All answers are correct.

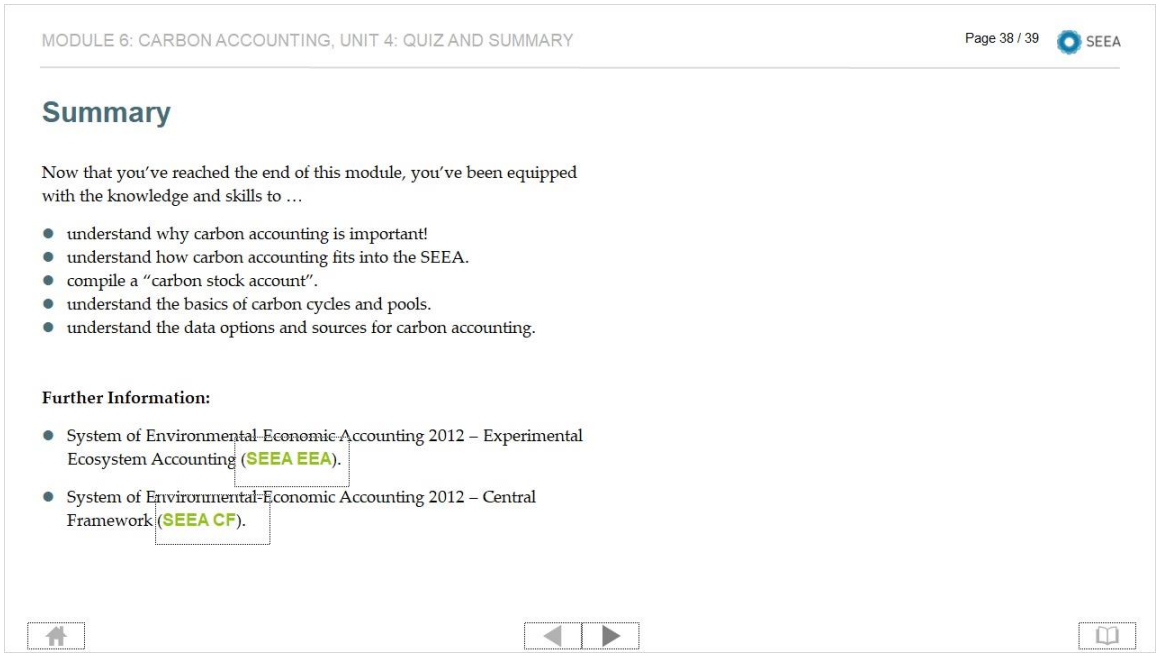
## Correct (Slide Layer)




## Incorrect (Slide Layer)



## *1.38 Summary*




## *1.39 References*