

# System of Environmental-Economic Accounting (SEEA 2012)

An introduction

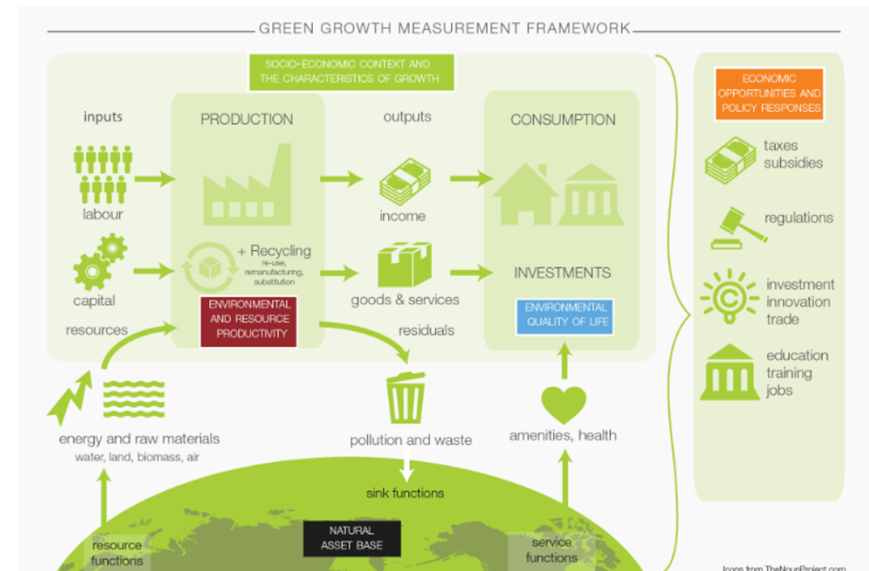
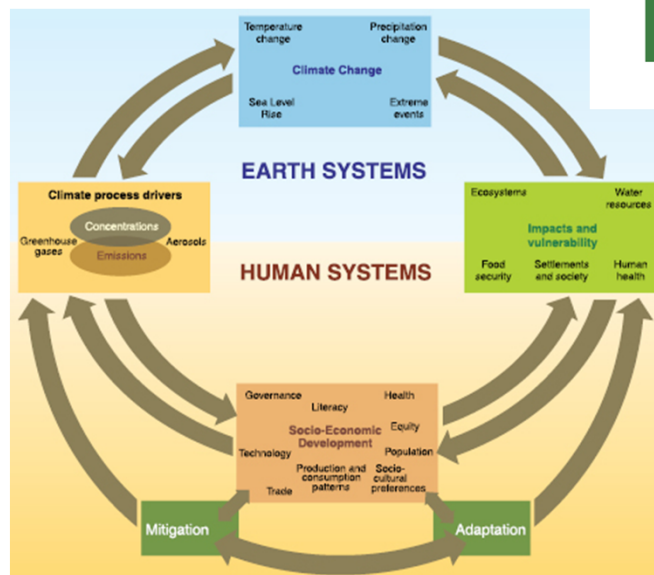
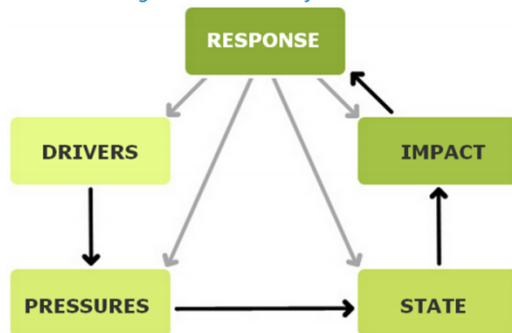
Michael Nagy, UNECE



# What are the main information needs?

## Informing different policy and indicator frameworks

STATISTICS



SEEA is considered as an underlying framework by international initiatives

It is a multi-purpose accounting framework



## STATISTICS

- Monitoring Sustainable Development Goals
- OECD: Towards Green Growth
- European Union: Beyond GDP
- Conference of European Statisticians: Set of core Climate Change related Indicators
- World Bank: Wealth Accounting and the Valuation of Ecosystem Services (WAVES)
- Etc.

# SEEA responds to complex national and international policy questions

Some examples



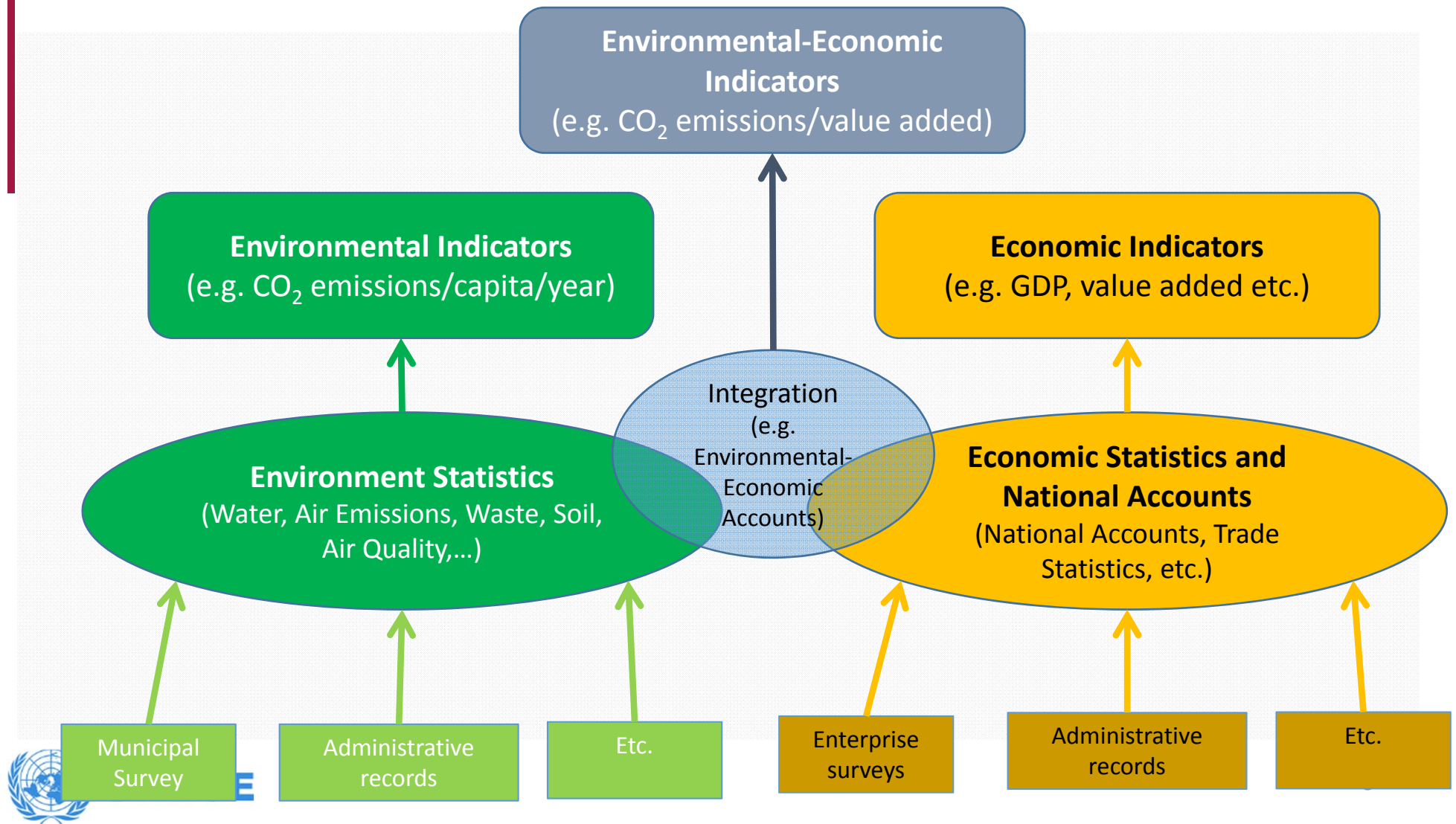
## STATISTICS

- How can natural resources be used sustainably? What is the impact of regulatory environmental measures on different economic sectors and households?
- How do ecosystems contribute to the well-being of people and to the economy?
- Which are the most cost-efficient measures to improve the state of the environment?
- What are the effects of environmental taxes on the environment and on the economy?
- Etc.

# Why do we need environment statistics AND environmental-economic accounts?

Integrating environmental and economic information

STATISTICS





# A note on Frameworks

FDES and SEEA ideally are used together



## STATISTICS

FDES is an **organising** framework

- Based on Pressure-State-Response
- Good for compiling basic statistics and reporting
- Covers most issues of concern
- BUT: May risk viewing all human activities as “pressures”

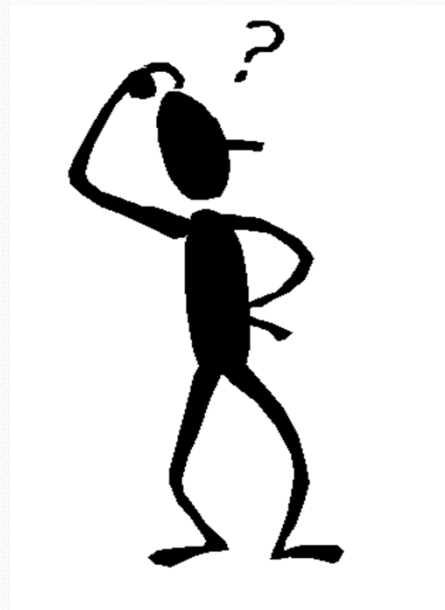
SEEA is an **accounting** framework

- Integrates related statistics into “accounts” (e.g. water, energy, land, ecosystems)
- Links to SNA by using same classifications and methods
- Good for compiling integrated indicators (e.g. water intensity of economy) to assess trade-offs
- BUT: covers limited set of issues & less experience

# Why Environmental-Economic Accounting

What is it about?

STATISTICS



# Why make environmental accounts?

Aren't environmental statistics enough?

## STATISTICS



### Statistics

- Often developed to answer one particular question or problem.
- Difficult to figure out if all information is included.
- Not always easy to see the whole picture, or how it relates to other things





# Why make environmental accounts?

Aren't environmental statistics enough?

## STATISTICS



### Environmental accounts

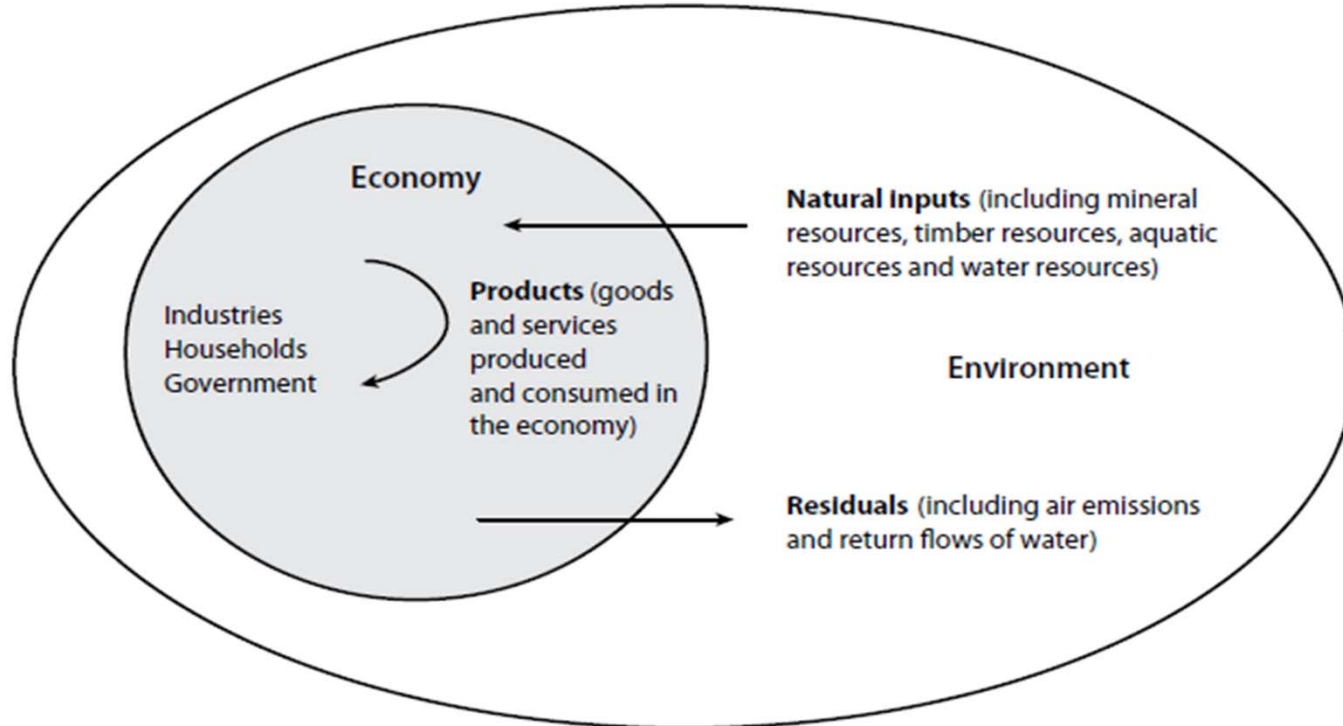
- Helps to make sense of the larger picture.
- Helps to identify pieces that are missing
- Can make connections to other statistics - especially economic statistics



# Main concepts of environmental-economic accounting

Similar to FDES, but following accounting principles

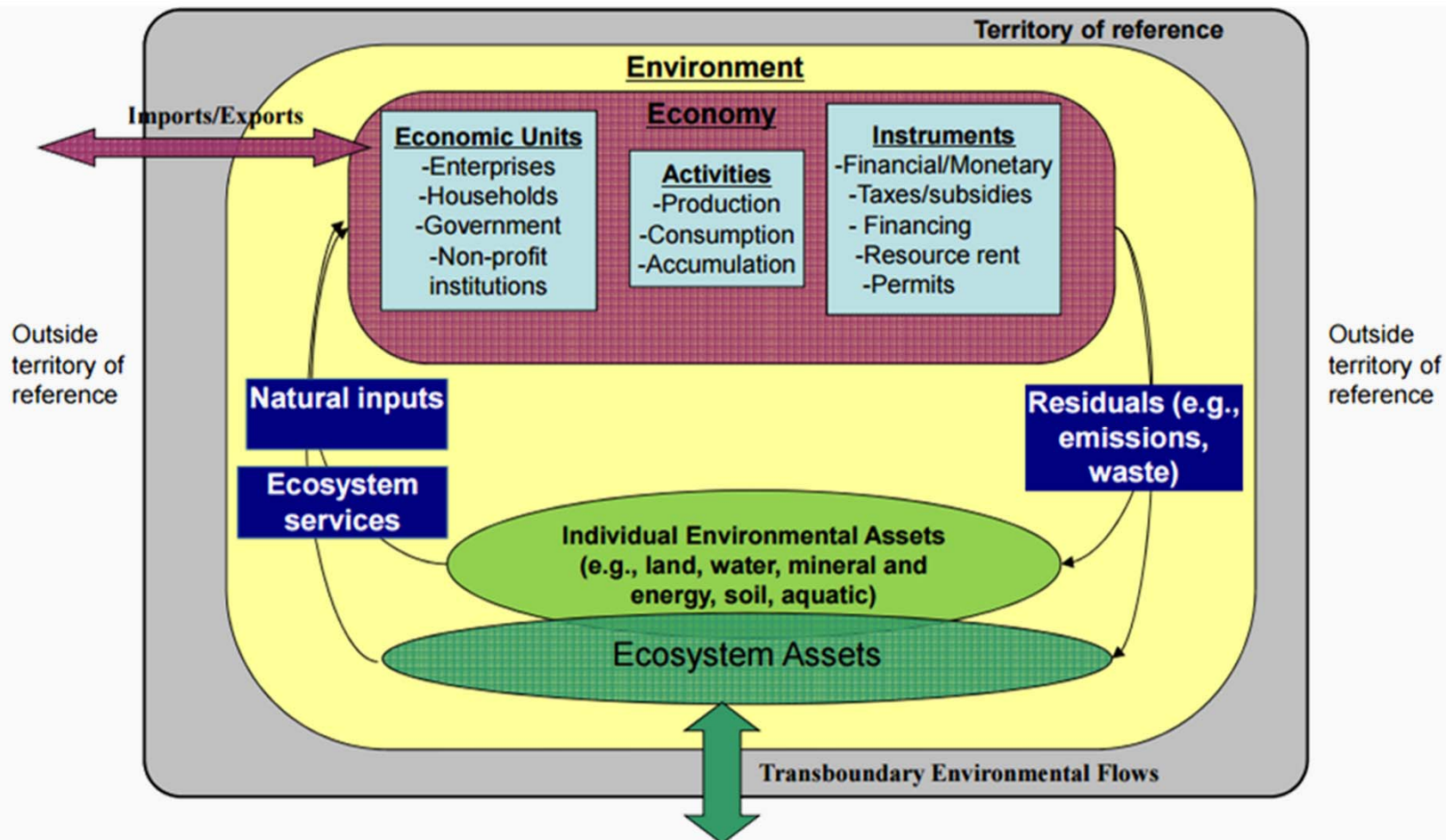
STATISTICS



# Main concepts of environmental-economic accounting

Environmental Accounting = Expansion of national accounting

STATISTICS





# Environmental accounts are satellite accounts to the System of National Accounts (SNA)

What is “wrong” or missing from the SNA?

## STATISTICS



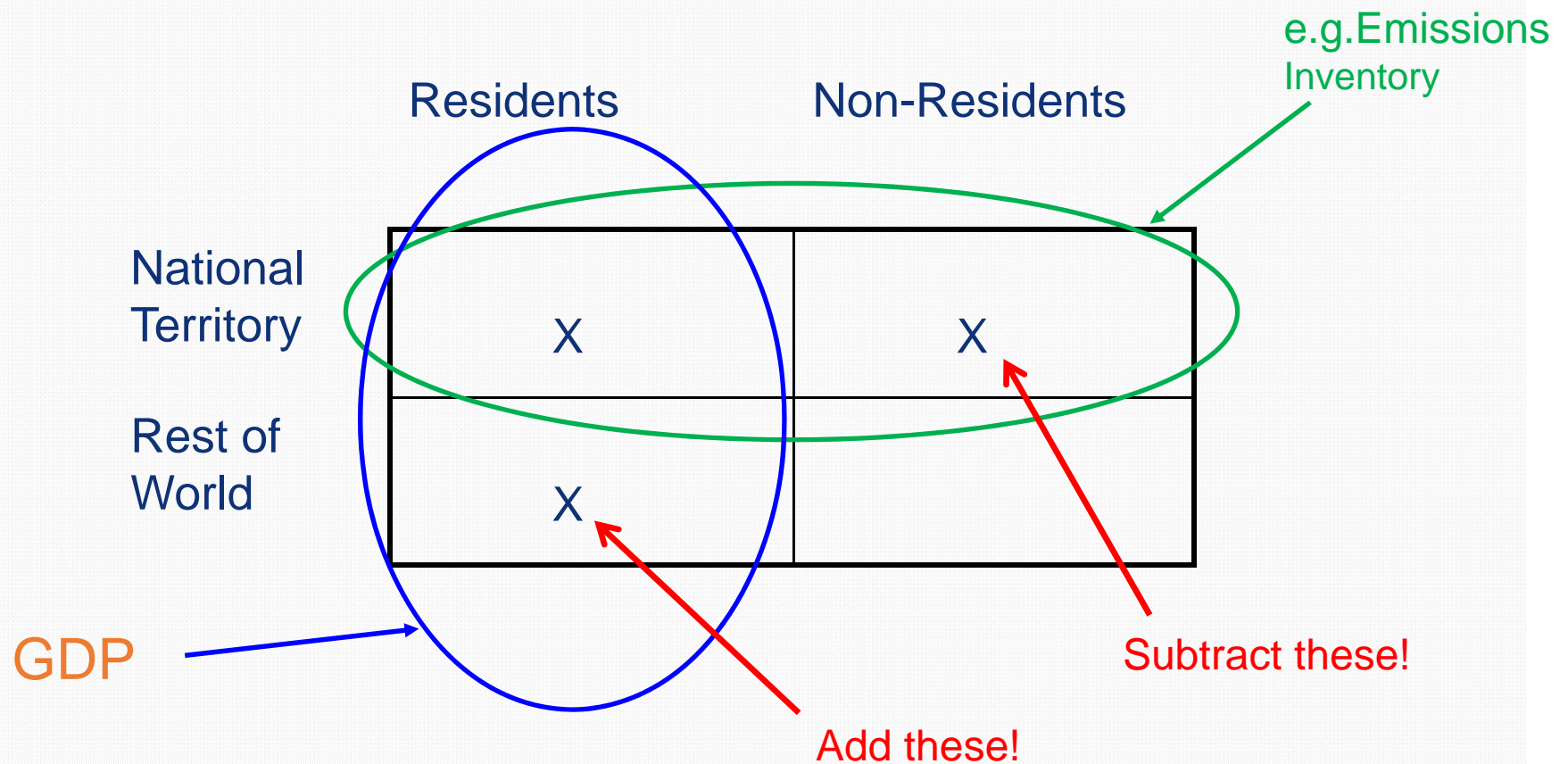
- Values of natural resources not included in the national accounts until they enter the economic system.
- In other words, in the SNA,
  - A tree has no value until it is cut down.
  - GDP increases with environmental accidents since economic activity is stimulated. No negatives are included for damage to the environment.



# Difference between SNA boundary and territory boundary

Main difference is usually international transport

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Need to make the environmental statistics correspond to the national accounts definitions



## STATISTICS

- What about imports and exports? Need to be included since part of national accounts.
- Double counting? Are units counted 2 times?
- Production boundary for national accounts different than for physical data?
- Territorial definition (e.g. Greenhouse Gas Emissions Inventory) vs. economic definition (national accounts)

# SEEA Central Framework

SEEA-CF 2012 – an internationally accepted standard

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- adopted in 2012 as an **international statistical standard** by the UN Statistical Commission
- already used in **54 countries**
- adheres to the **principles of the System of National Accounts (SNA)**
- provides **standard terminology, definitions and classifications** for environmental accounting

See <https://seea.un.org/>

# SEEA and its relation with other standards and guidelines

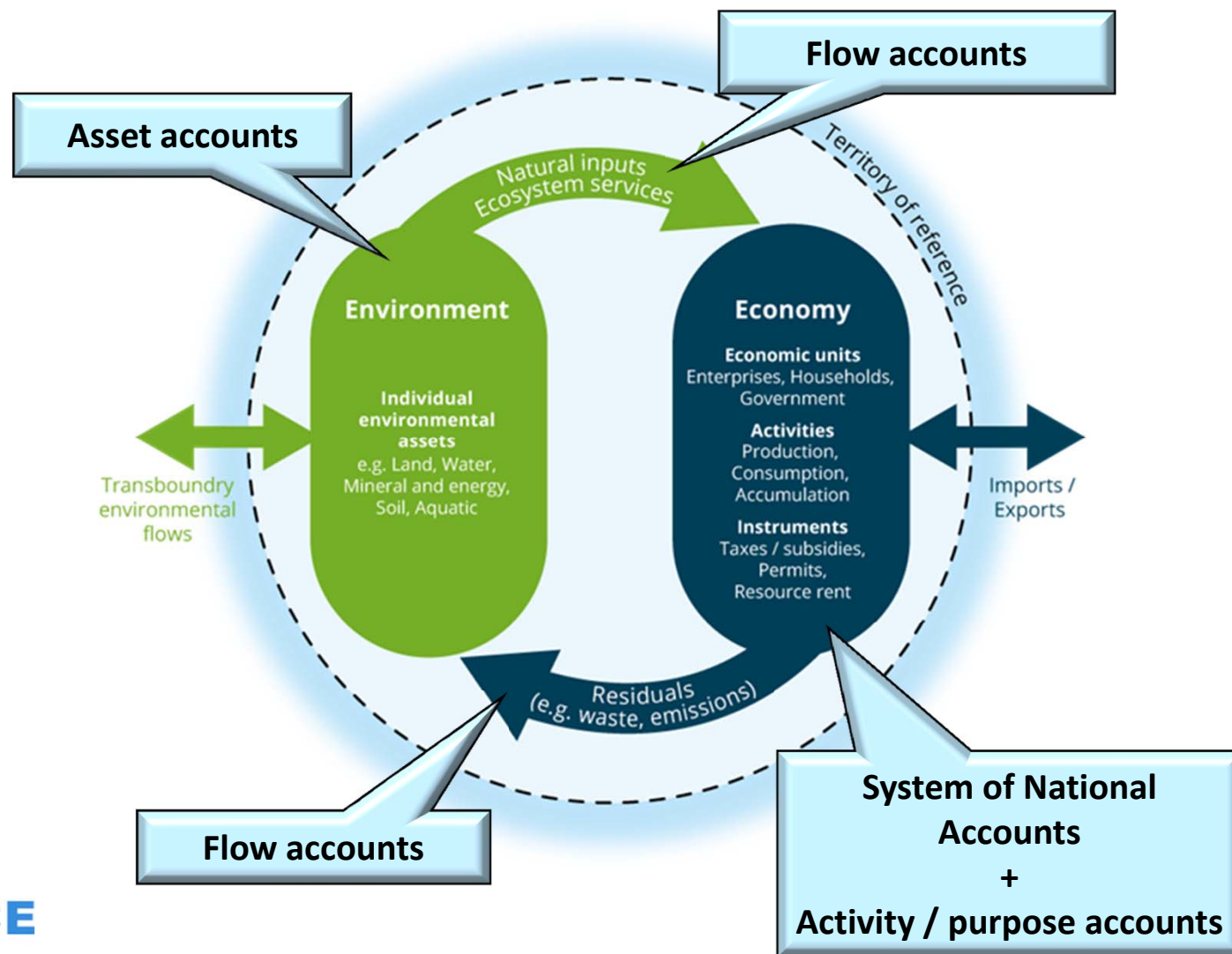
STATISTICS



See <https://seea.un.org/>

# What accounts exist in the SEEA-CF?

STATISTICS





# 1. Physical flow accounts

## Material flows

### STATISTICS



- Measured in physical units (for example: tonnes)
- Natural resources and Products (for example, water, energy)
- Residuals (pollution): emissions to air, water emissions/pollution, waste
- Physical Supply and Use Table (PSUT)
  - Nature is added into the monetary SUT format
  - Table 3.1 in SEEA-CF 2012



# 1. Physical flow accounts

## Start with SNA Supply and Use Table (SUT)

STATISTICS



**Table 2.1**  
Basic form of a monetary supply and use table

	Industries	Households	Government	Accumulation	Rest of the world	Total
<b>Supply table</b>						
Products	Output				Imports	Total supply
<b>Use table</b>						
Products	Intermediate consumption	Household final consumption expenditure	Government final consumption expenditure	Gross capital formation (including changes in inventories)	Exports	Total use
Value added						

Note: Dark grey cells are null by definition.

# 1. Physical flow accounts

## Physical Supply and Use Table – extended to include the environment

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Table 2.2

Basic form of a physical supply and use table

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

# 1. Physical flow accounts

## Accounting and balancing identities



Flows of materials into an economy must equal the flows of materials out of an economy plus any net additions to stock in the economy.

**Input-output identity**

Within the economy, the amount of a product supplied must also be used with the economy, or exported.

**Supply and use identity**

## 2. Economic accounts- flows

Env. Protection expenditures, goods and services, policy instruments



### STATISTICS

- Information is already included in the SNA. Goal is to separate it from the standard accounts to show who is spending how much on environmental protection.
- Economic information about environmental protection activities
  - Supply: Environment industry – environmental goods & services
  - Demand: environmental protection expenditure by industries and government
- Environmentally related taxes, subsidies and permits



### 3. Asset accounts in physical and monetary terms

#### General structure

#### STATISTICS



Table 2.3

Basic form of an asset account

Opening stock of environmental assets
Additions to stock
Growth in stock
Discoveries of new stock
Upward reappraisals
Reclassifications
<i>Total additions of stock</i>
Reductions of stock
Extractions
Normal loss of stock
Catastrophic losses
Downward reappraisals
Reclassifications
<i>Total reductions in stock</i>
Revaluation of the stock <sup>a</sup>
Closing stock of environmental assets

<sup>a</sup> Only applicable for asset accounts in monetary terms.

- Same format for both physical and monetary units
- Types of natural resource assets:
  - Mineral and energy resources  
Oil, natural gas, coal  
Minerals – metallic and non-metallic
  - Timber resources
  - Aquatic resources





### 3. Asset accounts: What are changes in stock?

Additions to stock

STATISTICS



#### **Growth in stock**

Increases in the stock over an accounting period due to growth

#### **Discoveries of new stock**

Arrival of new resources to a stock through exploration and evaluation

#### **Upward reappraisals**

A reassessment due to the use of updated information

#### **Reclassifications**

Changes because an asset is used for a different purpose

### 3. Asset accounts: What are changes in stock?

Reductions in stock

STATISTICS



#### Extractions

Physical removal or harvest through a process of production

#### Normal reductions

Expected losses due to natural deaths of biological resources

#### Catastrophic losses

Large-scale events that destroy a large number of assets

#### Downward reappraisals

Reassessments due to the use of updated information

#### Reclassifications

Occur when an environmental asset is used for a different purpose

## 4. Integrated or combined accounts

Hybrid or 'NAMEA'

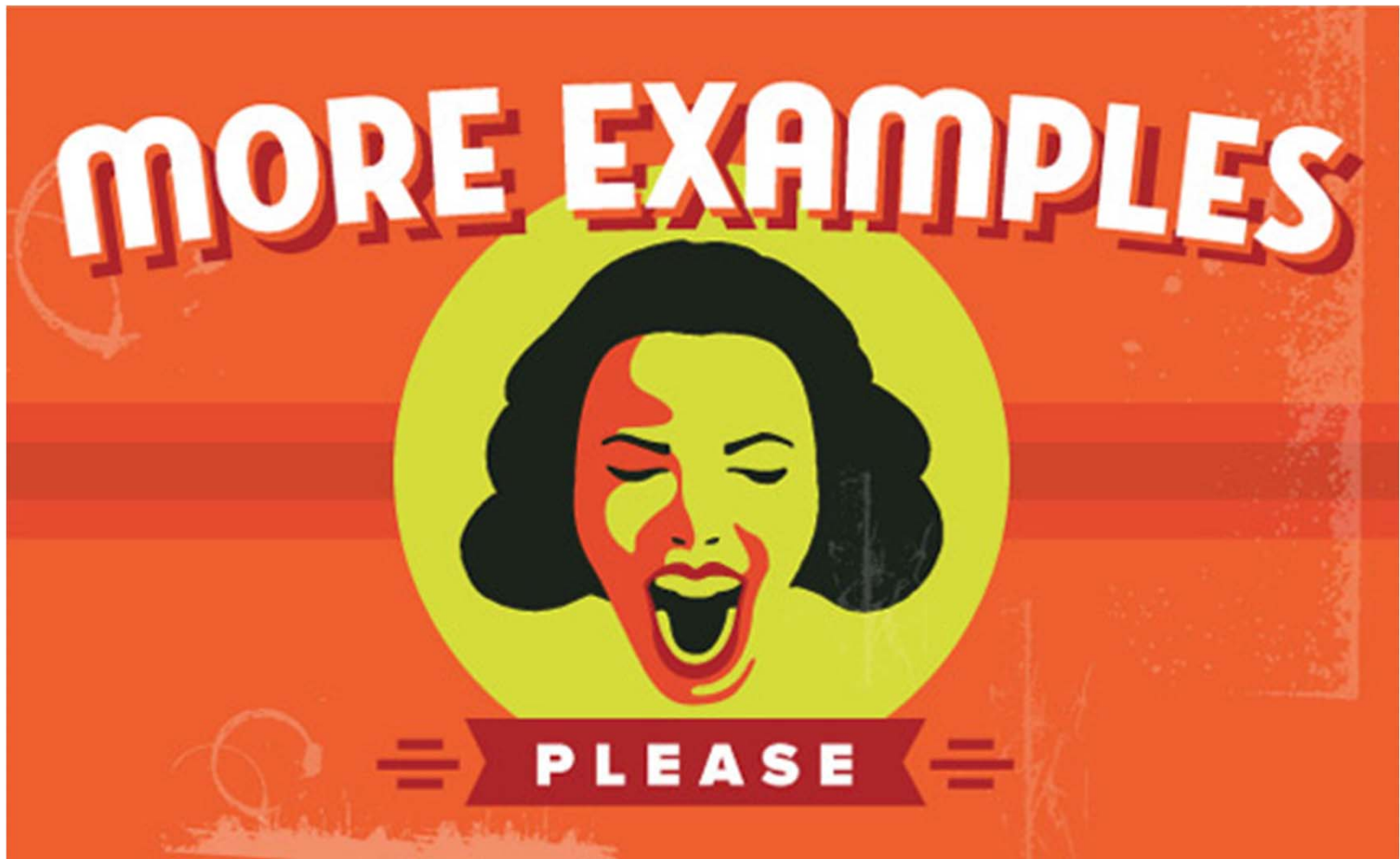
STATISTICS



- Combined accounts (key: same industry classifications)
  - Linking physical and national accounts data together
  - Thereby showing the relationships between economic activity and environmental consequences
  - Can be used for analysing industries that are important contributors to pollution
- Ratio indicators – often used in 'Green Economy' indicators
- Main data set for analysis purposes – ratio, profiles, decomposition, I-O...

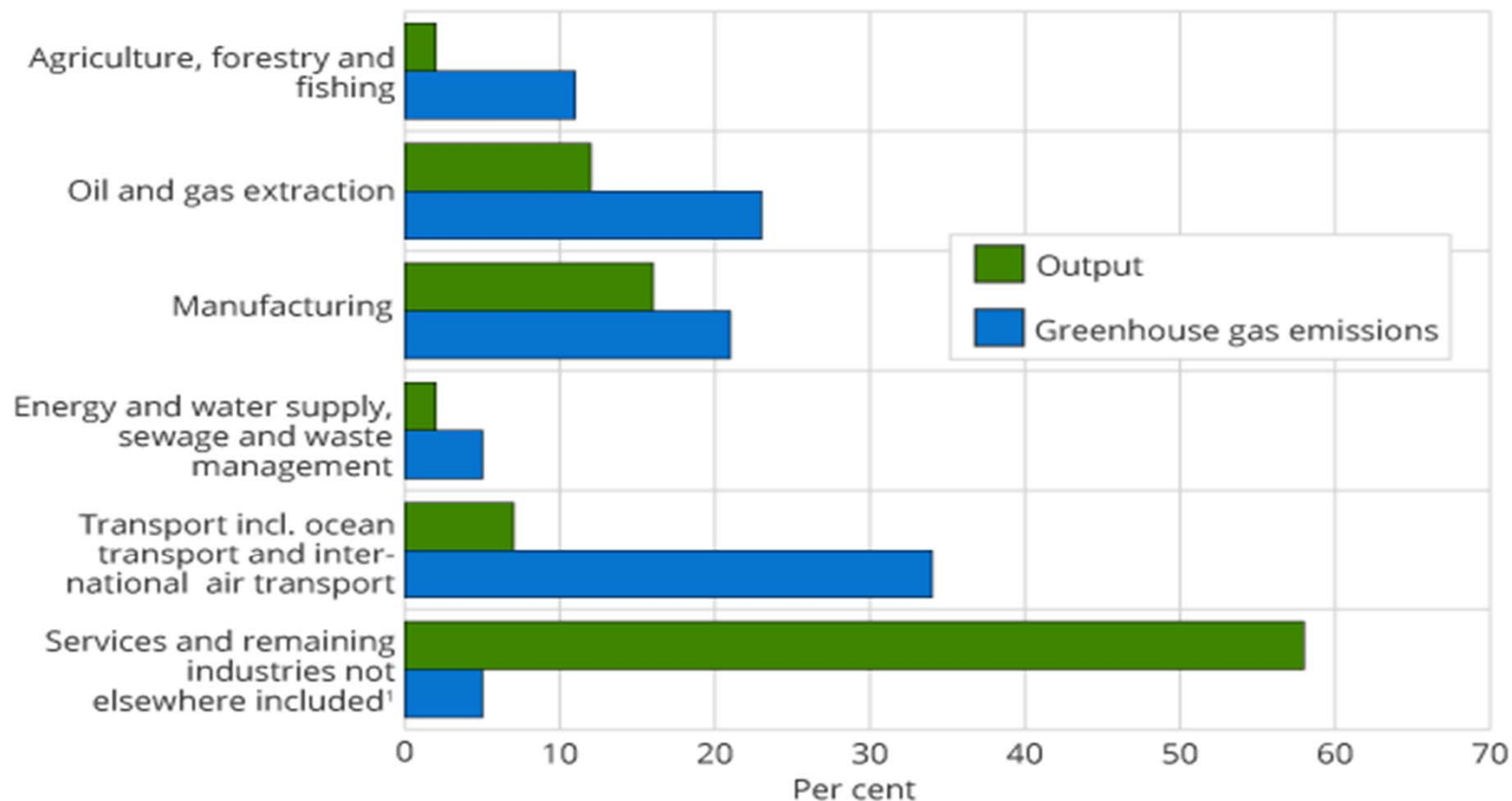
NAMEA = National Accounting Matrix including Environmental Accounts

# Examples for SEEA applications



## Example Norway (1/2): «Profile» with output and GHG emissions by industry – who contributes the most

Figure 3. Greenhouse gas emissions (CO<sub>2</sub>-equivalents) and output (fixed 2005-prices) divided according to industries and share of totals. 2012



<sup>1</sup> Services, energy and water supply and construction, education, health and social work and general government administration.  
Source: Statistics Norway.

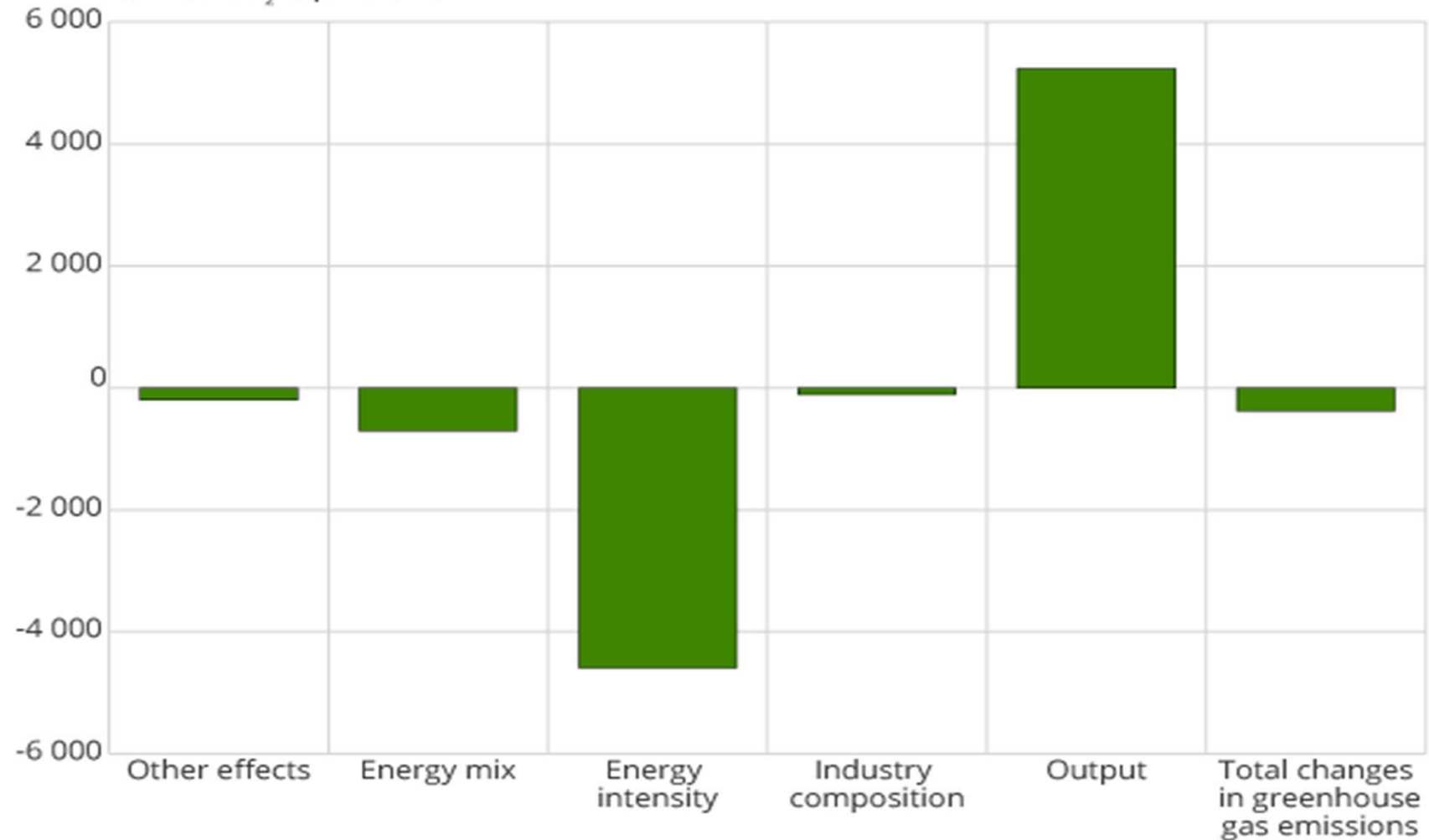




## Example Norway (2/2): Decomposition Analysis – causes of the observed changes from one year to another

**Figure 5. Effects causing changes in greenhouse gas emissions (decomposition) between 2011 and 2012**

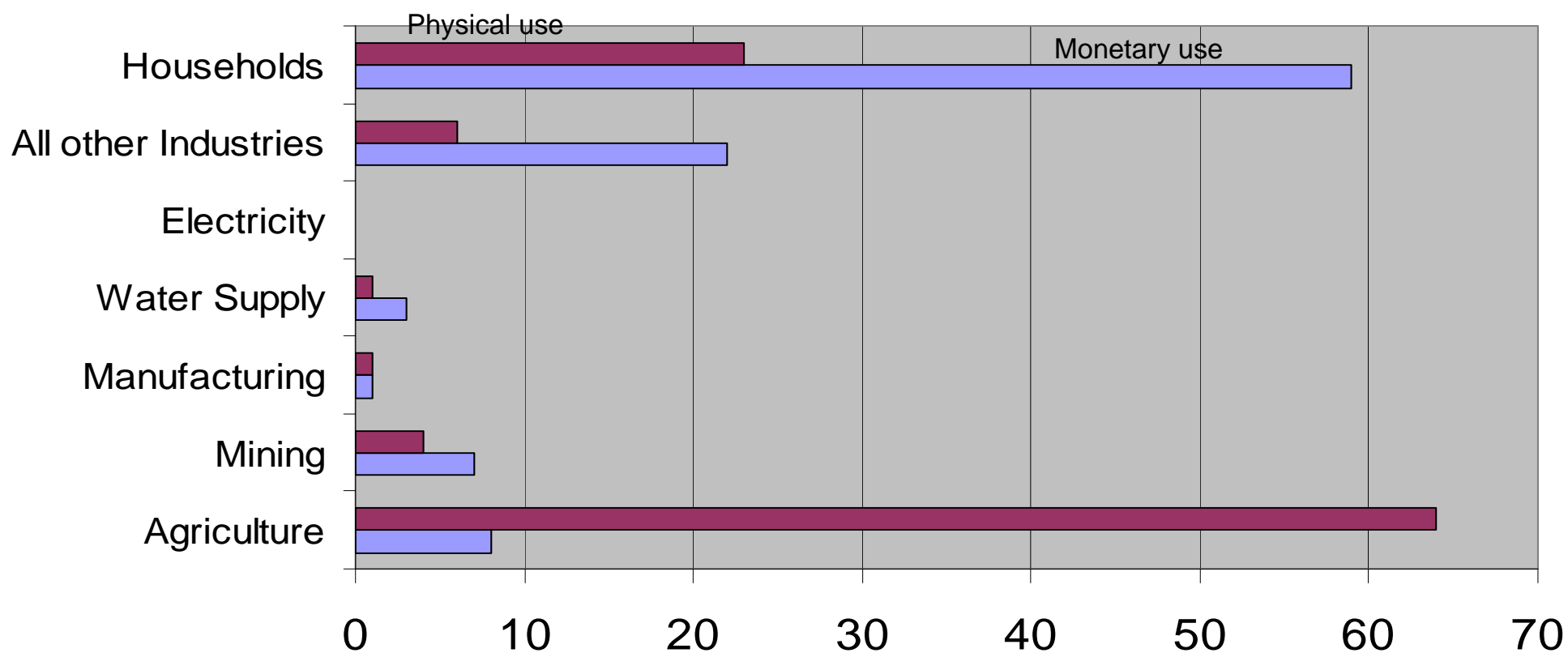
Million tonnes CO<sub>2</sub>-equivalents



Source: Statistics Norway.



# Example Australia: Monetary versus physical use of distributed water (% of total use)



## Modelling Effects of Price Changes: Murray-Darling River Basin Australia

Based on historical water use & price data, simulated impact on GDP of doubling water prices and the expected increases in water use efficiency (WUE) of 1-2%

	Increase in GDP, A\$million	
	1%increase WUE	2%increase WUE
<b>Irrigated agriculture</b>	<b>-24</b>	<b>78</b>
<b>Dryland agriculture</b>	<b>-51</b>	<b>-112</b>
<b>Food and fibre processing</b>	<b>44</b>	<b>97</b>
<b>Other industries</b>	<b>262</b>	<b>410</b>
<b>Total impact on GDP</b>	<b>253</b>	<b>521</b>



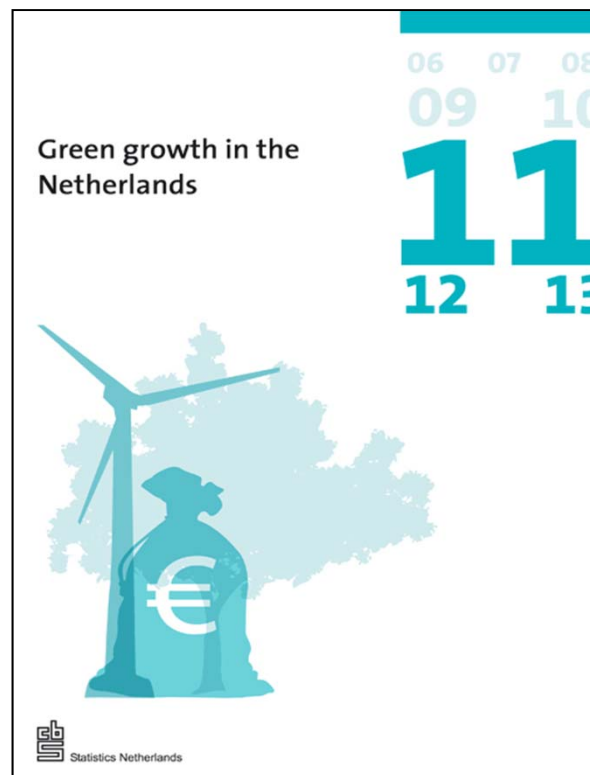
# Netherlands: Measuring green growth

## Objective:

- Assess the state of green growth in the Netherlands
- Benchmark for a more thorough and comprehensive assessment of green growth in the future

- **Point of departure: OECD indicators**
- *Data availability*
- *Robustness of indicators*
- *Relevance for the Netherlands*
  - **List of 20 relevant indicators**

**Project was completed in only 2 months**





# Netherlands: Measuring green growth: SEEA as a data source

Group	Indicator	Environmental accounts	Environmental and energy statistics	Other
i Environmental Efficiency	Production-based greenhouse gas intensity	X		
	Consumption-based greenhouse gas	X		
	Energy efficiency	X		
	Renewable energy		X	
	Surpluses of nutrients		X	
	Material intensity	X		
	Water use intensity	X		
ii Natural asset base	Waste treatment	X		
	Stocks of standing timber	X		
	Fish inputs	X		
	Natural gas reserves	X		
	Land conversion into built-up land		X	
iii Environmental quality of life	Threats to biodiversity		X	
	Pollution induced health problems			X
iv Policy responses				X
	Green patents			
	Share of green taxes	X		
	Energy prices	X		
	Carbon trade	X		
	Environmental investments	X		
	Green jobs	X		

# SEEA 2012 and the SDG Indicators

UN Statistical Commission recognized SEEA as an important framework for  
SDG indicators

STATISTICS



# SEEA 2012 and the SDG Indicators

UN Statistical Commission recognized SEEA as an important framework for  
SDG indicators



## STATISTICS

- The Statistical Commission “*recognized SEEA as an important statistical framework for the post-2015 development agenda and the sustainable development goals indicators*” in 2014.
- The SNA and SEEA are statistical standards that can be used to monitor a number of environmental-economic **SDG Indicators in an integrated way.**

# SEEA 2012 and the SDG Indicators

10 SDG goals are directly related to the environmental pillar



## STATISTICS

2 - Agriculture

6 - Water

7 - Energy

8 - Economic growth

9 - Industrialization

11 - Cities

12 - Consumption and production

13 - Climate change

14 - Marine and coastal

15 - Ecosystems

**>40 indicators of these goals can be informed by SEEA**

**SEEA accounts informing more than 3 SDG indicators are:**

- Land Accounts
- Physical supply and use of energy
- Physical supply and use of water
- Experimental Ecosystem Accounts
- Environmental Protection Expenditures
- Material Flow Accounts

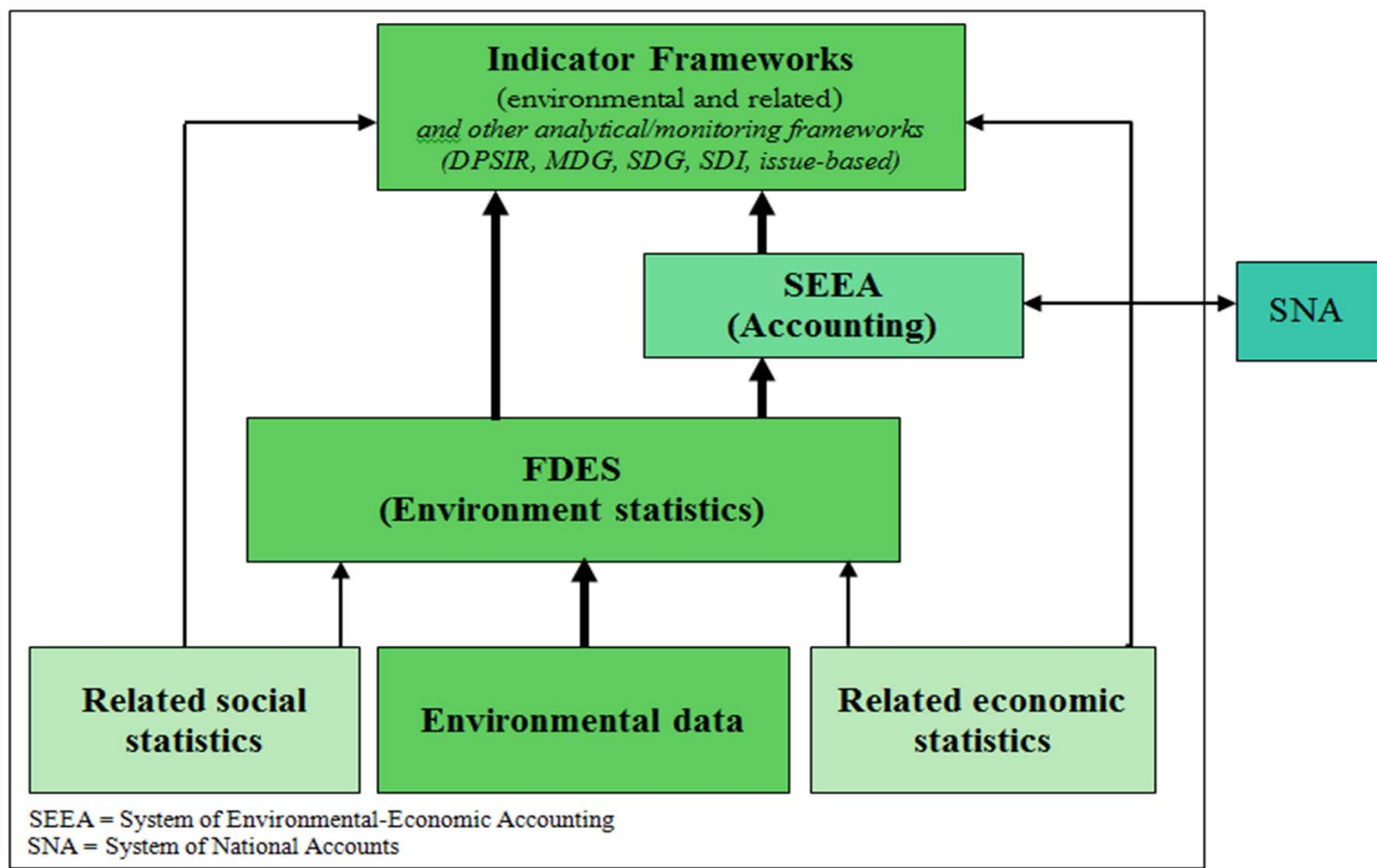


# Conclusions: Main take home message

Environment Statistics, Environmental-Economic Accounts and environment related indicator frameworks build upon each other'



STATISTICS





- I. Linking SEEA-CF 2012 / FDES 2013 / Green Growth
- II. Experimental Ecosystem Accounting



Thank you!

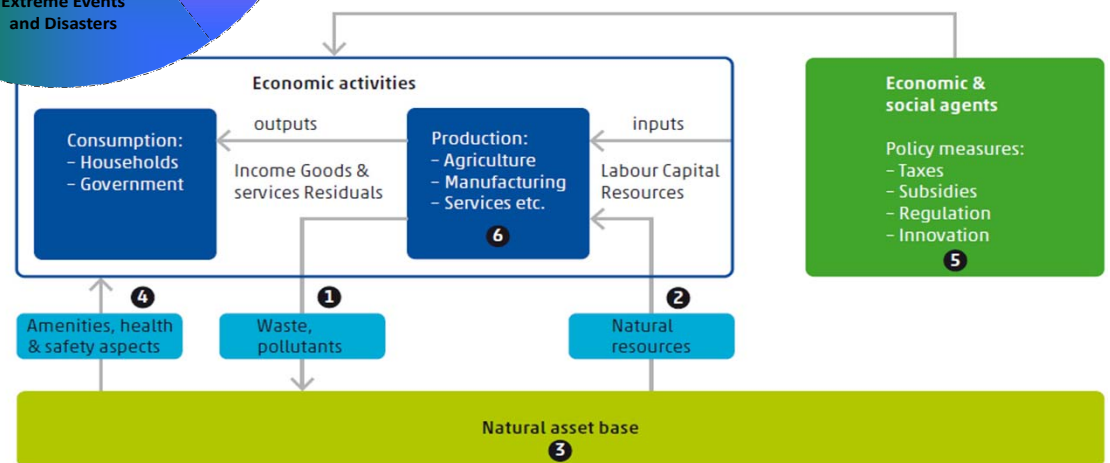
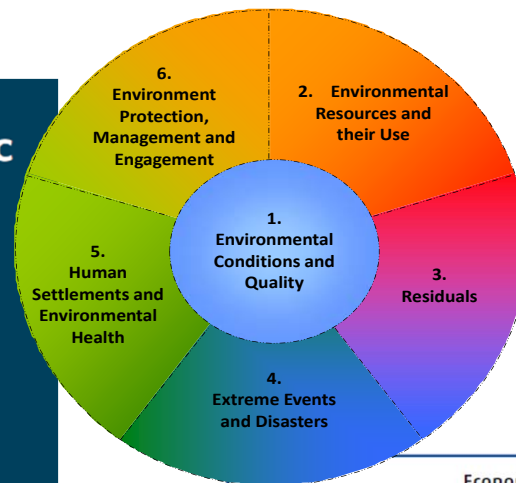
Michael Nagy  
UNECE



STATISTICS



# Annex I: SEEA-CF 2012 / FDES 2013 / Green Growth Implement in coordination!



1. Indicators monitoring environmental efficiency
2. Indicators monitoring resource efficiency
3. Indicators monitoring the natural asset base

4. Indicators monitoring environmental quality of life
5. Indicators monitoring green policy instruments
6. Indicators monitoring economic opportunities





## Asset Accounts

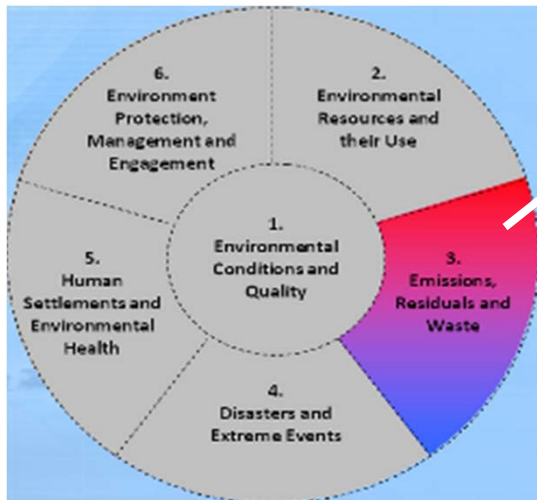


### Component 2: Environmental Resources and their Use

Flow

Sub-component 2.1: Non-energy Mineral Resources  
Sub-component 2.2: Energy Resources  
Sub-component 2.3: Land  
Sub-component 2.4: Soil Resources  
Sub-component 2.5: Biological Resources  
Sub-component 2.6: Water Resources

## Accounts



### Component 3: Residuals

Sub-component 3.1: Emissions to Air  
Sub-component 3.2: Generation and Management of Wastewater  
Sub-component 3.3: Generation and Management of Waste



**Component 6:  
Environment  
Protection,  
Management and  
Engagement**

Sub-component 6.1: Environment Protection and Resource Management Expenditure

Sub-component 6.2: Environmental Governance and Regulation

Sub-Component 6.3: Extreme Event Preparedness and Disaster Management

Sub-component 6.4: Environmental Information and Awareness

# OECD: Green Growth Indicators

<http://www.oecd.org/greengrowth/greengrowthindicators.htm>



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## Green growth and sustainable development

- > Consumption, innovation and the environment
- > Economic policies to foster green growth
- > Environmental policy tools and evaluation
- > Fisheries
- > Greening cities, regions and communities
- > Green growth and development
- > Greening energy
- > Greening jobs and skills
- > Greening transport
- > Sustainable agriculture

### Green growth indicators

Policies that promote green growth need to be founded on a good understanding of the different factors that affect green growth, and appropriate information is needed to monitor progress and measure results.

Monitoring progress towards green growth requires indicators based on internationally comparable data. These need to be embedded in a conceptual framework and selected according to well specified criteria. Ultimately, they need to be capable of sending clear messages which speak to policy makers and the public at large.

As part of its Green Growth Strategy, the OECD has developed a conceptual framework and indicators that help governments monitor progress towards green growth.

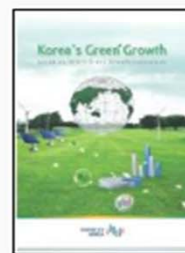
FOCUS: Joint report on Green Growth Indicators, produced under the GGKP programme on Green Growth Measurement and Indicators: [Moving Towards a Common Approach on Green Growth Indicators](#) (PDF), GGGI, OECD, UNEP and World Bank (April 2013).



Sample OECD green growth indicators [now online](#).

### OECD green growth indicators in practice

Countries like the Czech Republic, Denmark, Germany, Korea, the Netherlands and the Slovak Republic have already applied and adjusted the OECD green growth measurement framework and indicators to their specific national contexts to assess their state of green growth. With the support of OECD, the Latin America Development Bank, the Latin American and the Caribbean Economic System and the United Nations Industrial Development Organization, work is underway in Mexico, Colombia, Costa Rica, Ecuador, Guatemala, Paraguay and Peru to apply the OECD indicators as a way to identify key areas of national concern and the scope for improving the design, choice and performance of policy instruments. Please see here for the [workshop on green growth indicators in latin american countries](#) which took place in June 2012.



[Korea](#)



[The Netherlands](#)



[The Czech Republic](#)

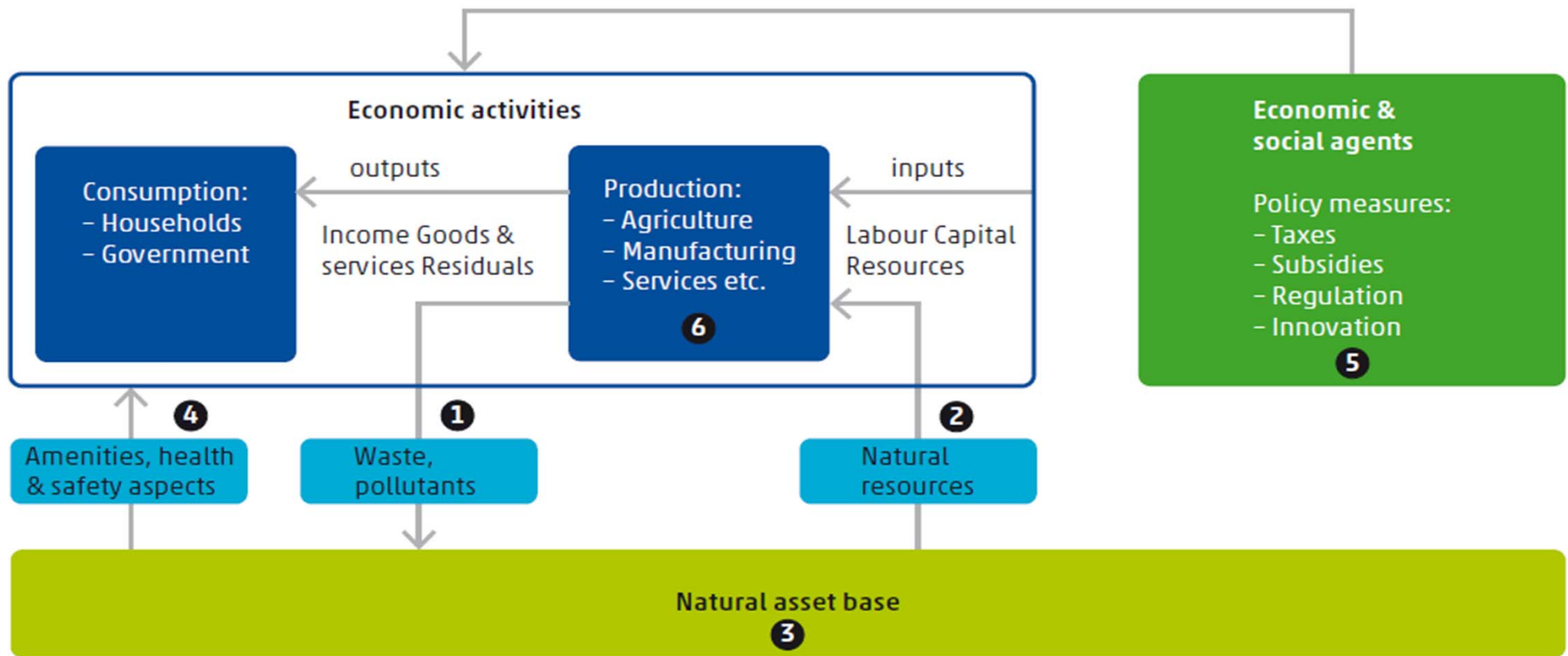


[Denmark](#)



[Germany](#)

# Measurement Framework for Green Growth



1. Indicators monitoring environmental efficiency
2. Indicators monitoring resource efficiency
3. Indicators monitoring the natural asset base

4. Indicators monitoring environmental quality of life
5. Indicators monitoring green policy instruments
6. Indicators monitoring economic opportunities

# SEEA-CF 2012, FDES 2013, Green Growth

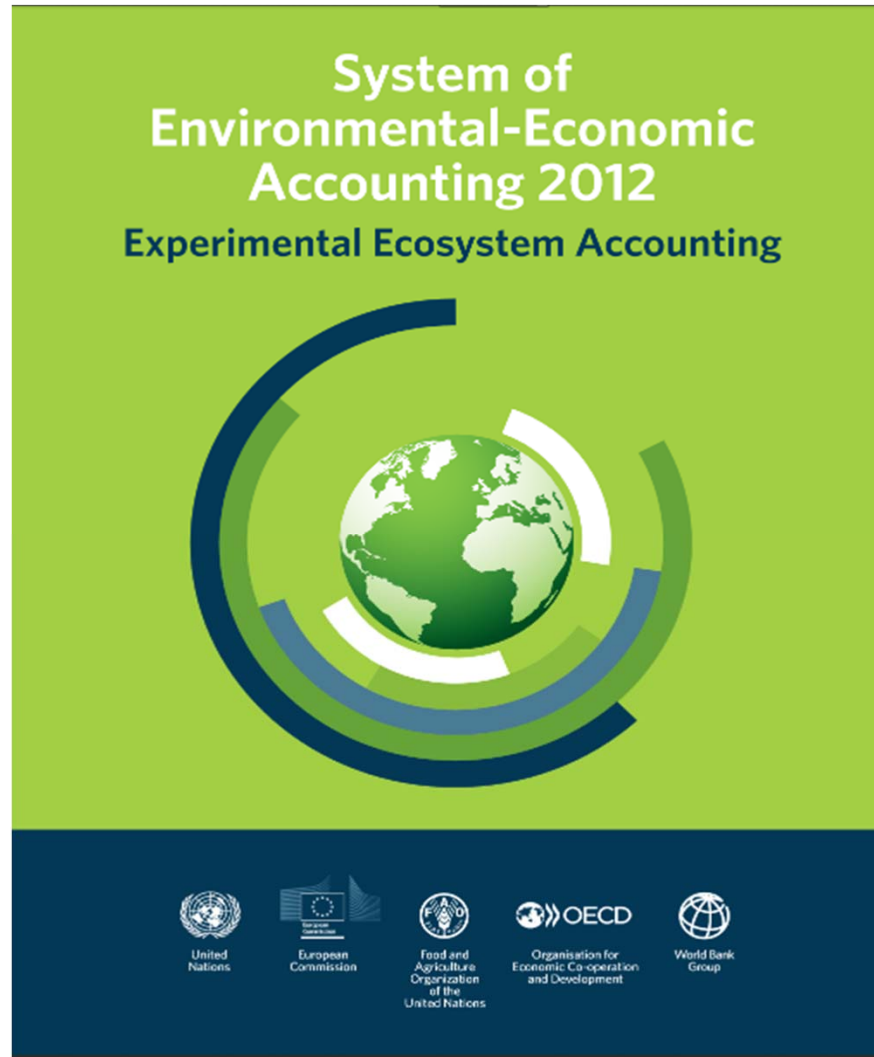
OECD Green Growth Categories / Potential Indicators	 FDES	Related to SEEA-CF
<b>Environmental Quality of Life</b>		
Urban air quality or exposure to particulates	1.3.1 Air Quality or 3.1 Emissions to Air	Physical Flows
Consider other potential topics such as: <ul style="list-style-type: none"> <li>• Health statistics related to air pollution?</li> <li>• Access to clean water, sewage treatment, waste treatment</li> <li>• Noise, volume of traffic (proxy for noise)</li> </ul>	5.2 Environmental Health 5.1.2 Access to water, sanitation 3.3.2 Mgmt of waste 1.3.5 Noise	Physical Flows
<b>Monitoring economic opportunities and policy responses</b>		
“Core” Environment Industry – ISIC Section E: by 2-digits	6 Environment Protection, Mgmt & Engagement	Monetary Flow
Environmental Taxes (Government Revenue)	6.2.2 Environmental regulation and instruments	Monetary Flow
Government Expenditure (COFOG 05)	6.1.1 Government Environment protection expenditure	Monetary Flow



# SEEA-CF 2012, FDES 2013, Green Growth

OECD Green Growth Categories / Potential Indicators	 <b>FDES</b>	Related to SEEA-CF
<b>Monitoring the Natural Asset Base</b>		
Copper sub-soil assets (reserves – in physical units)	2.1.1 Stocks and changes of non-energy mineral resources	Asset Accounts
Coal sub-soil assets (reserves – in physical units)	2.2.1 Stocks and changes of mineral energy resources	Asset Accounts
Natural Protection Areas – by type of protection	1.2.3 Biodiversity	
Disasters	4.1 Natural Extreme Events and Disasters	
Threatened species	1.2.2 Ecosystems	
Grazing / over-grazing of pasture land	2.5 Biological Resources	
Hunting permits / poaching	2.5.5 Wild, uncultivated biological resources	

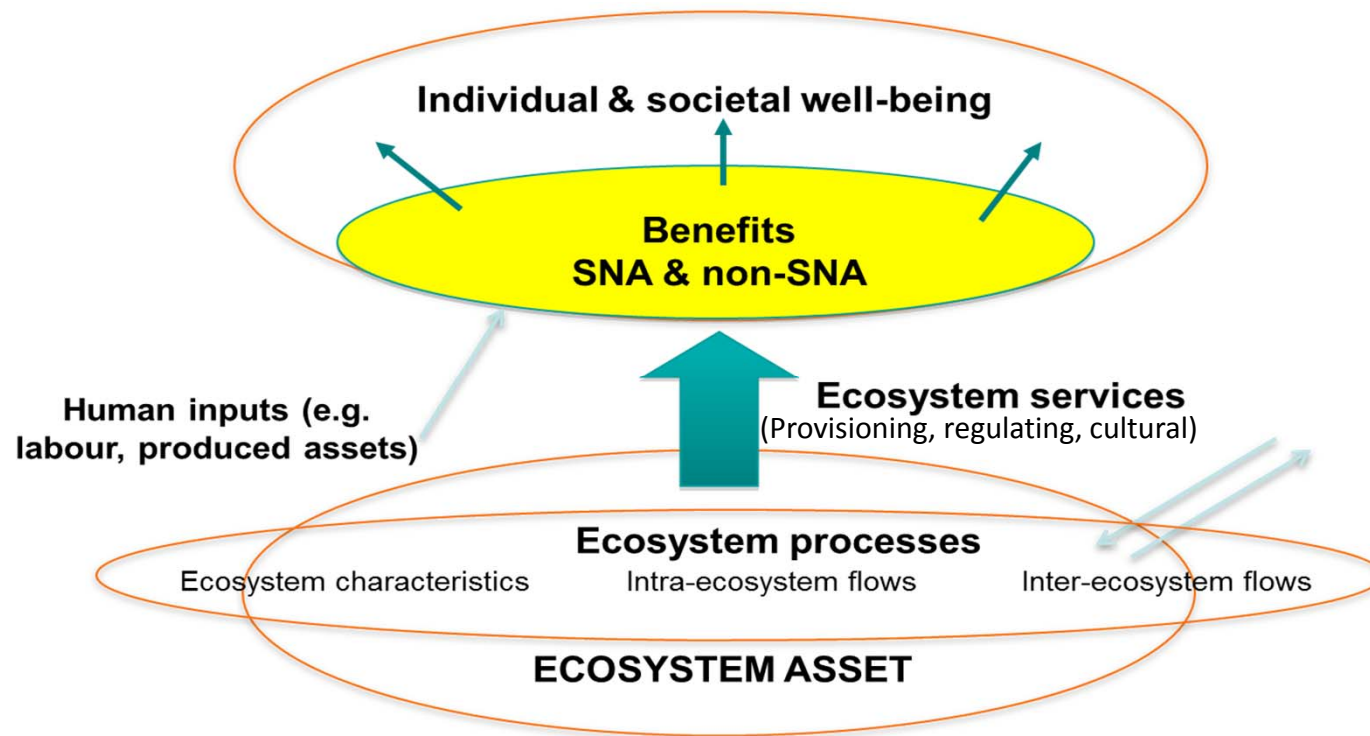
# Annex II: Experimental Ecosystem Accounting



# Why ecosystem accounts?

## To better understand:

- The impacts of ecosystem change on people
- Potential response options (mitigate, adapt)
- The effects, and cost/benefit ratio of response options



## SEEA-Experimental Ecosystem Accounting - Background

- Complements SEEA Central Framework with focus on ecosystems perspective
- Developed as part of broader process of revising SEEA 2003
- “Experimental” because significant methodological challenges remain and further testing of concepts needed

# Relationship to SEEA Central Framework

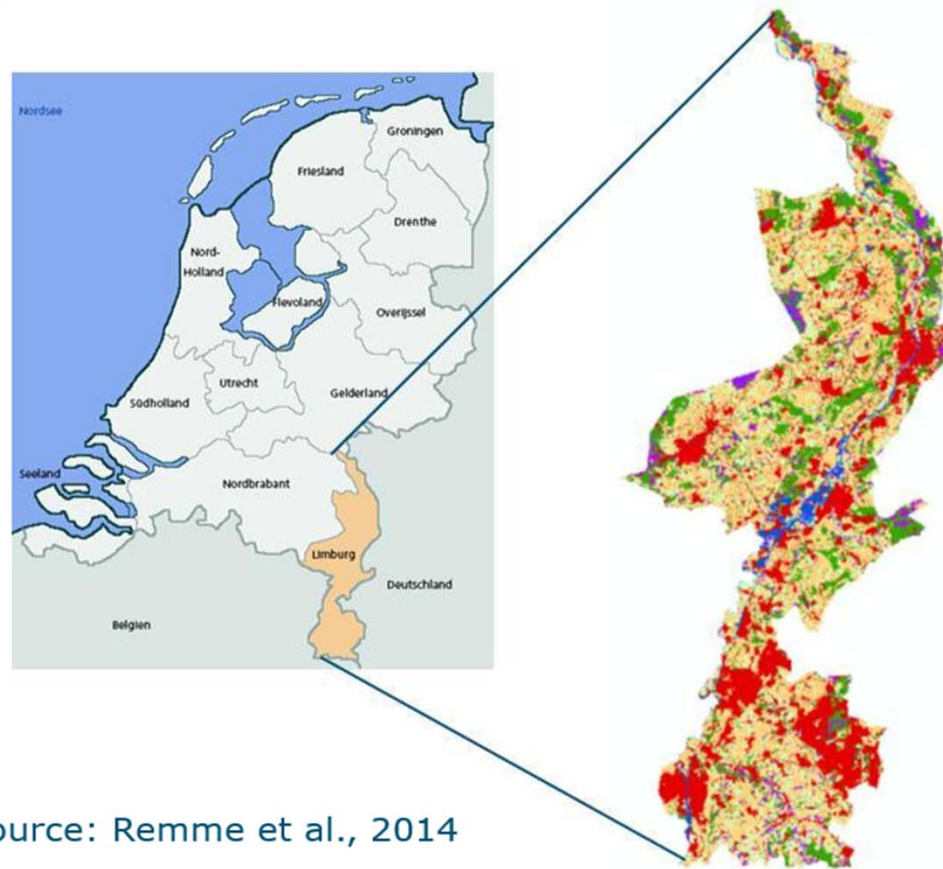
- Extends range of flows (production boundary) for accounting compared to SNA and SEEA in physical and monetary terms
- Many flows from Central Framework also included in Experimental Ecosystem Accounting (e.g. flows of timber), but extension of EEA is to attribute flows to spatial areas
- Some Central Framework natural input flows are excluded from Experimental Ecosystem Accounting (e.g. mineral and energy resources)



# Ecosystem account example 1/3

## Ecosystem production account example: Limburg province the Netherlands

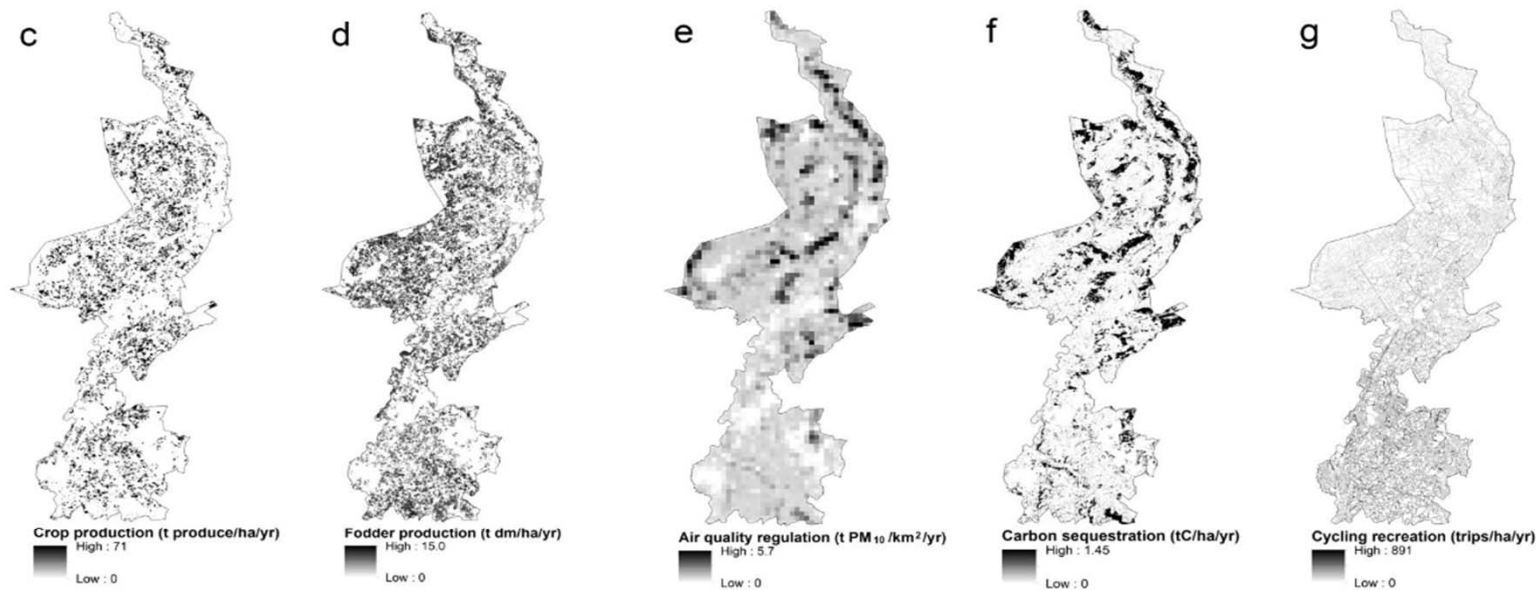
- Biophysical ecosystem account developed for Limburg Province, the Netherlands
- 2200 km<sup>2</sup>, 1.1 million inhabitants
- Analysis of 7 ecosystem services



Source: Remme et al., 2014

# Ecosystem account example 2/3

## Ecosystem production accounts Limburg, NLs



Source: Remme et al., 2014

# Ecosystem account example 3/3

## Ecosystem production account table Limburg

LCEU	Ecosystem service													
	Crop production		Fodder production		Drinking water extraction		Hunting		Air quality regulation		Forest carbon sequestration		Recreational cycling	
	Total	Mean (SD)	Total	Mean (SD)	Total	Mean (SD)	Total	Mean (SD)	Total	Mean (SD)	Total	Mean (SD)	Total	Mean (SD)
	Mtons MEQ	kg MEQ ha <sup>-1</sup> yr <sup>-1</sup>	ktons dm	kg dm ha <sup>-1</sup> yr <sup>-1</sup>	10 <sup>3</sup> m <sup>3</sup> water	m <sup>3</sup> water ha <sup>-1</sup> yr <sup>-1</sup>	kg meat	kg meat km <sup>-2</sup> yr <sup>-1</sup>	tons PM <sub>10</sub>	kg PM <sub>10</sub> km <sup>-2</sup> yr <sup>-1</sup>	ktons C	kg C ha <sup>-1</sup> yr <sup>-1</sup>	10 <sup>3</sup> trips	trips ha <sup>-1</sup> yr <sup>-1</sup>
Pasture	-	-	521	12,041 (1,573)	9,110	3,099 (2,231)	9,100	21 (17)	405	911 (532)	-	-	1,872	103 (78)
Cropland	2.46	36,314 (1,785)	-	-	14,855	3,082 (2,422)	14,732	20 (17)	715	956 (534)	-	-	2,631	99 (73)
Forest	-	-	-	-	4,577	3,214 (2,624)	8,100	24 (20)	686	2,040 (1,221)	55	1,563 (263)	1,472	126 (94)
Water	-	-	-	-	3,289	9,460 (3,698)	-	-	40	624 (569)	-	-	147	110 (92)
Urban	-	-	-	-	7,862	4,321 (3,527)	-	-	285	547 (562)	-	-	2,735	70 (57)
Heath	-	-	-	-	219	1,293 (821)	678	32 (25)	45	2,062 (1,111)	-	-	30	82 (59)
Peat	-	-	-	-	0	0 (0)	70	13 (3)	7	970 (345)	-	-	3	92 (44)
Other nature	-	-	-	-	1,187	3,093 (2,567)	1,513	25 (20)	69	1,155 (710)	-	-	226	128 (93)
Provincial total	2.46		521		41,099		34,193		2,252		55			

Source: Remme et al., 2014