Main concepts used in environment statistics (UN Framework for the development of Environment Statistics, FDES) and the System of Environmental-Economic Accounting (SEEA)

How they support user's needs

Michael Nagy, UNECE

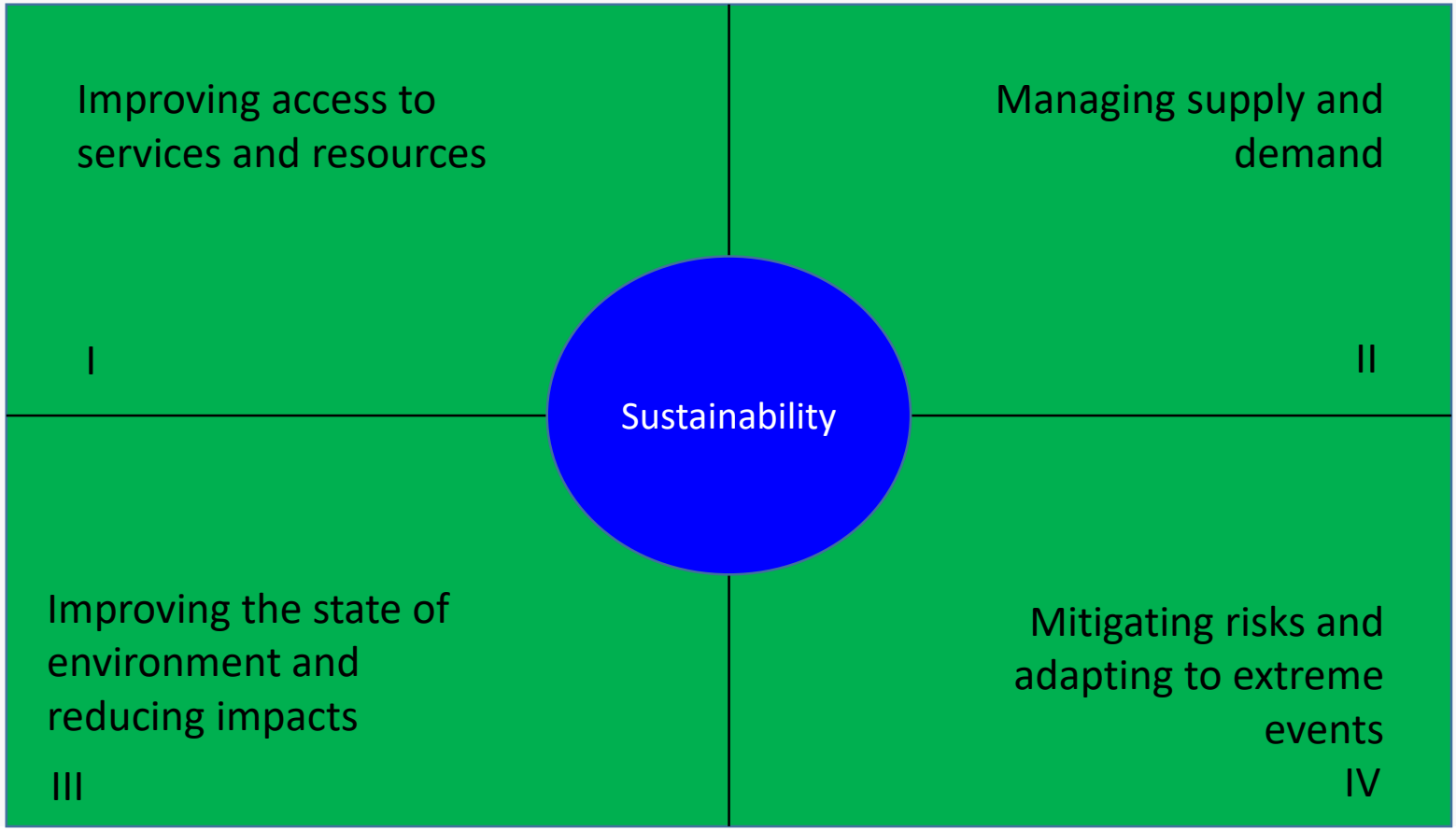
STATISTICS

ROSSTAT/UNECE/UNEP/OECD Joint Workshop on environment-related SDG Indicators, Moscow, Russian Federation, 19-21/03/2019

What are the main information needs?

Informing different policy perspectives

STATISTICS



What are the main information needs?

Informing different policy and indicator frameworks

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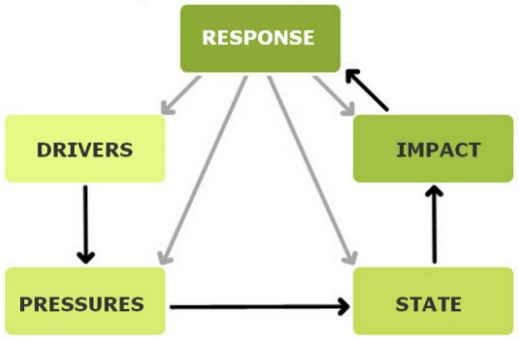

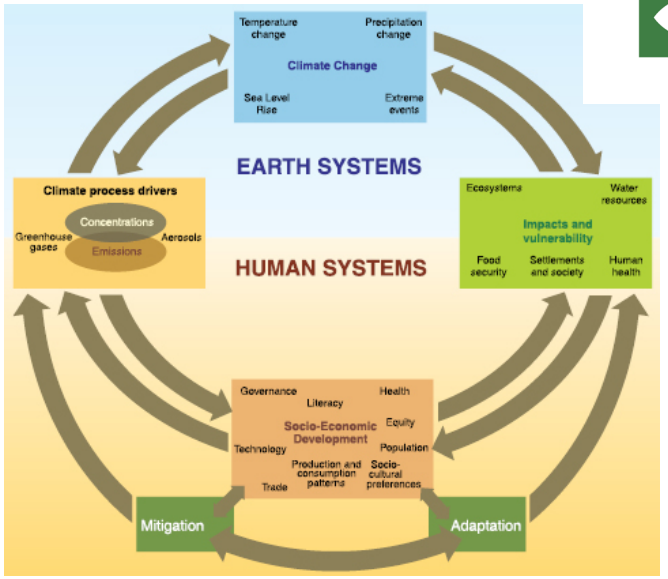

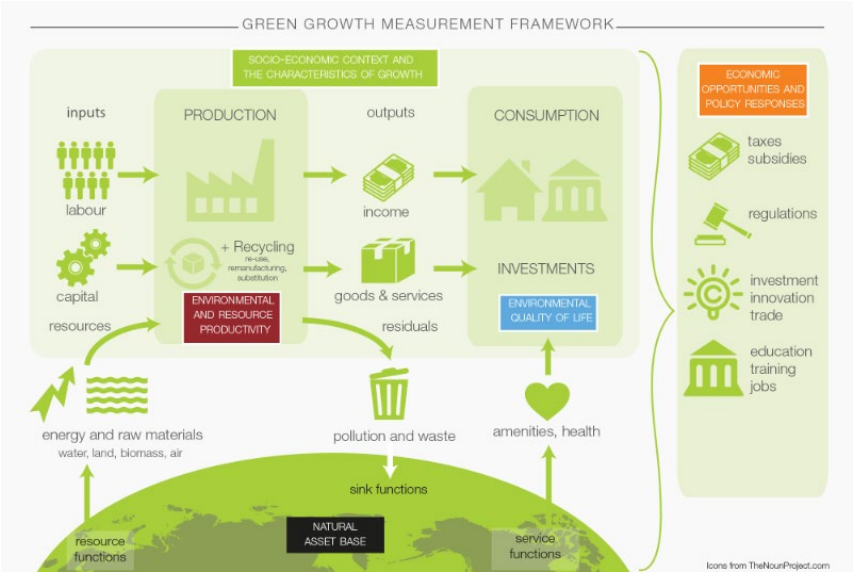

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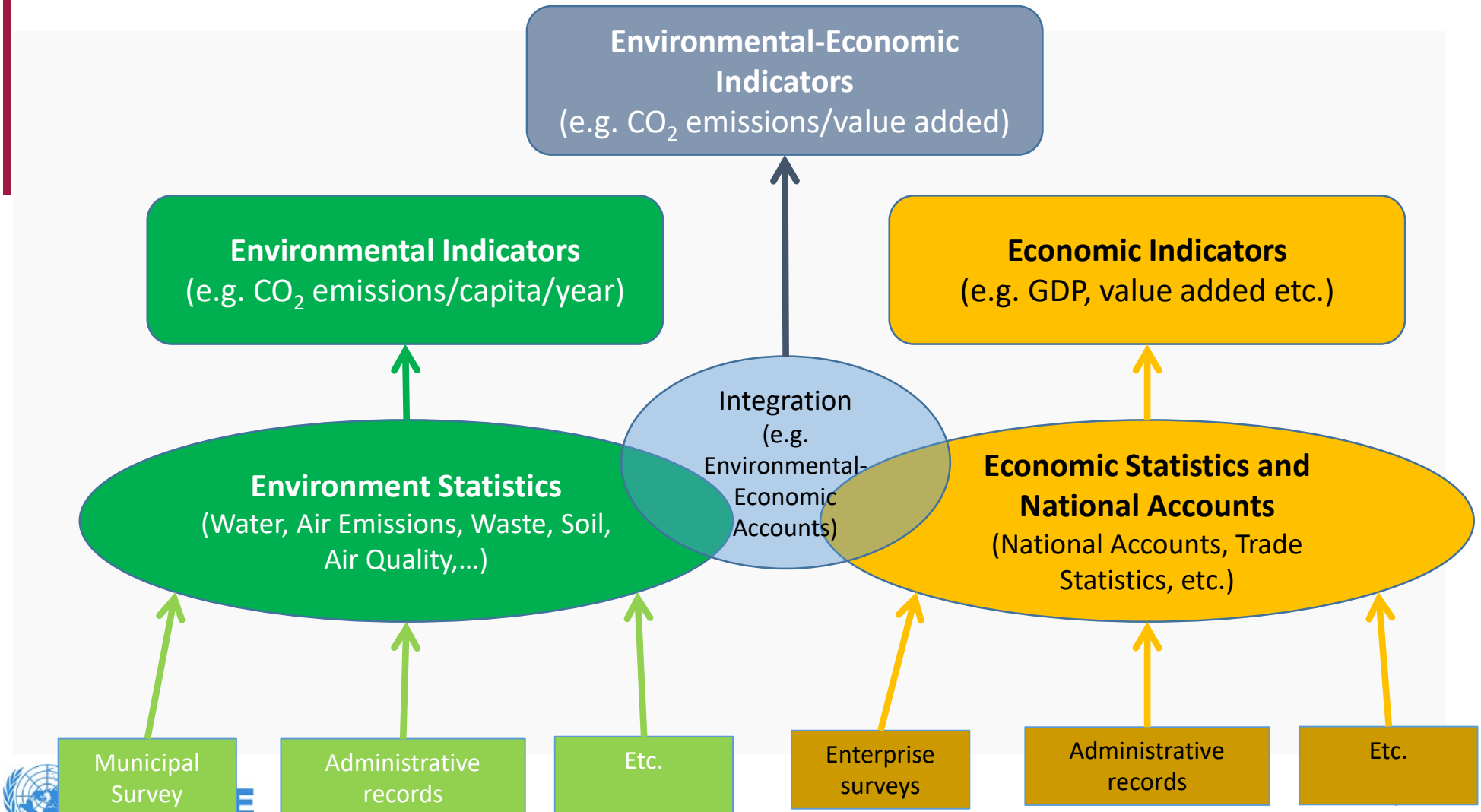
Why do we need environment statistics AND environmental-economic accounts?

Integrating environmental and economic information

STATISTICS



A note on Frameworks

FDES and SEEA ideally are used together

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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

Source: Michael Bordt (UNESCAP)

Why environment statistics?

A single trusted source for multiple purposes

STATISTICS

- Improve **knowledge**
- Support evidence-based **policy**
- Provide **information** to the general public, media and other user groups

Purpose of the FDES 2013

Biophysical aspects, related human sub-system, impacts and interactions

STATISTICS

Guide the formulation of environment statistics programmes by

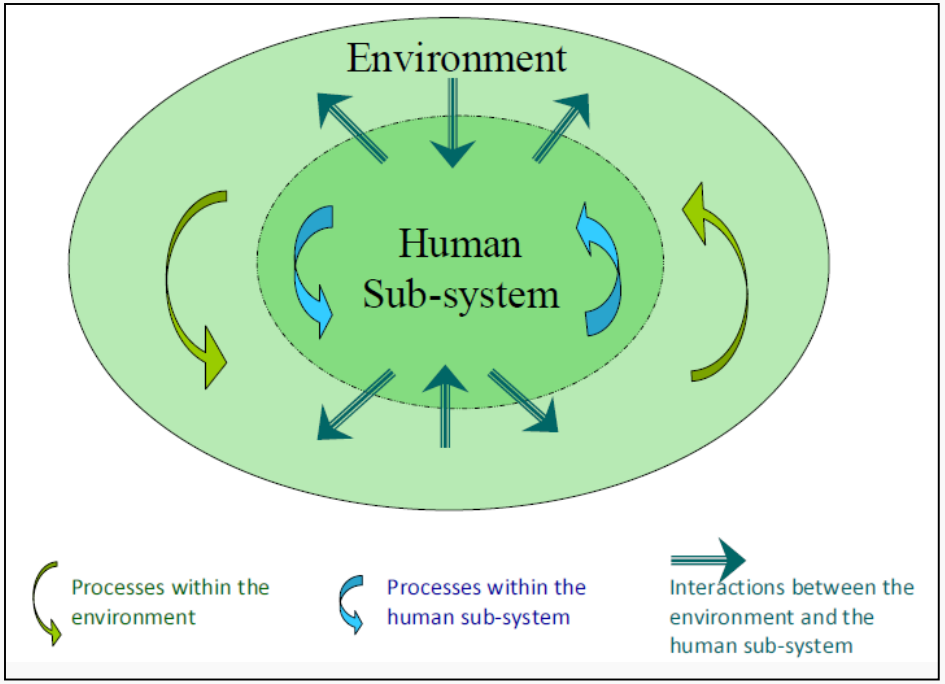
- Delineating the scope of environment statistics and identifying its constituents
- Contributing to the assessment of data requirements, sources, availability and gaps
- Guiding the development of multipurpose data collection processes and databases
- Assisting in the coordination and organisation of environment statistics

Conceptual foundation of the FDES 2013

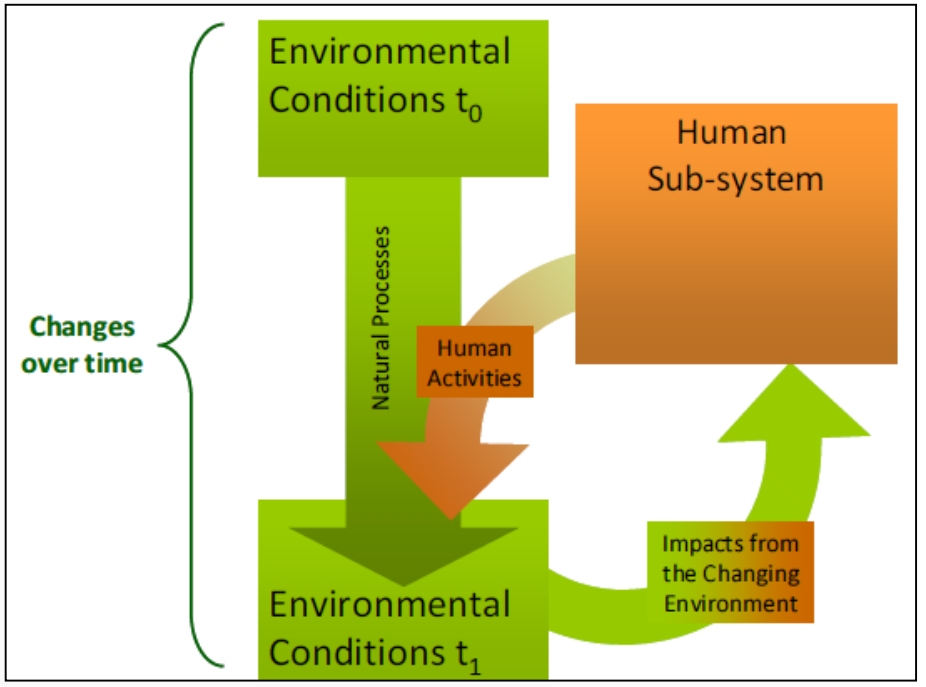
Environmental conditions, impacts and related human activities

STATISTICS

Environment, Human Sub-system and Interactions



Environmental conditions and their changes



Scope and structure of the FDES 2013

Biophysical aspects, related human sub-system, impacts and interactions

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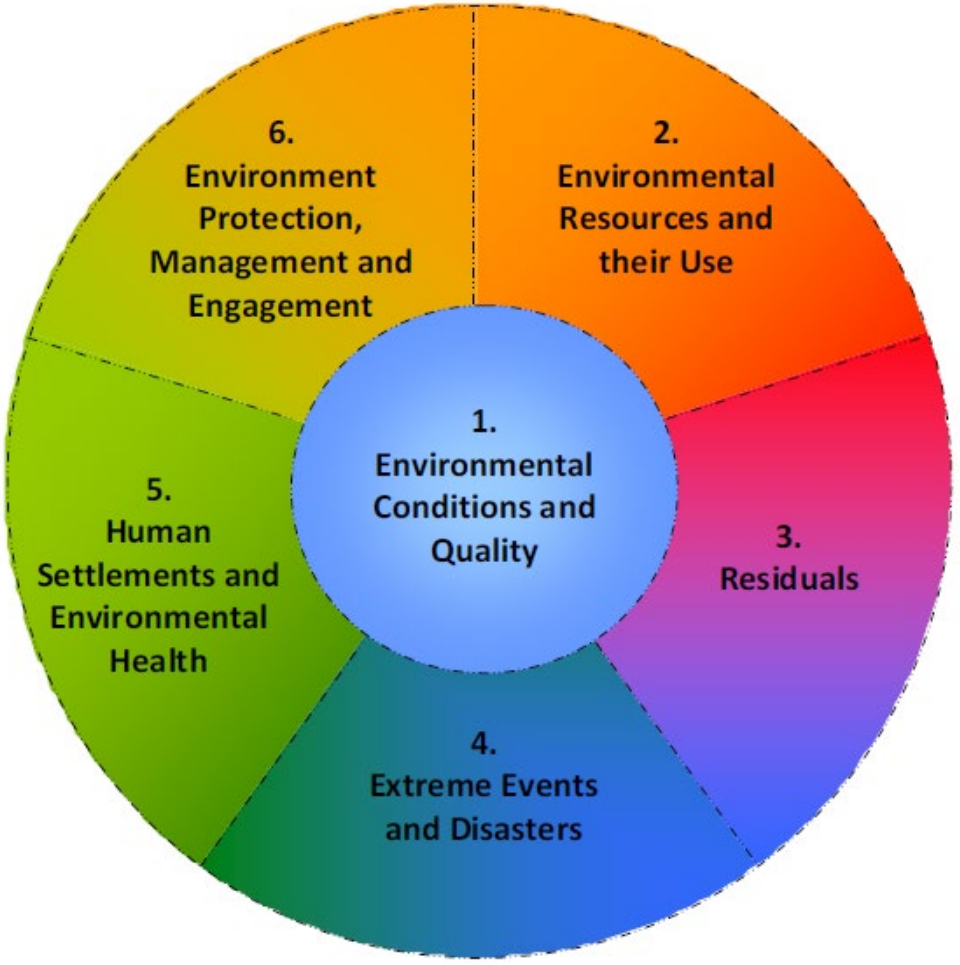

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A multi-level approach of the FDES

Levels of the FDES

1 digit	2 digits	3 digits	4 or 5 digits
Component	**Sub-component**	**Statistical Topic**	**Statistics**

Component 1: Environmental Conditions and Quality	Sub-component 1.1: Physical Conditions Sub-component 1.2: Land Cover, Ecosystems and Biodiversity Sub-component 1.3: Environmental Quality
Component 2: Environmental Resources and their Use	Sub-component 2.1: 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
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 Sub-component 3.4: Release of Chemical Substances
Component 4: Extreme Events and Disasters	Sub-component 4.1: Natural Extreme Events and Disasters Sub-component 4.2: Technological Disasters
Component 5: Human Settlements and Environmental Health	Sub-component 5.1: Human Settlements Sub-component 5.2: Environmental Health
Component 6: Environmental Protection, Management and Engagement	Sub-component 6.1: Environmental 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

Example of Basic Set of Environment Statistics

Component 1: Environmental Conditions and Quality

Sub-component 1.3: Environmental Quality

Topic	Statistics and Related Information (**Bold Text - Core Set/Tier 1**; Regular Text - Tier 2; *Italicized Text - Tier 3*)
Topic 1.3.1: Air quality	a. Local air quality
	1. **Concentration level of particulate matter (PM_{10})**
	2. **Concentration level of particulate matter ($PM_{2.5}$)**
	3. **Concentration level of tropospheric ozone (O_3)**
	4. **Concentration level of carbon monoxide (CO)**
	5. **Concentration level of sulphur dioxide (SO_2)**
	6. **Concentration levels of nitrogen oxides (NO_X)**
	7. Concentration levels of heavy metals
	8. Concentration levels of non-methane volatile organic compounds (NMVOCs)
	9. *Concentration levels of dioxins*
	10. *Concentration levels of furans*
	11. Concentration levels of other pollutants
	12. Number of days where maximum allowable levels were surpassed per year
	b. Global atmospheric concentrations of greenhouse gases
	1. Global atmospheric concentration levels of carbon dioxide (CO_2)
	2. Global atmospheric concentration levels of methane (CH_4)

Flexibility and adaptability: prioritizing components, sub-components and topics

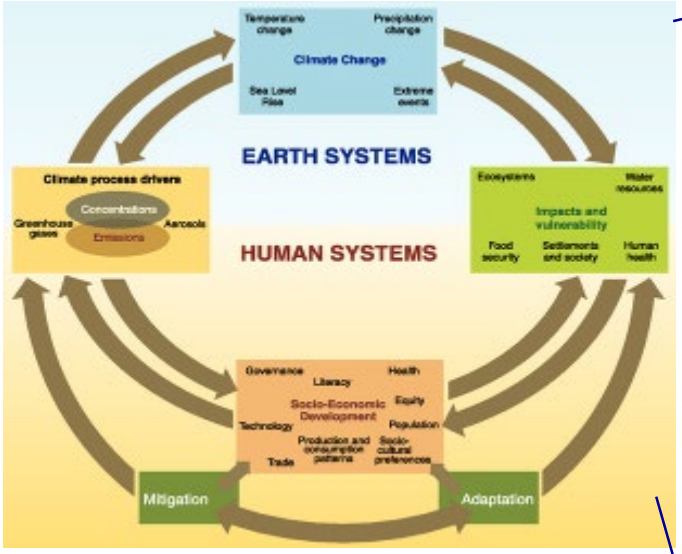
Flexibility and adaptability: tiers

Applications of the FDES to cross-cutting issues (Chapter 5 of FDES 2013)

- The FDES can be applied to inform about cross-cutting policy issues important to countries at any given time.

- Examples:
  - Water and the environment
  - Energy and the environment
  - Climate change
  - Agriculture and the environment

Climate change statistics



Source: Intergovernmental Panel on Climate Change

Note: Also applicable for the CES Recommendations on CC-related Statistics.

Climate Process Drivers

Sub-component 1.3: Environmental Quality	Sub-component 3.1: Emissions to Air
1.3.1 Air quality	3.1.1 Emissions of greenhouse gases 3.1.2 Consumption of ozone depleting substances

Climate Change Evidence

Sub-comp. 1.1: Physical Conditions	Sub-comp. 4.1: Natural Extreme Events and Disasters
1.1.1 Atmosphere, climate and weather 1.1.2 Hydrographical characteristics	4.1.1 Occurrence of natural extreme events and disasters

Climate Change Impacts and Vulnerability

Sub-comp. 1.1: Physical Conditions	Sub-comp. 1.2: Land Cover, Ecosystems and Biodiversity	Sub-comp. 1.3: Environmental Quality	Sub-comp. 2.3: Land	Sub-comp. 4.1: Natural Extreme Events and Disasters	Sub-comp. 5.1: Human Settlements	Sub-comp. 5.2: Environmental Health
1.1.2 Hydrographical characteristics 1.1.4 Soil characteristics	1.2.1 Land cover 1.2.2 Ecosystems and biodiversity 1.2.3 Forests	1.3.3 Marine water quality	2.3.1 Land use	4.1.2 Impact of natural extreme events and disasters	5.1.3 Housing conditions	5.2.3 Vector-borne diseases 5.2.4 Health problems associated with excessive UV radiation exposure

Mitigation and Adaptation

Sub-comp. 2.2: Energy Resources	Sub-comp. 6.1: Environmental Protection and Resource Management Expenditure	Sub-comp. 6.2: Environmental Governance and Regulation	Sub-comp. 6.3: Extreme Event Preparedness and Disaster Management
2.2.2 Production, trade and consumption of energy	6.1.1 Government environmental protection and resource management expenditure 6.1.2 Corporate, non-profit institution and household environmental protection and resource management expenditure	6.2.2 Environmental regulation and instruments 6.2.3 Participation in MEAs and environmental conventions	6.3.1 Preparedness for natural extreme events and disasters

Why Environmental-Economic Accounting

What is it about?

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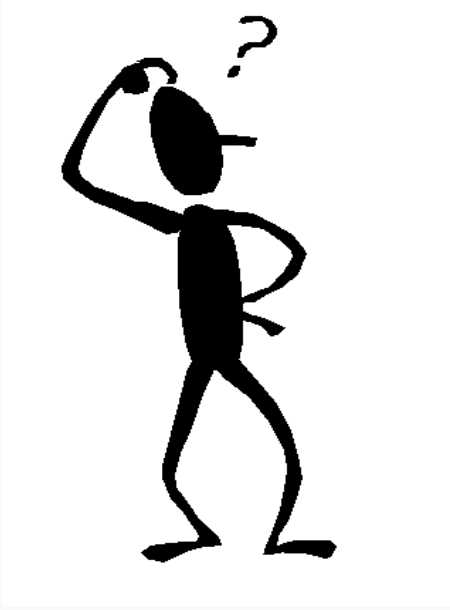


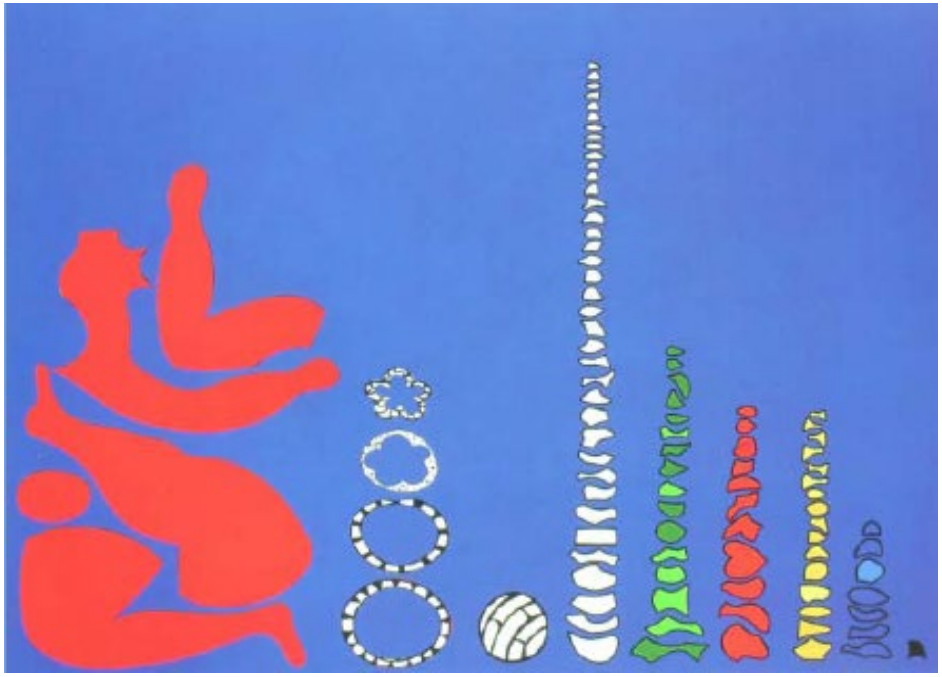
Why make environmental accounts?

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

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SEEA responds to complex policy questions

Some examples

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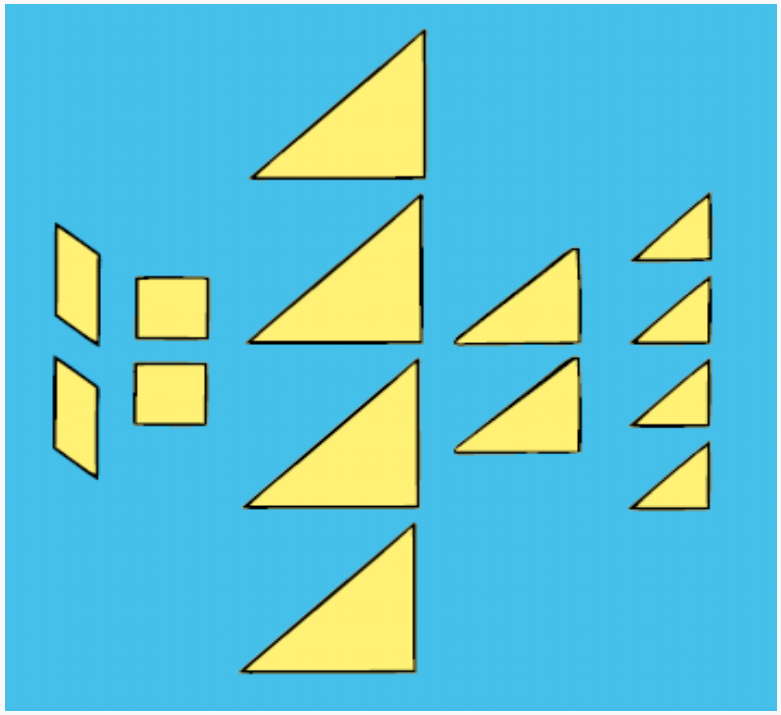
- How can natural resources be used sustainably? What is the impact of regulatory environmental measures on different economic sectors and households?
- How do ecosystems contribute to the well-being of people and to the economy?
- Which are the most cost-efficient measures to improve the state of the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

From Statistics to Accounts

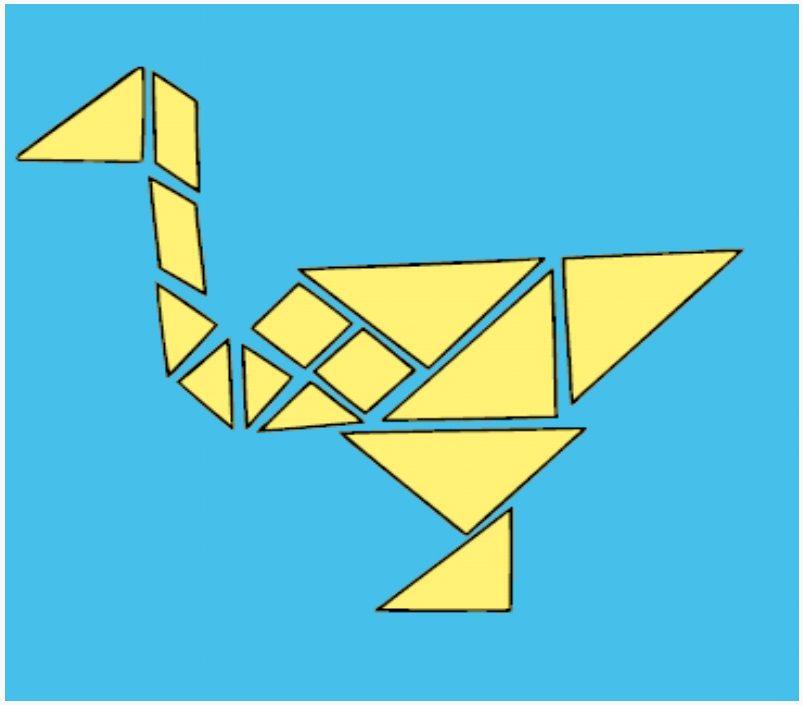
Use of the SNA principles

STATISTICS

Statistics



Accounts



Source: United Nations Statistics Division

Stocks and **flows** in
physical and **monetary** terms

SEEA is considered as an underlying framework by international initiatives

It is a multi-purpose accounting framework

STATISTICS

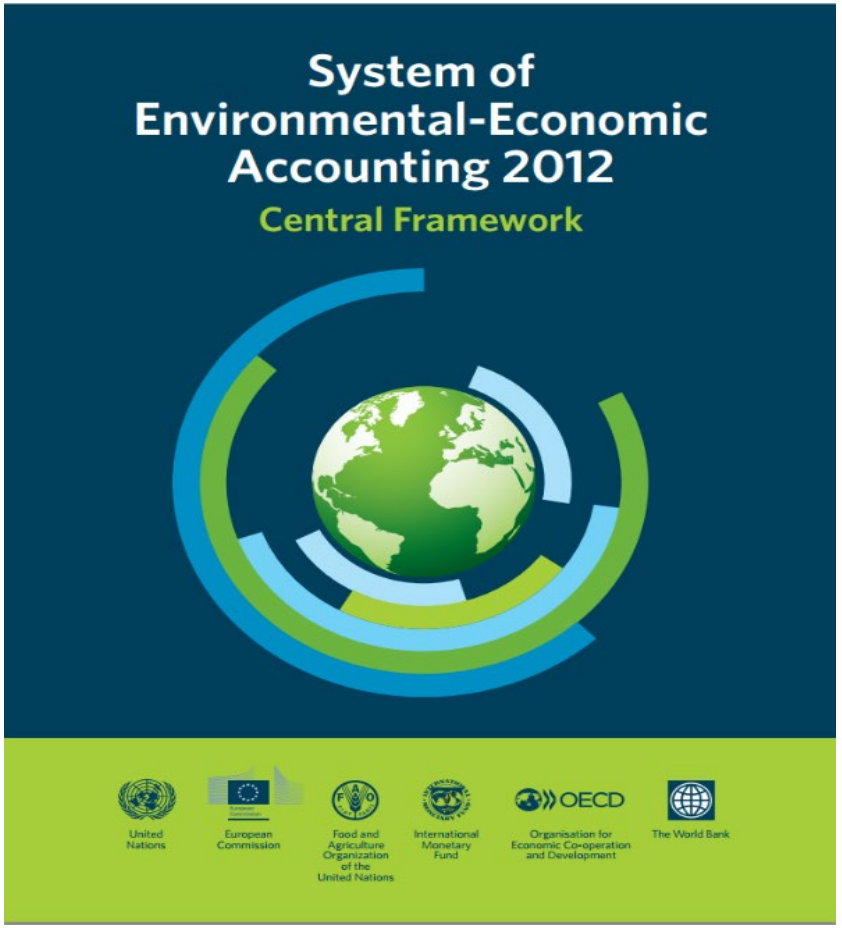
- Monitoring Sustainable Development Goals
- OECD: Towards Green Growth
- European Union: Beyond GDP
- Conference of European Statisticians: Set of core Climate Change related Indicators
- World Bank: Wealth Accounting and the Valuation of Ecosystem Services (WAVES)
- Etc.

SEEA Central Framework

International statistical standard since 2012

STATISTICS

- Internationally agreed statistical framework to measure environment and its interactions with economy
- Adopted as international statistical standard by UN Statistical Commission in 2012
- Developed through inter-governmental process
- Published by UN, EU, FAO, IMF, OECD, WB



Main concepts of environmental-economic accounting

Similar to FDES, but following accounting principles

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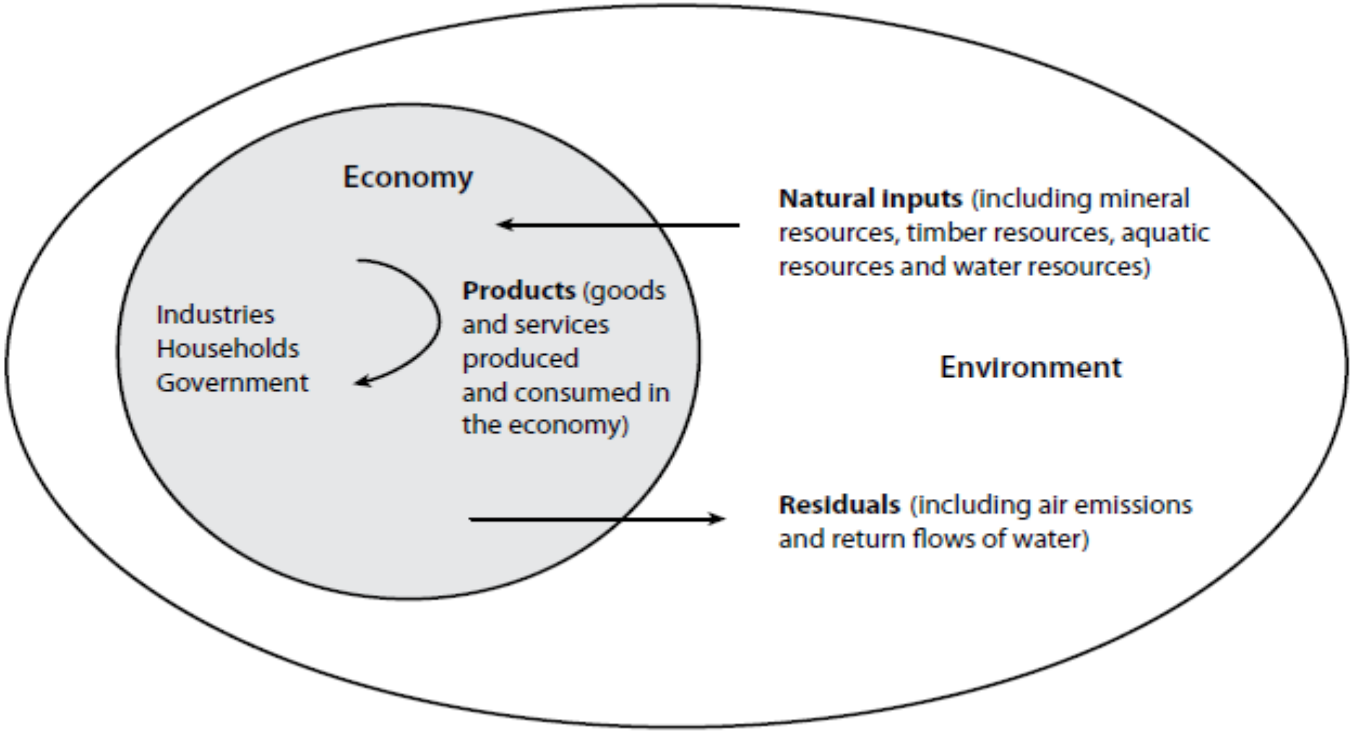

Environmental accounts are satellite accounts to the System of National Accounts (SNA)

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.

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Difference between SNA boundary and territory boundary

Main difference is usually international transport

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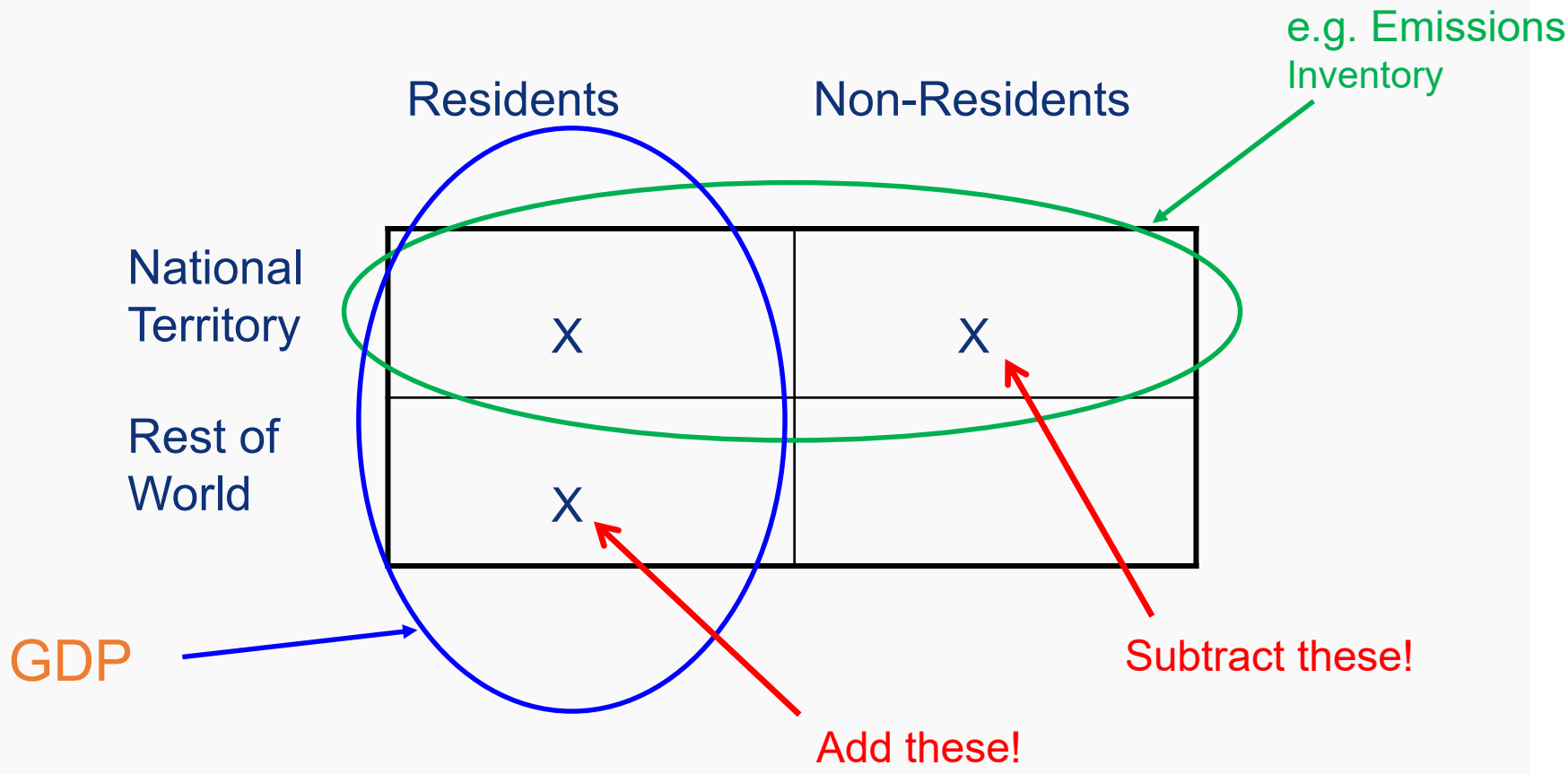


Need to make the environmental statistics correspond to the national accounts definitions

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)

Guidelines & framework

System of Environmental Economic Accounting (SEEA)

STATISTICS

a) SEEA Central Framework (SEEA-CF):

- Integration framework consisting of agreed concepts,

  definitions, classifications and accounting tables for environmental accounting
- Common concepts (e.g. residence) and classifications (ISIC, CPC) as in the National Accounts (SNA)
- Includes complementary elements (e.g. physical information, etc.)

b) SEEA extensions and applications: Country examples

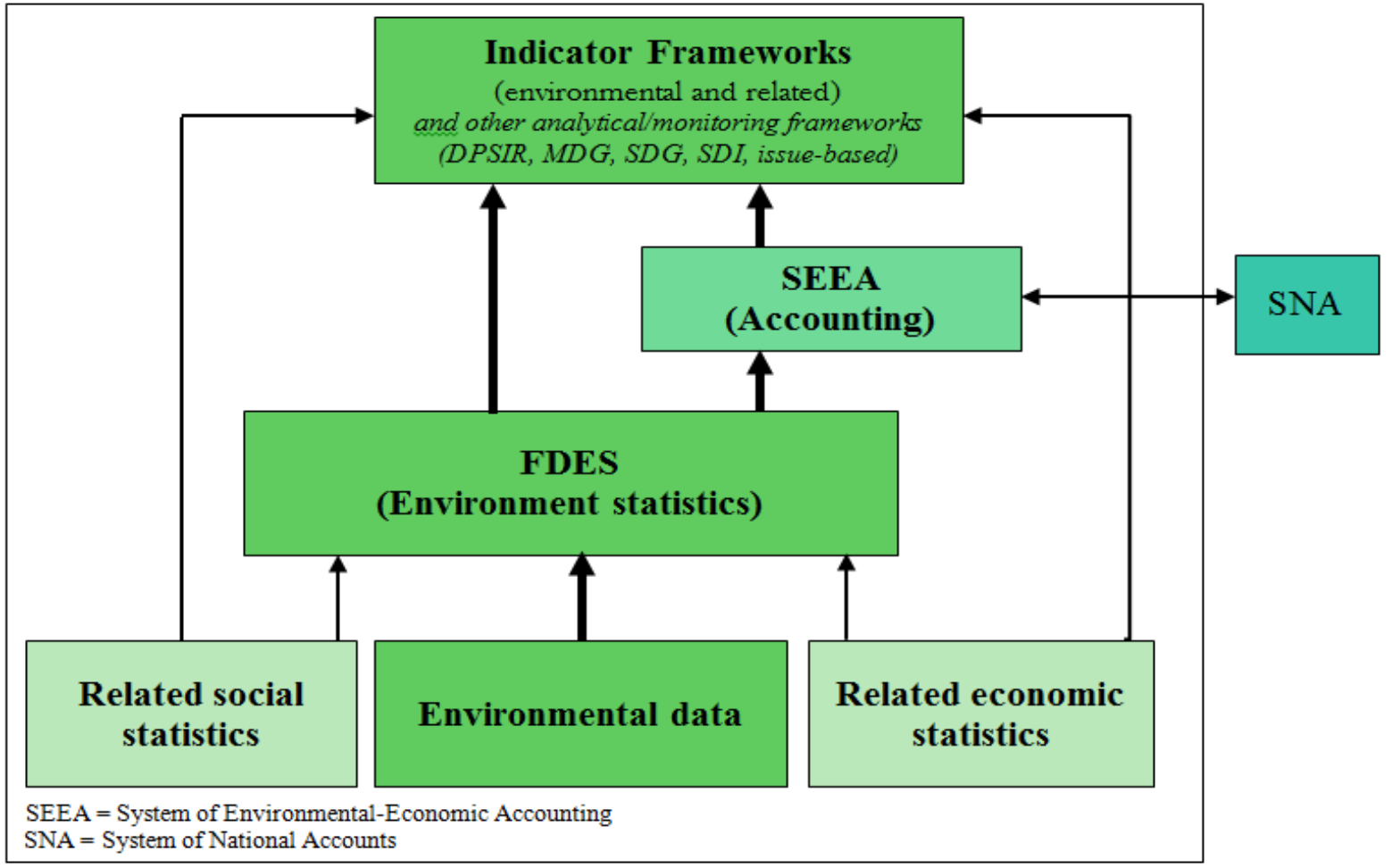
c) SEEA experimental ecosystem accounting: Enlarged asset boundaries

All available on https://seea.un.org/

Main take home message

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

STATISTICS



Annexes

STATISTICS

I. The links between SEEA 2012 and FDES 2013
II. Linking SEEA-CF 2012 / FDES 2013 / Green Growth
III. SEEA 2012 and the SDG Indicators
IV. Experimental Ecosystem Accounting
V. Examples

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Thank you!

Michael Nagy
UNECE

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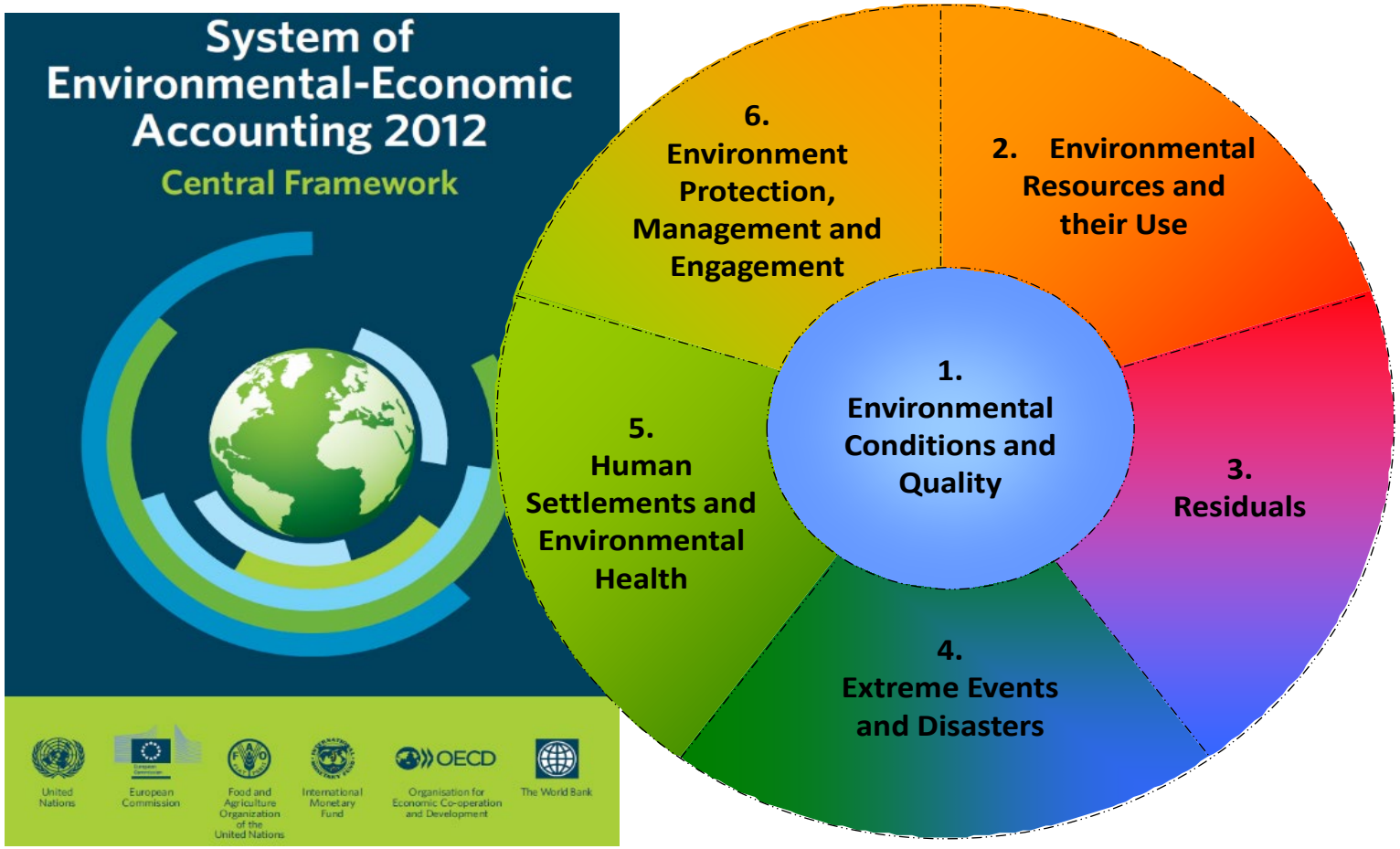
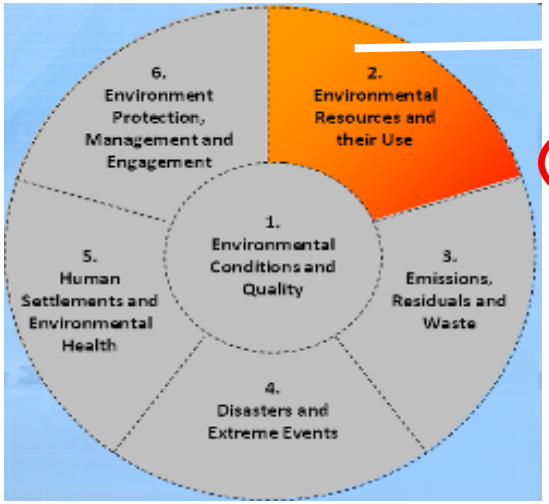
Annex I: The links between SEEA 2012 and FDES 2013

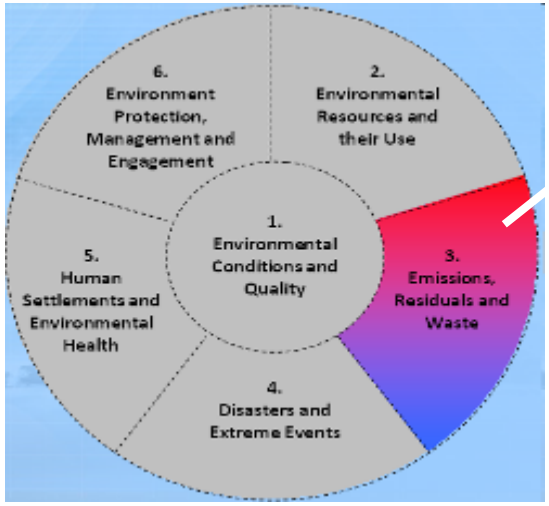




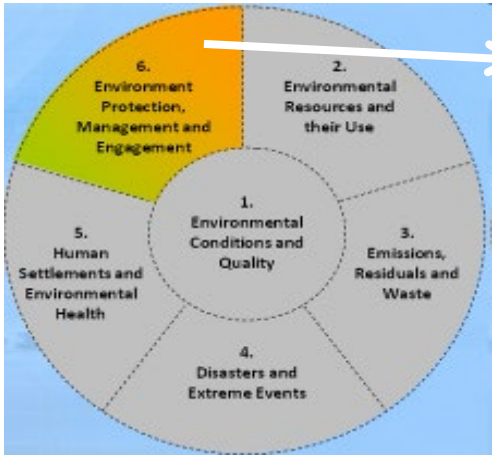
Asset Accounts

Component 2: Environmental Resources and their Use	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

Flow Accounts

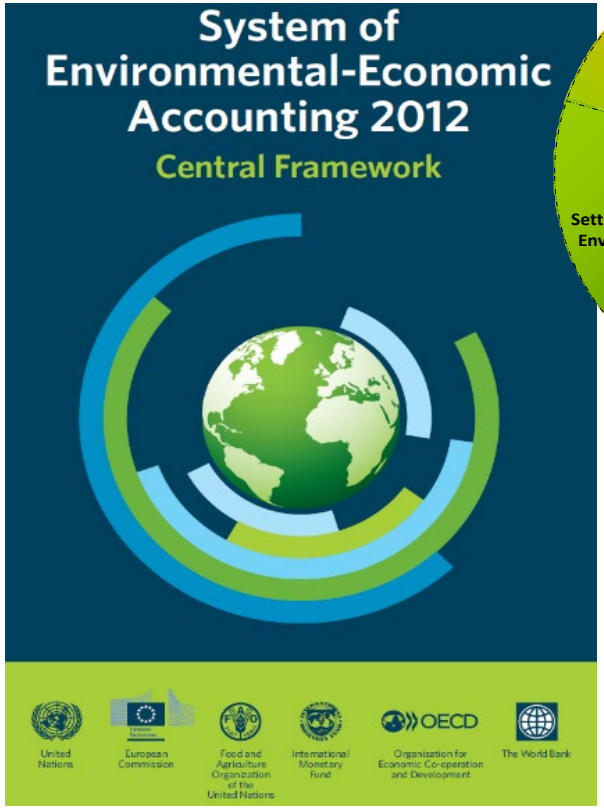


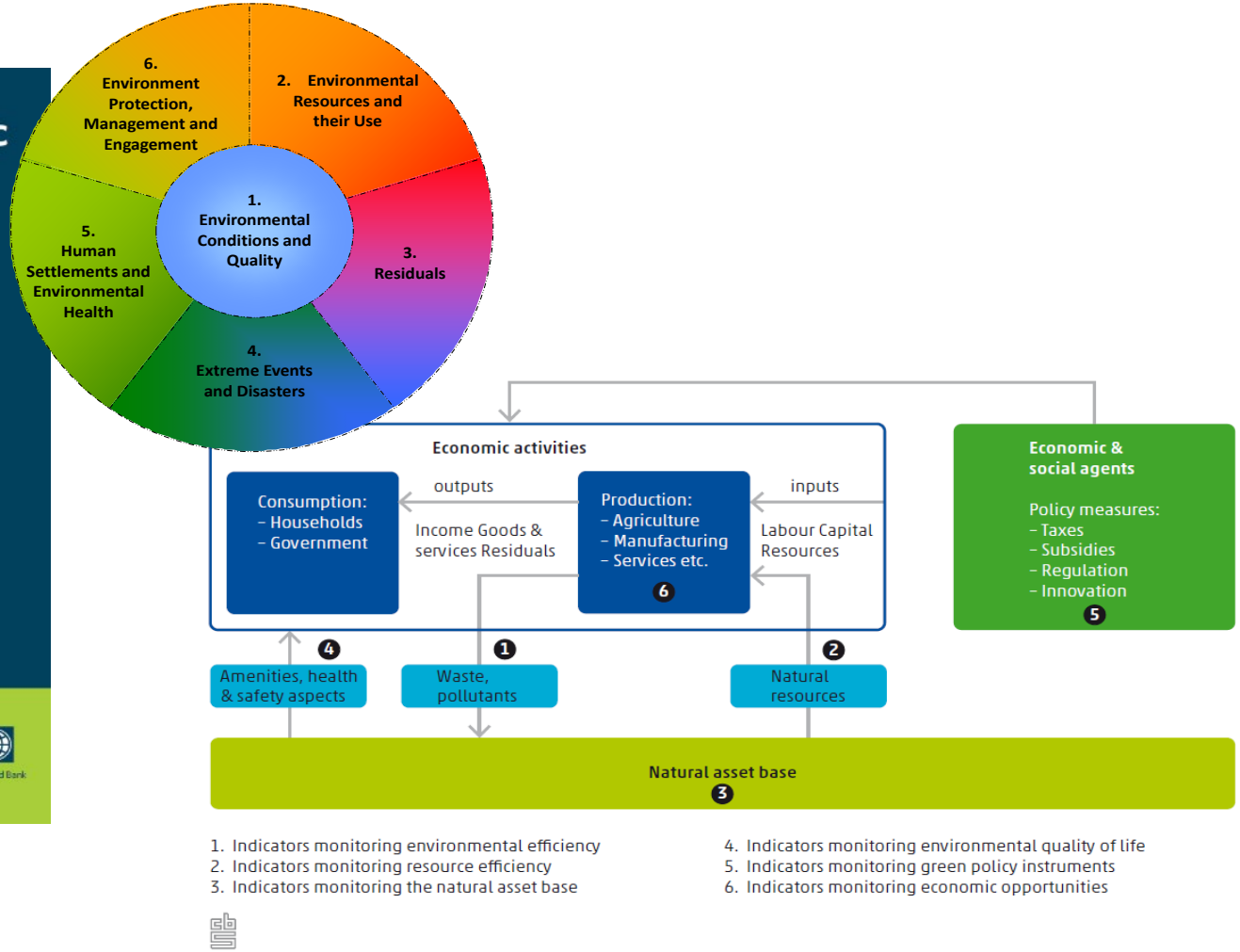
Component 3: Residuals	Sub-component 3.1: Emissions to Air Sub-component 3.2: Generation and Management of Wastewater Sub-component 3.3: Generation and Management of Waste



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

Annex II: 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

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.

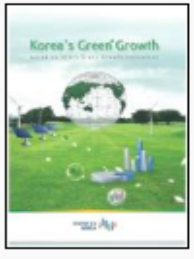
As part of its Green Growth Strategy, the OECD has developed a conceptual framework and indicators that help governments monitor progress towards green growth.

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.

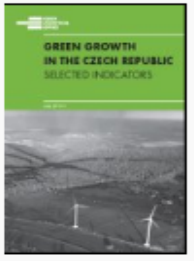
OECD green growth indicators in practice

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

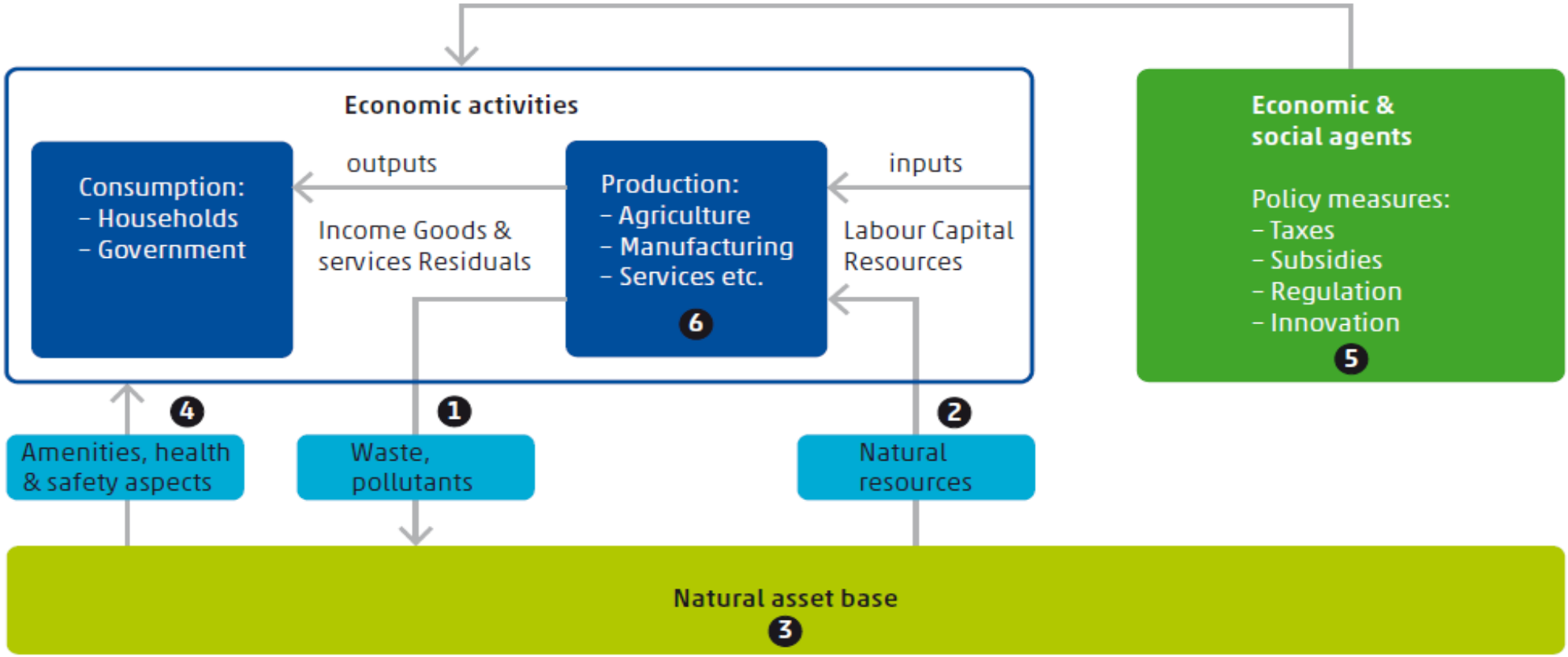


The Czech Republic

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 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		
		Waste treatment	X		
ii	Natural asset base	Stocks of standing timber	X		
		Fish inputs	X		
		Natural gas reserves	X		
		Land conversion into built-up land		X	
		Threats to biodiversity		X	
iii	Environmental quality of life	Pollution induced health problems			X
iv	Policy responses	Green patents			X
		Share of green taxes	X		
		Energy prices	X		
		Carbon trade	X		
		Environmental investments	X		
		Green jobs	X		

SEEA-CF 2012, FDES 2013, Green Growth

OECD Green Growth Categories / Potential Indicators	 FDES	Related to SEEA-CF
Environmental Quality of Life		
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: • **Health statistics related to air pollution?** • **Access to clean water, sewage treatment, waste treatment** • **Noise, volume of traffic (proxy for noise)**	5.2 Environmental Health 5.1.2 Access to water, sanitation 3.3.2 Mgmt of waste 1.3.5 Noise	Physical Flows
Monitoring economic opportunities and policy responses		
"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	 FDES	Related to SEEA-CF
Monitoring the Natural Asset Base		
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 III: SEEA 2012 and the SDG Indicators

SDG Indicators and the SEEA

- 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 and the Sustainable Development Goals (Status April 2016)

10 (out of 17) SDG goals are directly related to the environmental pillar:

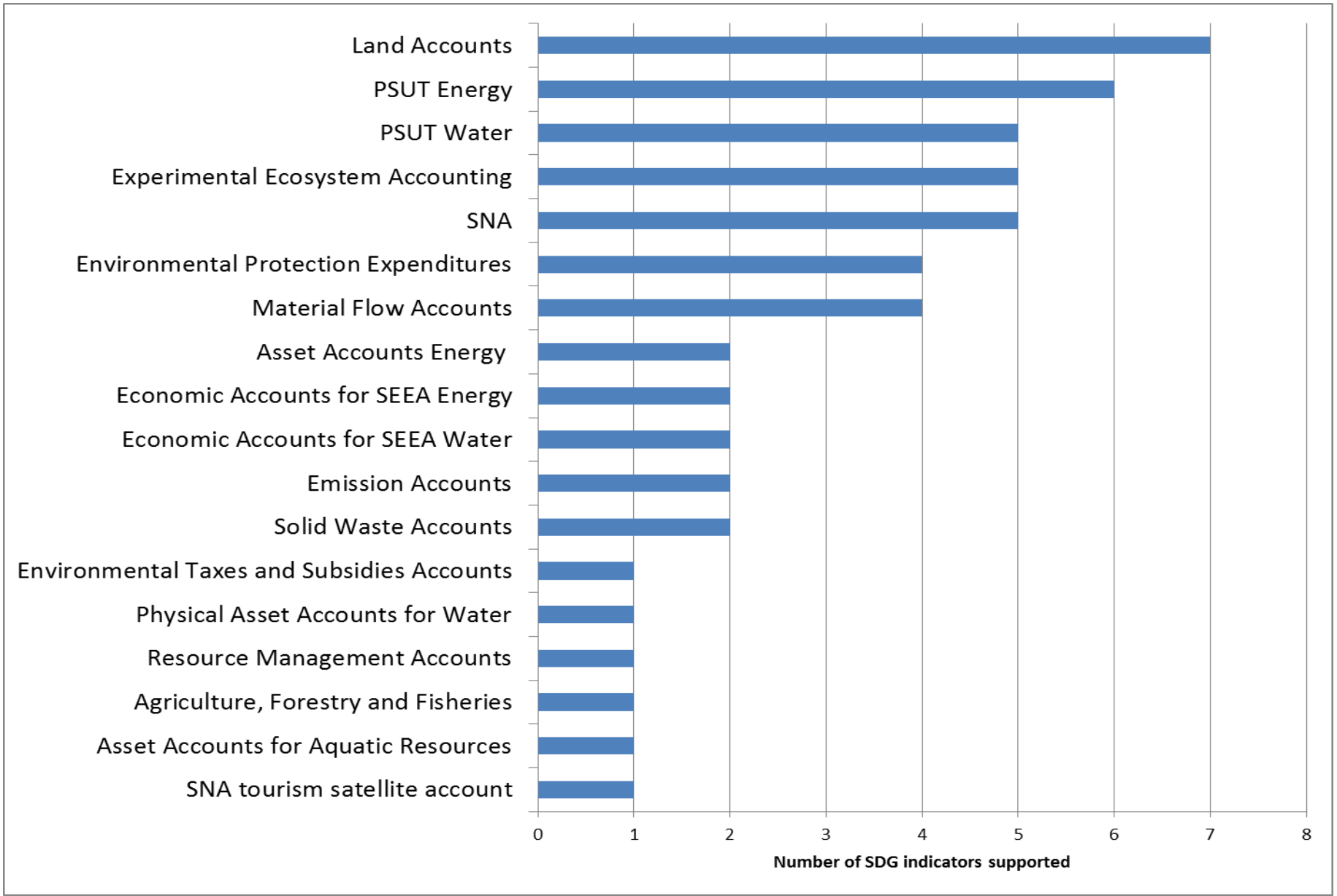
2 - Agriculture
6 - Water
7 – Energy
8 – Economic growth
9 – Industrialization
11 - Cities
12 - Consumption and production
13 - Climate change
14 - Marine and coastal
15 - Ecosystems

42 indicators of these goals can be informed by SEEA

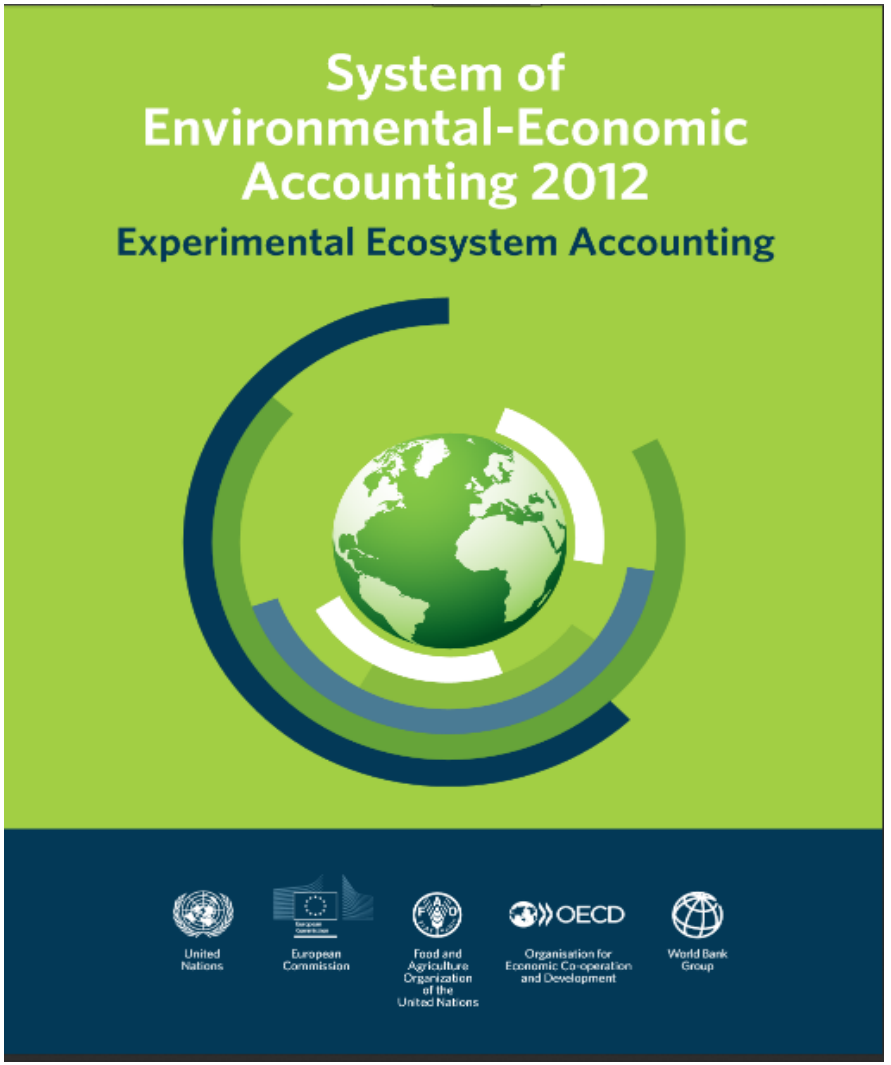
SEEA accounts informing more than 3 SDG indicators are:

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

SEEA Accounts informing SDG



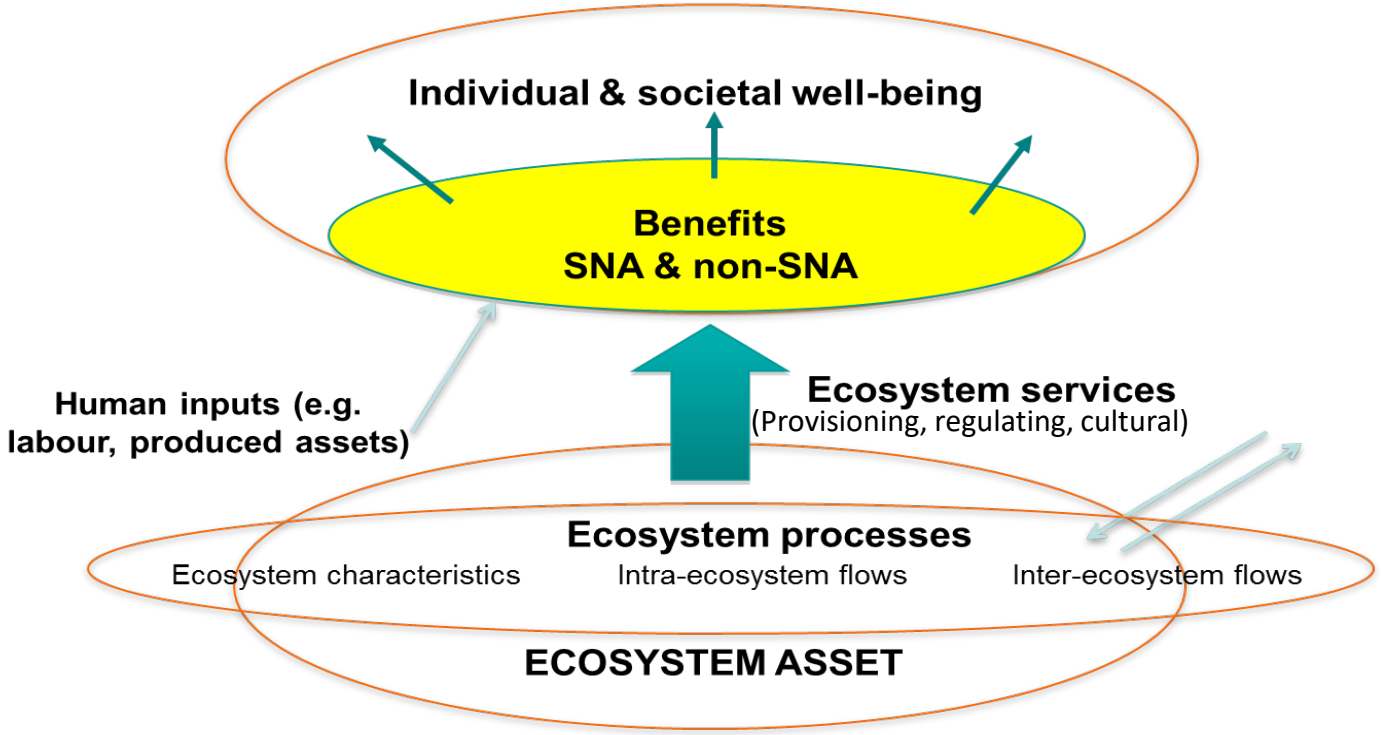
Annex IV: Experimental Ecosystem Accounting



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

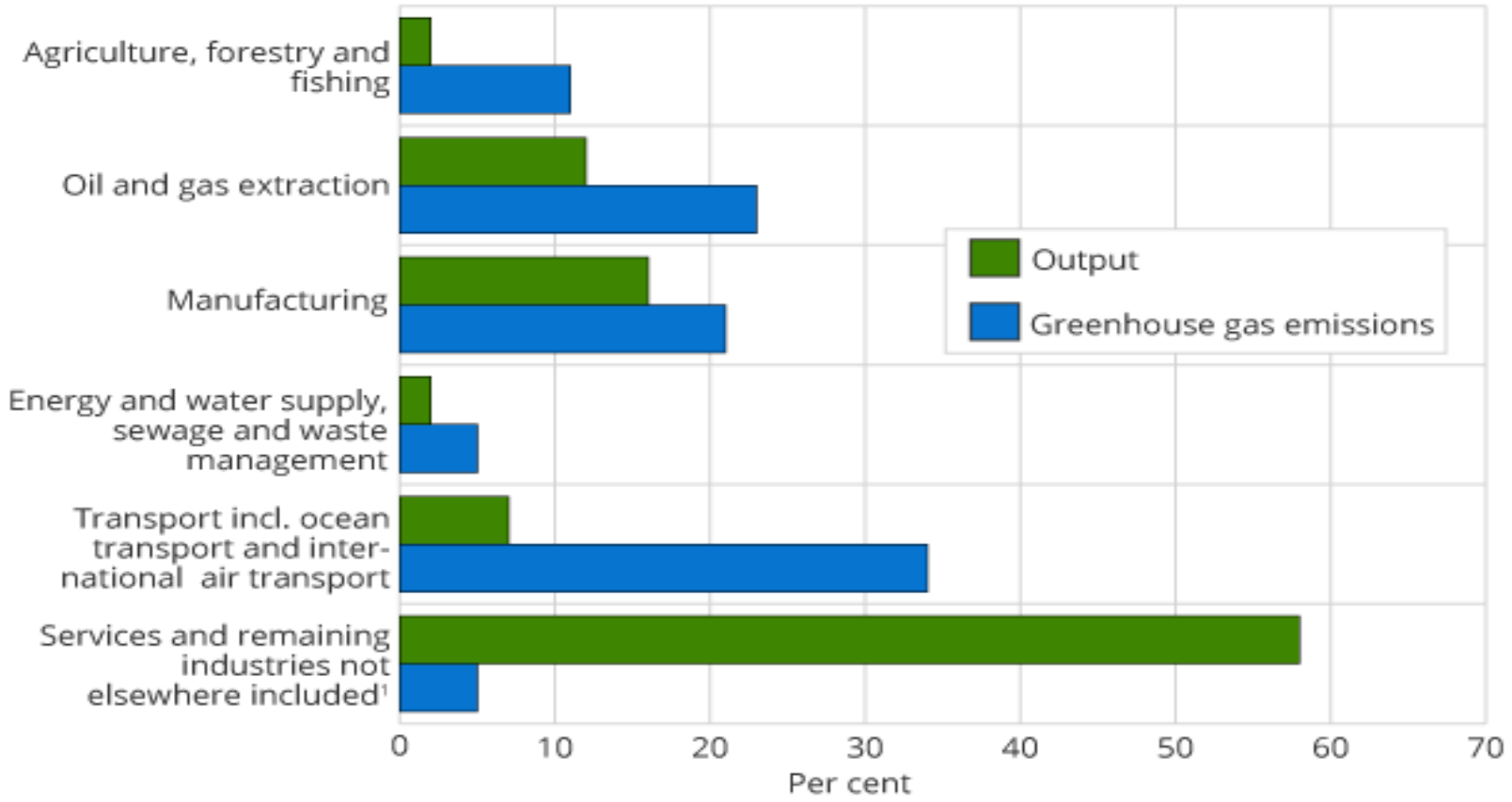
Relationship to SEEA Central Framework

- 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)

Annex V: Examples

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

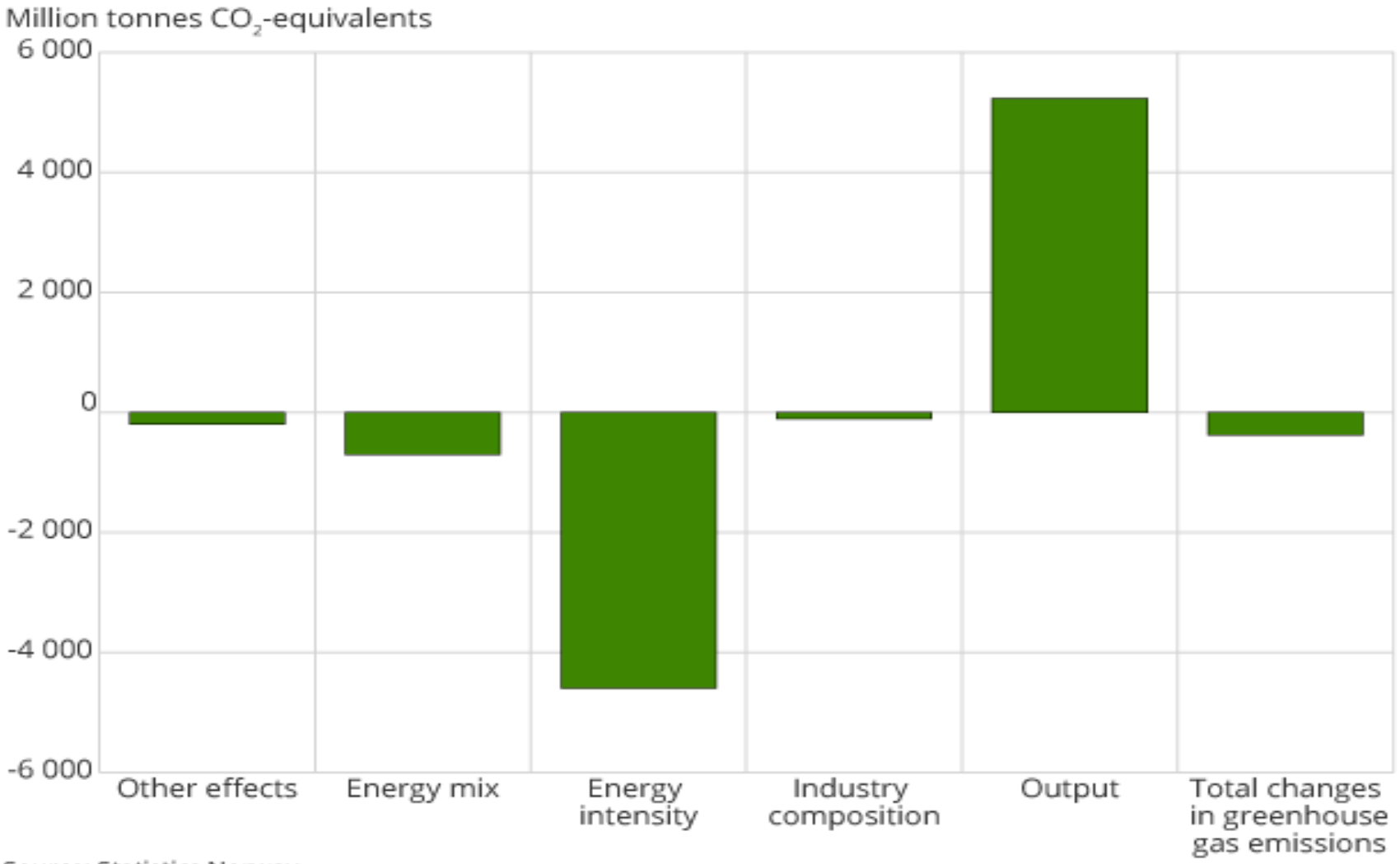
Figure 3. Greenhouse gas emissions (CO_2-equivalents) and output (fixed 2005-prices) divided according to industries and share of totals. 2012



[1] Services, energy and water supply and construction, education, health and social work and general government administration.
Source: Statistics Norway.

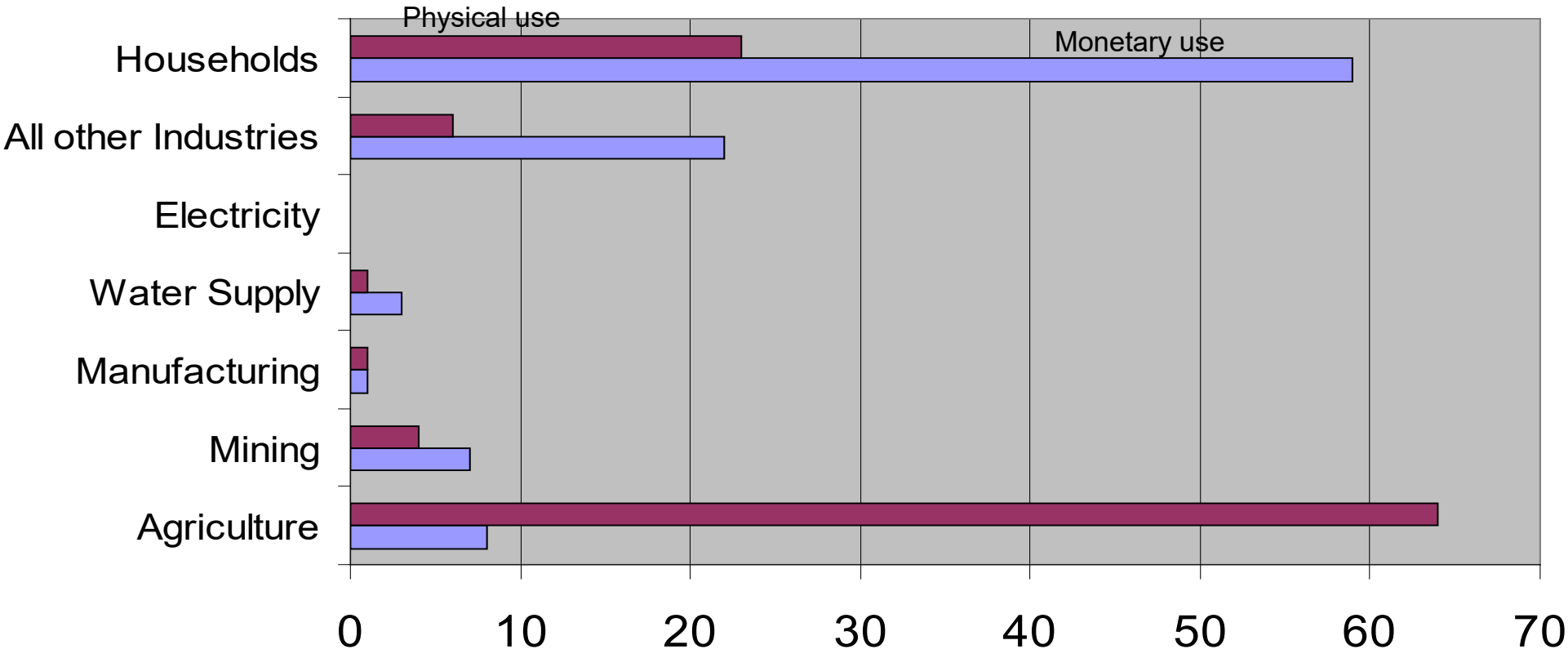
Example Norway (2/2): Decomposition Analysis – causes of the observed changes from one year to another

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



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

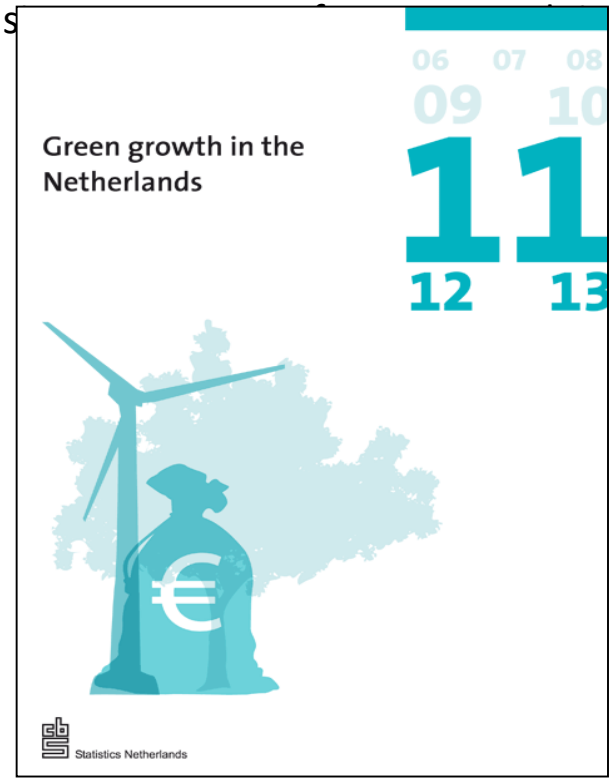
Based on historical water use & price data, simulated impact on GDP of doubling water prices and the expected increases in water use efficiency (WUE) of 1-2%

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

Netherlands: Measuring green growth

Objective:

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



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

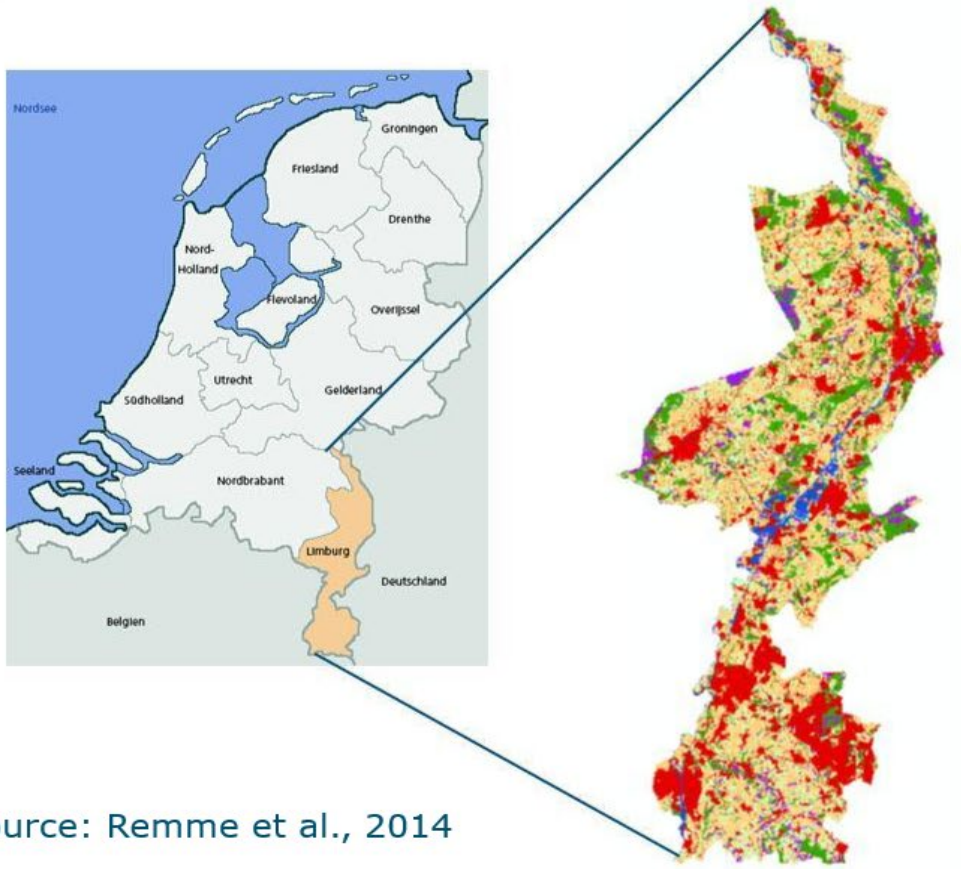
  → **List of 20 relevant indicators**

Project was completed in only 2 months

Ecosystem account example 1/3

Ecosystem production account example: Limburg province the Netherlands

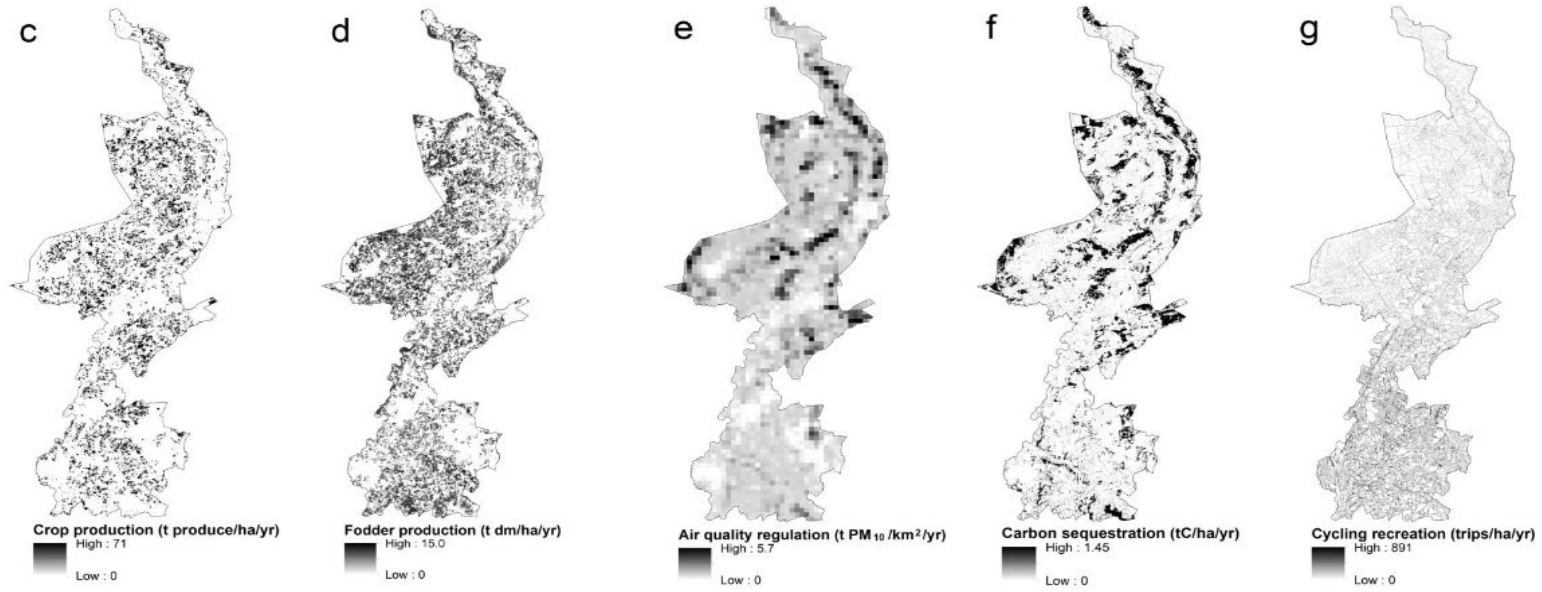
- Biophysical ecosystem account developed for Limburg Province, the Netherlands
- 2200 km², 1.1 million inhabitants
- Analysis of 7 ecosystem services



Source: Remme et al., 2014

Ecosystem account example 2/3

Ecosystem production accounts Limburg, NLs



Source: Remme et al., 2014

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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^{-1} yr^{-1}	ktons dm	kg dm ha^{-1} yr^{-1}	10^3 m^3 water	m^3 water ha^{-1} yr^{-1}	kg meat	kg meat km^{-2} yr^{-1}	tons PM_{10}	kg PM_{10} km^{-2} yr^{-1}	ktons C	kg C ha^{-1} yr^{-1}	10^3 trips	trips ha^{-1} yr^{-1}
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