

LINKING OF THE ECOSYSTEM AND AIR EMISSION ACCOUNTS: INTEGRATION OF THE NET CARBON SEQUESTRATION

Accounting for Human Induced Flows in Nature

Session B3: INCLUSION OF LULUCF IN AIR EMISSION ACCOUNTS

EXAMPLE

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UN London Group on Environmental Economic Accounting
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Relevance of air emission accounts for climate policy

Reasoning
why

- Currently, environmental economic accounts provide direct emissions data on the economy-environment nexus **but do not consider land use-related processes**.
- **Linked socioeconomic and environmental data** have already formed the basis for analyses related to the environmental intensity of production, the fairness of environmental taxes (i.e., whether polluters pay), and other aspects.
- In addition to direct emissions, sequestration and other comprehensive data regarding land and forest management need to be integrated.

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Reasoning: relevance of environmental economic accounts for climate policy on national level

Reasoning
why

?

The absence of land use related aspects has been identified **as an obstacle** to using environmental accounts data as a basis for mainstream climate policy debates in Estonia.

- Achieving **zero emissions by 2050** (which is part of international efforts to limit global warming to no more than 1.5°C above pre-industrial levels, as outlined in the Paris Agreement) **will have implications** for socioeconomic parameters, such as employment and value added in both carbon-sequestering and GHG-emitting activities.
- We started the extension of the accounts by testing the approach of **integrating the carbon sequestration information from ecosystem accounts to air emission accounts using land ownership as a distribution key**.
- Setting sequestration figures **in a comparable format** will help to integrate air emission accounts with economic data, facilitating more comprehensive analyses.

Analytical table represents the attempt to incorporate the land use dimension into our application

Air emission account: CO2, CO2 from biofuels, CH4

Economic parameters:

- Added value
- Export
- Employment
- Energy consumption
- Environmental taxes

Granularity: NACE A21

Year: 2020

To add :

Ecosystem account: ecosystem service, net carbon sequestration

DATA

Net carbon sequestration:

National Inventory Report of greenhouse gas emissions in Estonia

Ecosystem accounts:

global climate regulation ecosystem service: ecosystem contribution to reducing concentrations of greenhouse gases in the atmosphere through the removal (net sequestration)

Air emissions accounts (AEA)

Connecting carbon sequestration data with economic activities via **land ownership**

SCOPE OF THE CARBON-RELATED GREENHOUSE GAS REMOVALS

Carbon-related greenhouse gas emissions and removals, 2020, kt (kt=thousand tons).

Land-use category	CO2, kt	CO2-C, kt C (CO2 = 0.273C)	CH4, kt	CH4-C, kt C (CH4 = 0.75C)
A. Forest land	-193.4	-52.2	2.6	2.0
B. Cropland	413.7	111.7	NO,NE,NA	
C. Grassland	63.9	17.2	0.0	0.0
D. Wetlands	1 128.4	304.7	0.0	0.0
E. Settlements	375.8	101.5	NO,NE	
F. Other land	66.0	17.8	NO,NE	
G. Harvested wood products	-922.2			
H. Other (please specify)	NO			
Total LULUCF	932.2	251.7	2.7	2.0

Forests were the only land-use category in Estonia where carbon was sequestered rather than emitted.

Currently only positive net sequestration values (removals, „-“ in table) of ecosystem services have been considered, therefore other ecosystems which emit carbon and where net sequestration is negative, are excluded.

The signs for removals are negative (–) and for emissions positive (+)

Ownership of the land in ecosystem extent account

Ecosystem map



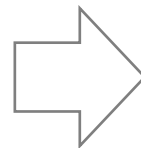
Land Cadastre



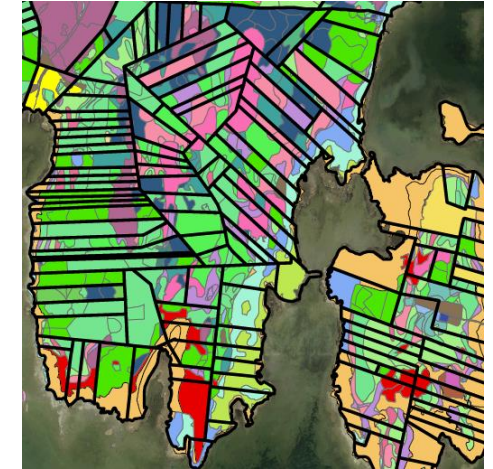
Statistical enterprise register



Ecosystem base map, Land Cadastre and statistical enterprise register data provided a basis for the creation of the ownership dimension in ecosystem extent account.



Merged dataset

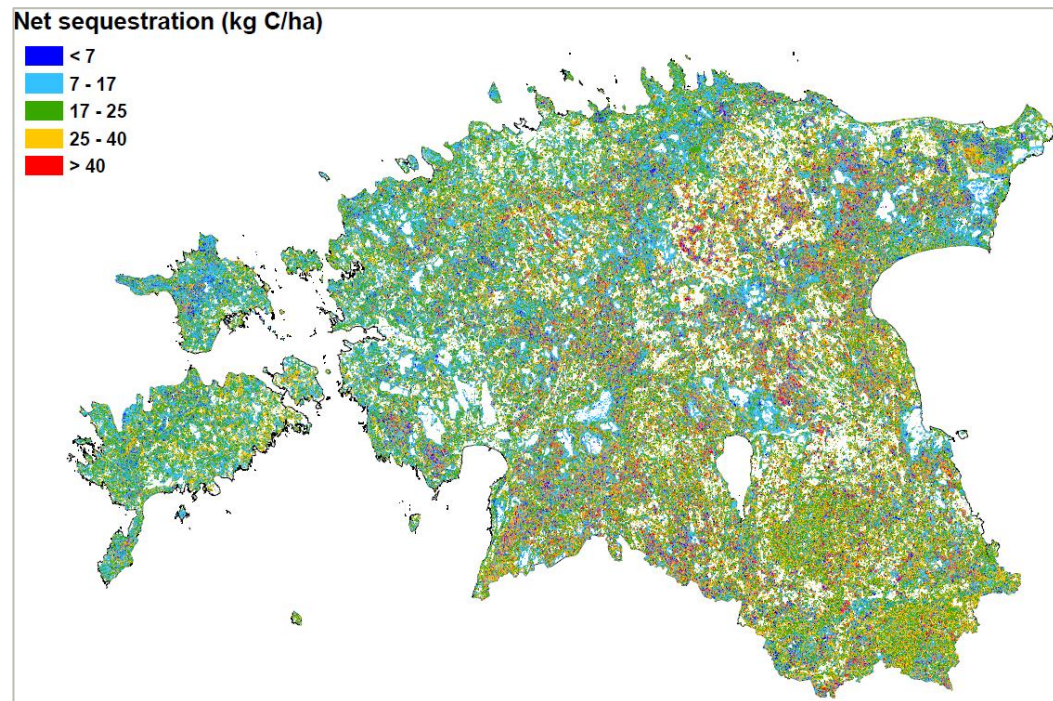


Opening extent account 2019, EUNIS Habitat classes and institutional sectors, ha

Institutional sector/ EUNIS ecosystem classification	General government	Corporations	...of which State Forest Management Centre	Households	Rest of the world	Un- known	TOTAL
Coastal	632	1556	1 353	644	100	65	2 997
Constructed, industrial and other artificial habitats	55 190	25 558	8 794	80 072	2 498	3 259	176 577
Grasslands and lands dominated by forbs, mosses or lichens	29 224	67 413	29 091	110 059	3 805	2 056	212 556
Habitat complexes	5 739	4 900	1 926	9 343	457	178	20 618
Heathland, scrub and tundra	3 333	5 027				189	3 970
Inland surface waters	11 354	21 603				1 242	43 095
Inland vegetated or sparsely vegetated habitats	19 420	27 300				1 709	68 894
Marine	2 439	7 576				132	10 507
Mires, bogs and fens	17 413	208 592	201 043	15 606	536	19 281	261 428
Regularly or recently cultivated agricultural, horticultural habitats	103 232	323 761	6 393	661 207	8 377	5 706	1 102 284
Woodland, forest and other wooded land	113 178	150 812	1 049 105	680 055	15 654	81 392	2 419 091
NA	202	464	303	357	15	23	1 062
TOTAL	361 356	2232562	1 334 720	1 603 376	33 954	115 232	4 346 480

More detailed levels are available in both dimensions

Two approaches to allocate the total value of carbon sequestration to economic activities



1. Net growth in live tree volume (annual increment of timber/forest stands).

Known as supply of global climate regulation ecosystem service: net carbon sequestration in ecosystem accounts: (2020)*

- Assumption: carbon sequestration strongly correlates with annual increment of forest stands
- The total value of carbon sequestration was distributed between economic activities of the users of the land based on spatial data of annual increment
- The increment is found for each forest stand compartment based on height, stand density and site quality class. Missing data were modeled based on majority tree species and site type.

2. Simpler approach based solely on **forest area**

- Carbon sequestration was considered to be correlated to the forest area and the total value of carbon sequestration was distributed between economic activities of the users of the land based solely on the proportion of the forest land belonging in an economic activity.

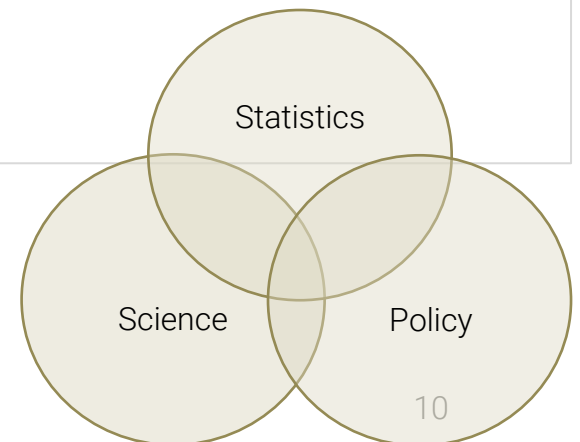
Carbon related greenhouse gases, net carbon sequestration(-) and economic indicators, 2020

	Air Emission Account			Human Induced Flows		Economic parameters				
	CO2	CO2 from biofuels	CH4	LULUCF— Net carbon sequestration		Added value, million EUR	Export, million EUR	Environmental taxes, million EUR	Employment, FTE	Energy consumption, TJ
				Method 1	Method 2					
Total industries	8 471.43	3 155.28	1 007.20	113,68	139,23	24 080,7	17 424,8	494,5	644 086,9	148 665,0
Agriculture, forestry and fishing	118,65	13,14	723,41	99,59	124,83	548,6	88,6	37,3	19 225,9	5 573,0
Crop and animal production	59,23	7,72	723,26	4,12	2,6	262,9	21,0	19,7	12 358,0	4 726,0
Forestry and logging	21,39	5,41	0,06	95,45	122,22	253,8	21,5	13,4	6 208,9	568,0
Fishing and aquaculture	38,02	0,01	0,09	0,01	0,01	31,9	46,2	4,2	659,0	279,0
Mining and quarrying	51,2	19,41	0,39	0,13	0,13	166,7	68,5	18,2	3 988,4	2 483,0
Manufacturing	1 669.04	756,48	5,91	0,79	0,59	3 524,2	7 470,4	76,9	119 032,1	23 921,0
Electricity, gas, steam and air conditioning supply	4 764.81	2 322.77	20,28	0,19	0,21	682,0	203,3	124,4	4 973,7	54 047,0
Water supply; sewerage; waste management	55,32	4,05	251,83	0,05	0,03	178,6	93,1	15,8	3 818,9	1 543,0
Construction	153,4	3,37	0,39	0,39	0,27	1 676,7	383,7	31,7	50 364,6	3 661,0
Wholesale and retail trade;	152,33	7,71	1,29	0,94	0,73	3 131,9	3 640,3	17,0	83 557,7	5 927,0
Transportation and storage	1 264.36	0,38	2,38	0,33	0,24	1 533,2	2 488,6	137,4	44 699,7	36 742,0
Accommodation and food service activities	32,78	2,52	0,41	0,32	0,23	299,5	84,7	1,4	24 860,4	941,0
Information and communication	9,51	0,22	0,03	0,05	0,05	1 814,2	1 444,5	2,5	30 836,4	1 084,0
Financial and insurance activities	4,87	0	0,03	0,08	0,03	1 212,5	121,9	1,1	12 618,8	175,0
Real estate activities	46,35	7,1	0,11	2,83	2	2 394,7	50,5	3,7	10 957,7	4 150,0
Professional, scientific and technical activities	25,97	0	0,05	0,35	0,25	1 417,6	789,5	4,4	30 956,0	704,0
Administrative and support service activities	51,13	0,06	0,07	0,26	0,2	851,4	393,7	5,8	22 082,7	693,0
Public administration and defense; compulsory social security	24,22	14,07	0,18	7,13	9,18	1 574,1	18,5	7,1	44 473,0	3 646,0
Education	12,91	1,69	0,1	0,03	0,02	1 253,9	10,0	3,2	61 841,2	1 136,0
Human health and social work activities	11,93	0,78	0,15	0,01	0,01	1 180,5	11,4	2,0	39 990,8	1 392,0
Arts, entertainment, and recreation	9,38	1,53	0,06	0,05	0,04	413,8	41,3	2,5	17 775,1	449,0
Other service activities, households as employers and household own-use production, extraterritorial organisations and bodies	13,25	0,00	0,12	0,18	0,14	226,5	22,0	2,0	18 033,7	400,0
Households	1 557.75	2 558.42	15,54	77,58	52,44			146,4		51748,0
NPISH				0,35	0,25					
Rest of the world				1,33	1,16					
Not specified				0,44	0,3					
Total	10 029.17	5 713.70	1 022.73	193,38	193,38					

Some observations



- General observation: it is good to have the data in comparable structure
- Estonia's net carbon sequestration is below 2% compare to emissions
- Households play a big role in sense of managing forest assets
- In order to be relevant wider coverage of processes in other assets is needed (carbon emissions from wetlands etc)
- Analyses and conclusions based on a single year are limited. Adding data for subsequent periods regarding sequestration to the data cube will facilitate analyses of changes and the effectiveness of measures at the economic activity level.



Possible next steps, national level

Climate
neutrality by
2050

Maintenance
of forests as
carbon sinks

Users interests:

Achieving zero emissions by 2050 will impact socioeconomic factors like employment and value added in both carbon-sequestering and GHG-emitting sectors.

Planned measures: reducing of logging, promoting reforestation, developing financial instruments and managing land use changes to minimize greenhouse gas emissions. requires comprehensive data on CO2 emissions and sequestration, integrated with socio-economic data.

- Continue with the analyses model
- Incorporating other ecosystem assets and also emissions (not just sequestration)
- Spatial data of LULUCF would give the needed detail for more precise and direct estimations of carbon sequestration and also help to consider other processes happening on individual assets.



WORK IN PROGRESS

STATISTICS
ESTONIA

Thank you!

Read more on related topic:

[Chance for Better Policy: Can Ecosystem Account Provide a Missing Link between the Services Provided by Ecosystems and the Land Owners;](#) UN London Group on Environmental Accounting, 2020; Kaia Oras (Statistics Estonia), Üllas Ehrlich (prof., Tallinn University of Technology), Kätlin Aun; (Statistics Estonia); Grete Luukas (Statistics Estonia)

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Work is closely related and partly carried out under Eurostat grants: „ Development of the forestry, environmental subsidies and ecosystem accounts 101022852 – 2020-EE-ENVAC“ and „ Development of environmental accounts, 101113157 - 2022-EE-EGD“.