Using satellite data for land accounts – moving from a central framework approach to ecosystem accounts

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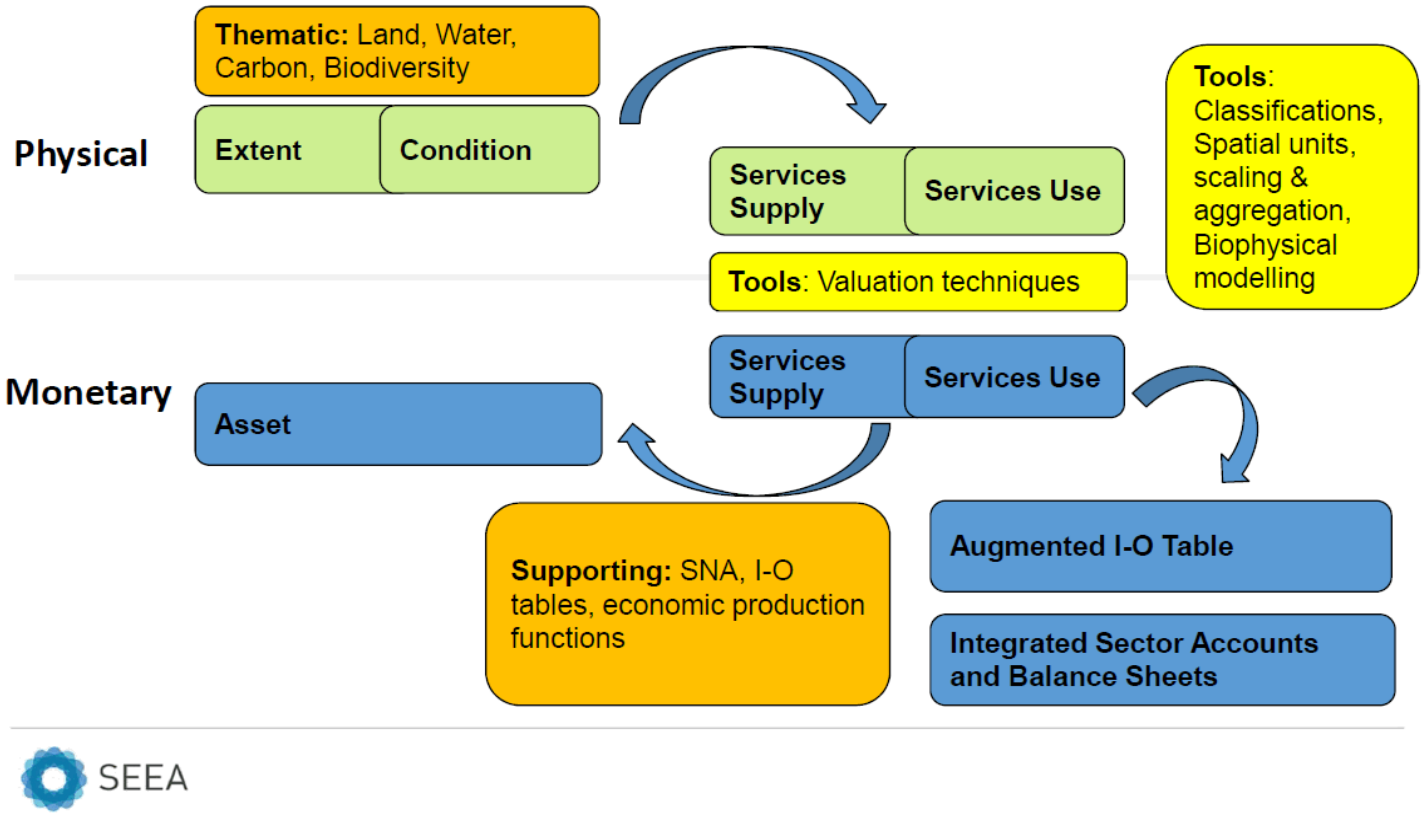
Using Satellite accounts for Land and ecosystem accounts



Land accounts

- Land account is central to economic and environmental accounting.
- Land account seeks to describe how land resource stocks change over time in a consistent and systematic way.
- Land account seeks to describe use of land as part of economic production and some of the issues that can be considered in the context of land accounts, i.e.:
  - impacts of urbanisation,
  - the intensity of crop and animal production,
  - the afforestation and deforestation,
  - …

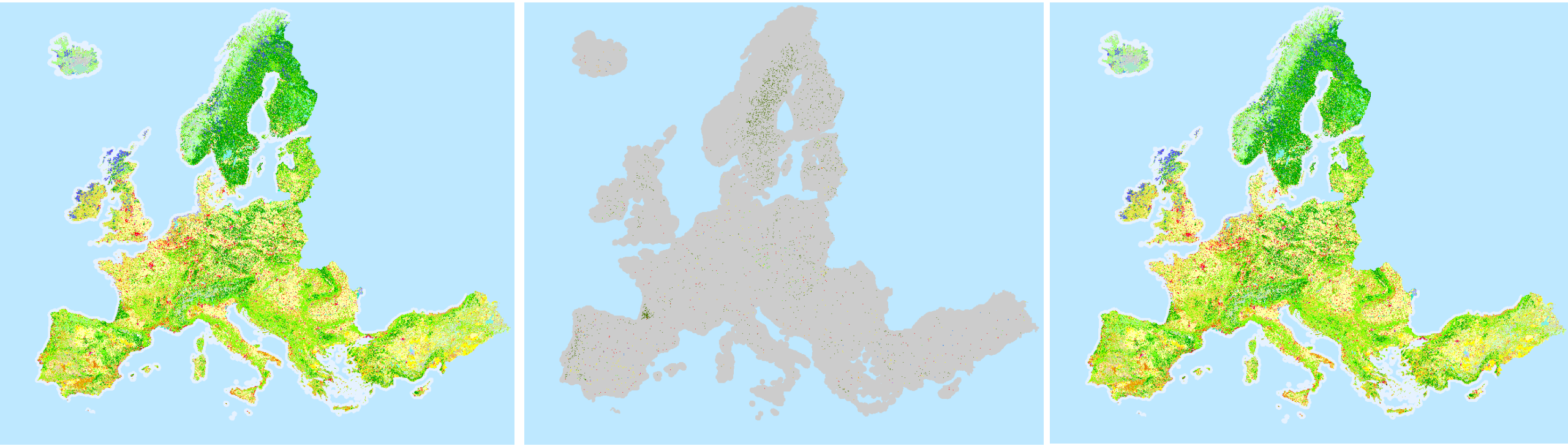
Ecosystem accounts

- Ecosystem extent accounts measure the changes in the area covered by ecosystems (and delineate ecosystems).
- The approach used at EEA and by KIP-INCA partners is based on the main ecosystem types used in MAES**.** These are broad ecosystem types that correspond to ecosystem assessment work and are developed from the data sets that are available at European level, mainly CORINE / Copernicus.
- Land accounts are closely linked to ecosystem extent account and use the same source data (Corine Land Cover)
- In the future Ecosystem extent accounts in Europe are expected to be based on a combination of improved land cover data (Sentinel 2) and biodiversity variables

Using satellite data for building land and ecosystem accounts

- Corine Land Cover (raster 100 m)

2006 | changes 2006-2012 | 2012



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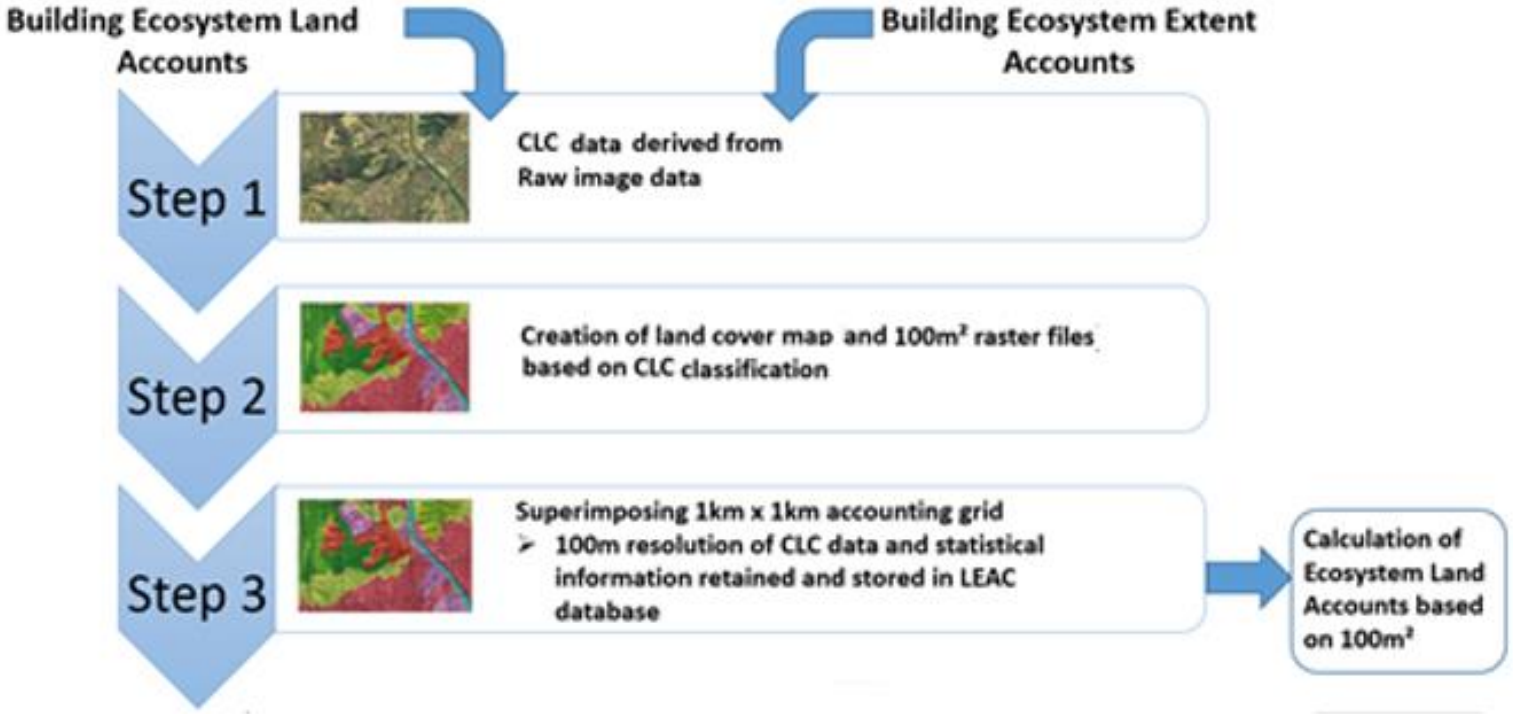


Process to build up land cover accounts and dominant land cover ecosystem type

Connecting classifications for land and ecosystem accounts

THE LAND COVER - ECOSYSTEM TYPES CLASSIFICATION

Ecosystem types			Correspondance with CLC classes	
MAES Ecosystem Types	LCET class	LCET label	CLC classes	CLC labels
1 - Urban	11	Urban and associated developed areas	111	Continuous urban fabric
			112	Discontinuous urban fabric
			121	Industrial or commercial units
			122	Road and rail networks and associated land
			123	Port areas
			124	Airports
			131	Mineral extraction sites
			132	Dump sites
			133	Construction sites
			141	Green urban areas
			142	Sport and leisure facilities
2 -Cropland	21	Rainfed herbaceous cropland	211	Non-irrigated arable land
	22	Irrigated herbaceous cropland	212	Permanent irrigated arable land
			213	Rice fields
	23	Agriculture plantations, permanent crops	221	Vineyards
			222	Fruit trees and berry plantations
			223	Olive trees
	24	Agriculture associations and mosaics	241	Annual crops associated with permanent crops
			242	Complex cultivation patterns
			244	Agro-forestry areas
			243	Agriculture land with significant areas of natural vegetation
3 - Grassland	31	Pastures and natural grassland	231	Pastures
			321	Natural Grassland
4 - Woodland and forest	41	Forest tree cover	311	Broad-leaved forest
			312	Coniferous forest
			313	Mixed forest
	42	Natural vegetation associations and mosaics	324	Transitional woodland shrub
5 - Heathland and shrub	51	Shrubland, bushland, heathland	322	Moors and heathland
			323	Sclerophyllous vegetation
6 - Sparsely vegetated land	61	Sparsely vegetated areas	333	Sparsely vegetated areas
	62	Barren land	331	Beaches, dunes and sand plains
			332	Bare rock
			334	Burnt areas
	63	Permanent snow and glaciers	335	Glaciers and perpetual snows
7 - Inland wetlands	71	Inland wetlands	411	Inland marshes
			412	Peatbogs
8 - Rivers and lakes	81	Inland water bodies	511	Water courses
			512	Water bodies
9 -Marine Inlets and transitional waters	91	Coastal wetlands	421	Salt marshes
			422	Salines
			423	Intertidal flats
	92	Coastal water bodies and inter-tidal areas	521	Coastal lagoons
			522	Estuaries
	93	Sea (interface with land)	523	Sea and Ocean

Classification of flows based on the 44X43 potential changes

lcf1	Urban land management
lcf2	Urban residential sprawl
lcf3	Sprawl of economic sites and infrastructures
lcf4	Agriculture internal conversions
lcf5	Conversion from forested & natural land to agriculture
lcf6	Withdrawal of farming
lcf7	Forests creation and management
lcf8	Water bodies creation and management
lcf9	Changes of Land Cover due to natural and multiple causes

Ecosystem extent accounts & land accounts

Stock and change account for European ecosystems, EEA 39 countries, 2006 – 2012 in km².

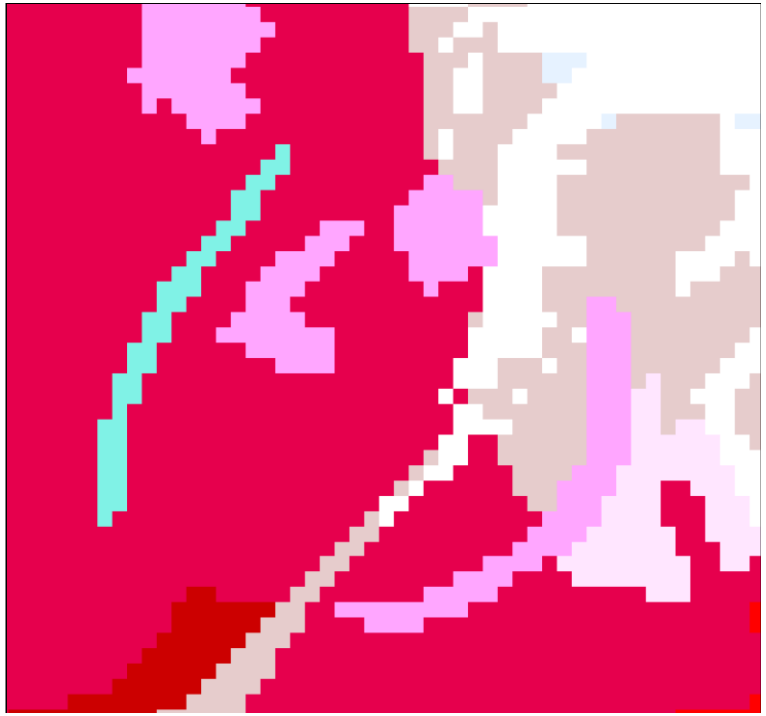
Area in km²	MAES ECOSYSTEM TYPES									
	1 Urban	2 Cropland	3 Grassland	4 Forest and woodland	5 Heathland and shrub	6 Sparsely vegetated land	7 Inland wetlands	8 Rivers and lakes	9 Marine Inlets and transitional waters	Total
Land extent 2006	**232,739**	**2,036,471**	**652,873**	**2,010,199**	**279,699**	**346,798**	**129,149**	**141,502**	**108,148**	**5,937,579**
lcf1 Urban land management	1,740	12	12	1	3			1		1,768
lcf2 Urban residential sprawl		645	142	66	6	6	-			866
lcf3 Sprawl of economic sites and infrastructures	150	3,137	975	974	184	128	37	14	47	5,646
lcf4 Agriculture internal conversion		5,986	2,190							8,176
lcf5 Conversions from forested and natural land to agriculture	296	87	186	465	131	48	51	32	3	1,299
lcf6 Withdrawal of farming		1,374	636							2,010
lcf7 Forest and management	154		298	67,271	299	783	71		-	68,877
lcf8 Water bodies creation and management	115	449	204	122	71	88		9		1,058
lcf9 Changes of land cover due to natural and multiple causes	87	126	81	873	560	1,129	29	217	48	3,151
Reductions to initial extent	**2,542**	**11,816**	**4,724**	**69,772**	**1,254**	**2,182**	**188**	**273**	**98**	**92,851**
lcf1 Urban land management	1,768									1,768
lcf2 Urban residential sprawl	866									866
lcf3 Sprawl of economic sites and infrastructures	5,646									5,646
lcf4 Agriculture internal conversion		5,798	2,378							8,176
lcf5 Conversions from forested and natural land to agriculture		935	364							1,299
lcf6 Withdrawal of farming		135	91	1,689	42	13	37		3	2,010
lcf7 Forest and management			72	68,709	42	53				68,877
lcf8 Water bodies creation and management						9		1,049		1,058
lcf9 Changes of land cover due to natural and multiple causes			343	4	501	1,839	211	208	45	3,151
Additions to initial extent	**8,280**	**6,868**	**3,248**	**70,402**	**585**	**1,914**	**248**	**1,257**	**48**	**92,851**
Net additions to initial land extent (additions - reductions)	+ 5,738	- 4,948	- 1,476	+ 630	- 669	- 268	+ 60	+ 984	- 50	
Net additions as % of initial extent	+ 2.5	- 0.2	- 0.2	+ 0.0	- 0.2	- 0.1	+ 0.0	+ 0.7	- 0.0	
Turnover of land extent (additions + reductions)	10,822	18,684	7,972	140,174	1,839	4,096	436	1,530	146	185,702
Turnover as % of initial land extent	4.6	0.9	1.2	7.0	0.7	1.2	0.3	1.1	0.1	3.1
Stable land extent	230,196	2,024,655	648,149	1,940,426	278,444	344,616	128,961	141,230	108,051	5,844,728
% of stable land extent	98.9	99.4	99.3	96.5	99.6	99.4	99.9	99.8	99.9	98.4
Land extent 2012	**238,476**	**2,031,524**	**651,397**	**2,010,828**	**279,030**	**346,530**	**129,208**	**142,487**	**108,099**	**5,937,579**

source: EEA/Copernicus CLC V18.5

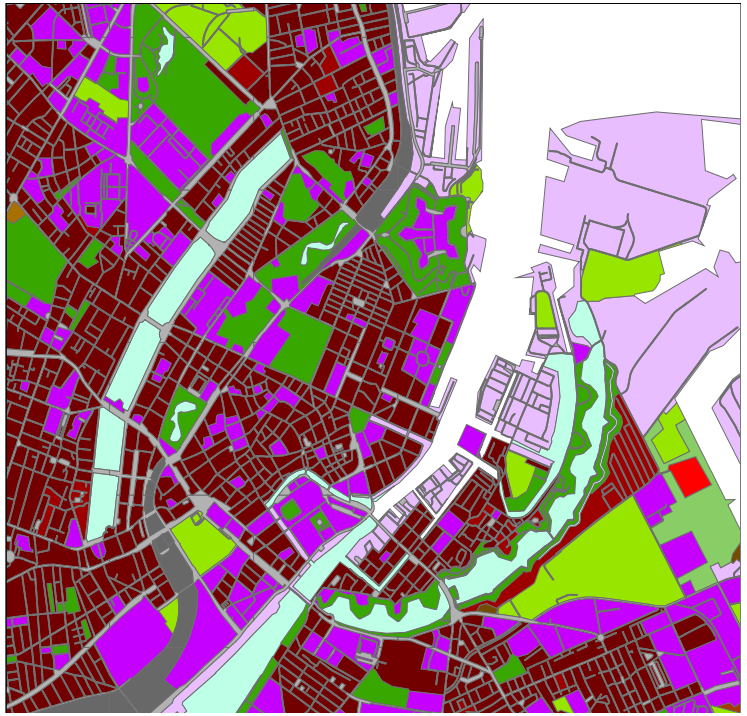
Using satellite data for urban accounts

- Urban Atlas
  - Corine Land Cover is used for European/country accounts
  - For small area it is better to use satellite data with a better precision
  - Copernicus in-situ products are seamless, fully nested

Centre of Copenhagen (CLC)

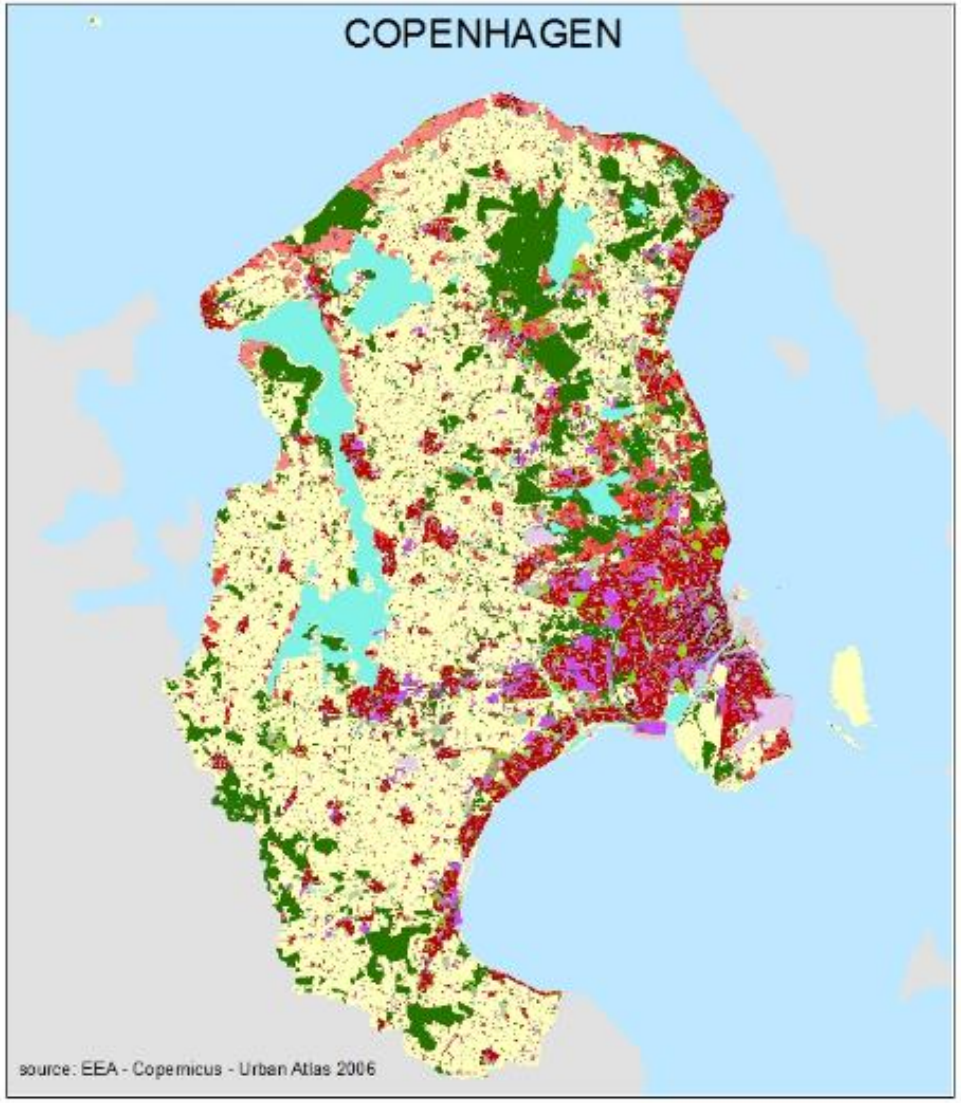


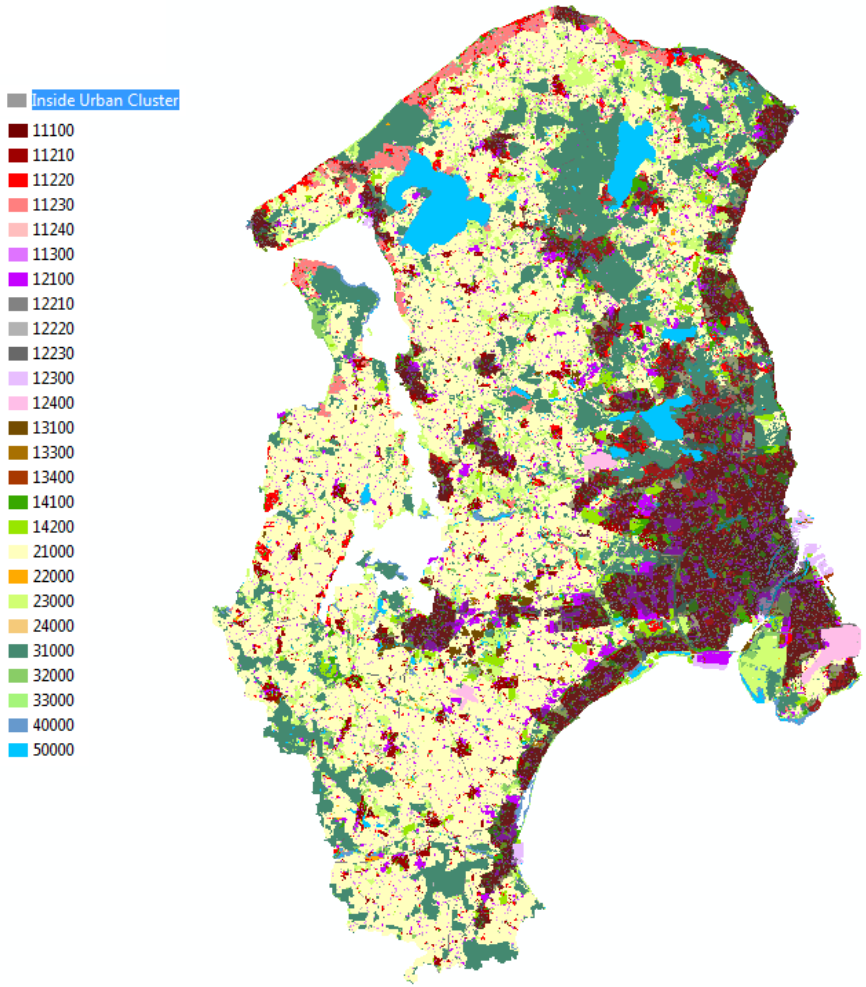
Centre of Copenhagen (Urban Atlas)



Using satellite data for urban accounts

Urban atlas data combined with urban cluster





Using satellite data for urban accounts

	Urban Ecosystem types							
Inside URBAN CLUSTER	1 Artificial surfaces				2 Cropland and natural areas	3 Forests	5 Water	Total
Area in ha	11 Urban fabric	12 Industrial, commercial and transport units	13 Mine, dump and construction sites	14 Artificial, non-agricultural vegetated areas	20 Agricultural,natural and wetland areas	31 Forests and transitional woodland	50 Water bodies	
Ecosystem extent 2006	27,080	12,820	717	6,211	3,718	2,144	638	53,329
Reductions to ecosystem extent	15	26	311	34	151	40	9	585
Additions to ecosystem extent	262	143	145	4	22	-	9	585
Net changes to ecosystem extent (additions - reductions)	+ 247	+ 117	- 166	- 30	- 129	- 40	+ 0	
Net changes as % of initial extent	+ 0.9	+ 0.9	- 23.2	- 0.5	- 3.5	- 1.9	+ 0.0	
Total turnover of ecosystem extent (additions + reductions)	277	169	456	38	173	40	18	1,170
Total Turnover as % of initial extent	1.0	1.3	63.6	0.6	4.7	1.9	2.8	2.2
No change in ecosystem extent	27,065	12,794	407	6,177	3,568	2,104	630	52,744
% of no changed ecosystem extent	99.9	99.8	56.8	99.5	96.0	98.1	98.7	98.9
Ecosystem extent 2012	27,327	12,937	551	6,181	3,590	2,104	639	53,329

	Urban Ecosystem types							
Outside URBAN CLUSTER	1 Artificial surfaces				2 Cropland and natural areas	3 Forests	5 Water	Total
Area in ha	11 Urban fabric	12 Industrial, commercial and transport units	13 Mine, dump and construction sites	14 Artificial, non-agricultural vegetated areas	20 Agricultural,natural and wetland areas	31 Forests and transitional woodland	50 Water bodies	
Ecosystem extent 2006	19,180	13,474	1,887	6,457	135,325	40,534	9,166	226,024
Reductions to ecosystem extent	10	15	830	11	1,200	383	65	2,511
Additions to ecosystem extent	350	433	640	379	615	-	94	2,511
Net changes to ecosystem extent (additions - reductions)	+ 340	+ 418	- 190	+ 368	- 585	- 383	+ 29	
Net changes as % of initial extent	+ 1.8	+ 3.1	- 10.1	+ 5.7	- 0.4	- 0.9	+ 0.3	
Total turnover of ecosystem extent (additions + reductions)	360	448	1,470	390	1,815	383	159	5,022
Total Turnover as % of initial extent	1.9	3.3	77.9	6.0	1.3	0.9	1.7	2.2
No change in ecosystem extent	19,171	13,459	1,057	6,446	134,126	40,151	9,101	223,511
% of no changed ecosystem extent	100.0	99.9	56.0	99.8	99.1	99.1	99.3	98.9
Ecosystem extent 2012	19,521	13,893	1,697	6,825	134,741	40,151	9,195	226,024

source : EEA-Copernicus Urban Atlas - Eurostat : Urban Cluster

Some first conclusions

- Use of satellite data is useful to develop land and ecosystem extent accounts but we need comparability in space and time.
- Use different types of satellite data according to the scope of your accounts
- Do not forget that SEEA is for national accounts with links between economy and environment
  - Continue to continue to develop at the same time Land accounts and Ecosystem extent accounts as linked accounts
  - Land and ecosystem extent accounts are a starting point to develop a complete ecosystem accounting with ecosystem condition accounts, ecosystem services accounts and integration to economic accounts.