CREEA - Compiling and Refining Environmental and Economic Accounts

WP 6: Climate Change issues and Kyoto Accounting

Task 2: Land use cover change accounts

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About CREEA

The main goal of CREEA is to refine and elaborate economic and environmental accounting principles as discussed in the London Group and consolidated in the future SEEA 2012, to test them in practical data gathering, to troubleshoot and refine approaches, and show added value of having such harmonized data available via case studies. This will be done in priority areas mentioned in the call, i.e. waste and resources, water, forest and climate change / Kyoto accounting. In this, the project will include work and experiences from major previous projects focused on developing harmonized data sets for integrated economic and environmental accounting (most notably EXIOPOL, FORWAST and a series of EUROSTAT projects in Environmental Accounting). Most data gathered in CREEA will be consolidated in the form of Environmentally Extended Supply and Use tables (EE SUT) and update and expand the EXIOPOL database. In this way, CREEA will produce a global Multi-Regional EE SUT with a unique detail of 130 sectors and products, 30 emissions, 80 resources, and 43 countries plus a rest of world. A unique contribution of CREEA is that also SUT in physical terms will be created. Partners are:

1. Nederlandse Organisatie Voor Toegepast Natuurwetenschappelijk Onderzoek (TNO), Netherlands (co-ordinator)
2. JRC -Joint Research Centre- European Commission (DG JRC IPTS), Belgium /Spain
3. Universiteit Leiden (Unileiden), Netherlands
4. Centraal Bureau voor de Statistiek (CBS), Netherlands
5. Norges Teknisk-Naturvitenskapelige Universitet (NTNU), Norway
6. Statistiska Centralbyran (SCB), Sweden
7. Universiteit Twente (TU Twente), Netherlands
8. Eidgenössische Technische Hochschule Zürich (ETH) Switzerland
9. 2.-0 LCA Consultants Aps (2.-0 LCA), Denmark
10. Wuppertal Institut Fur Klima, Umwelt, Energie Gmbh. (WI), Germany
11. SERI - Nachhaltigkeitsforschungs Und –Kommunikations Gmbh (SERI) Austria
12. European Forest Institute (EFI), Finland / Spain

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Executive Summary

Land use and total (or gross) land use change data were analysed with focus on UNFCCC national inventory data and CORINE land cover data, and in comparison with FAO data and specific national data. For the European countries for which CORINE data are available this data base represents in most cases the preferable one with regard to land use change. The data quality and comprehensiveness however differs a lot between the individual countries. Due to restricted or unclear data availability other global or international data bases could not be used to derive data for gross land use change. Data from FAO and in particular the Global Forest Resources Assessment could be used to indirectly estimate net land use changes such as cropland expansion as a result of deforestation. This was not further elaborated here but specific studies on the issue exist.

Allocation of land use (occupation) to industry sectors in SUTs can be done following the common approach for environmental extension data (see report to WP 7: Provision of data on land use by country and category).

Alignment of land use / land cover accounts with SEEA 2012 is currently hampered due to different classification systems. Further, available data do not fit with proposed SEEA categories which are characterised as being provisional.

With regard to land use change, our proposal is to keep it in a separate account by country/region which might be aggregated to a global account once comprehensive, harmonised data sets were available. The effects on land use change could then be included by linking the land occupation (as above) to the global market for land (the global LUC matrix).

A summary of the status of land use change data for 2007 in CREEA is given in Table 0.1. As envisaged in the DoW, complete land use/land cover change accounts – by categories given in the national inventory reports - could be obtained for most Annex I countries in CREEA (twenty-nine in total out of 35) – even though using Corine land cover data for most of them. For six Annex I countries listed in CREEA, LUC data were incomplete, i.e. Australia, Canada, United Kingdom, Greece, Japan, USA. Besides these there are some more Annex I countries not detailed in CREEA for which LUC data are available: Liechtenstein and Ukraine (complete, as well as for the EU-27 aggregated), Belarus, Croatia, Iceland and Monaco (incomplete). For the Non-Annex I CREEA countries Brazil, China, Indonesia, India South Korea, Mexico, Taiwan and South Africa there were no data available.

Table 0.1: Status of land use change data in CREEA

Country/Region	Code	Source	Status	Remarks	Annex I	Annex II
Australia	AU	UNFCCC	incomplete	some data included elsewhere; no data for land use change related to settlements	Annex I	Annex II
Austria	AT	CORINE	complete		Annex I	Annex II
Belgium	BE	CORINE	complete		Annex I	Annex II
Bulgaria	BG	CORINE	complete		Annex I	
Brazil	BR	no data				
Canada	CA	UNFCCC	incomplete	some data not estimated; no data at all related to grasslands and to other land	Annex I	Annex II
Switzerland	CH	UNFCCC	complete		Annex I	Annex II
China P.R.	CN	no data				
Cyprus	CY	CORINE	complete		Annex I	
Czech Republic	CZ	CORINE	complete		Annex I *	
Germany	DE	CORINE	complete		Annex I	Annex II
Denmark	DK	CORINE	complete		Annex I	Annex II
Estonia	EE	CORINE	complete		Annex I	
Spain	ES	CORINE	complete		Annex I	Annex II
Finland	FI	CORINE	complete		Annex I	Annex II
France	FR	CORINE	complete		Annex I	Annex II
United Kingdom	GB	UNFCCC	incomplete	some data not estimated or included elsewhere; no data at all related to wetlands and to other land; no data for settlements remaining settlements	Annex I	Annex II
Greece	GR	UNFCCC	incomplete	several data not estimated; change in settlements area seems far too low	Annex I	Annex II
Hungary	HU	CORINE	complete		Annex I	
Indonesia	ID	no data				
India	IN	no data				

Ireland	IE	CORINE	complete		Annex I	Annex II
Italy	IT	UNFCCC	complete		Annex I *	Annex II
Japan	JP	UNFCCC	incomplete	several data included elsewhere; change in settlements area seems far too high	Annex I	Annex II
South Korea	KR	no data				
Lithuania	LT	CORINE	complete		Annex I	
Luxembourg	LU	CORINE	complete		Annex I	Annex II
Latvia	LV	CORINE	complete		Annex I	
Mexico	MX	no data				
Malta	MT	CORINE	complete		Annex I	
Netherlands	NL	UNFCCC	complete		Annex I	Annex II
Norway	NO	CORINE	complete		Annex I	Annex II
New Zealand	NZ	UNFCCC	complete		Annex I	Annex II
Poland	PL	CORINE	complete		Annex I	
Portugal	PT	CORINE	complete		Annex I	Annex II
Romania	RO	CORINE	complete		Annex I	
Russia	RU	UNFCCC	complete		Annex I *	
Sweden	SE	CORINE	complete		Annex I	Annex II
Slovenia	SI	CORINE	complete		Annex I *	
Slovakia	SK	CORINE	complete		Annex I *	
Taiwan	TW	no data				
Turkey	TR	CORINE	complete		Annex I *	
USA	US	UNFCCC	incomplete	several data included elsewhere or not estimated; no wetlands and no other land data	Annex I	Annex II
South Africa	ZA	no data				
RoW Europa	WE	no data				
RoW Americas	WL	no data				
RoW Asia & Pacific	WA	no data				
RoW Africa	WF	no data				

RoW Middle East	WM	no data				
European Union	EU	UNFCCC	complete		Annex I	
Belarus	BY	UNFCCC	incomplete	some data not estimated or included elsewhere; almost no data of land use change at all; no data at all related to settlements	Annex I *	
Croatia	HR	UNFCCC	incomplete	only very few data at all	Annex I *	
Iceland	IS	UNFCCC	incomplete	some data not estimated or included elsewhere	Annex I	Annex II
Liechtenstein	LI	UNFCCC	complete		Annex I *	
Monaco	MC	UNFCCC	incomplete	data only for parks and gardens	Annex I *	
Ukraine	UA	UNFCCC	complete		Annex I *	

Notes:

* Party for which there is a specific COP and/or CMP decision

1 Work plan from DoW

The work on task 2 will comprise the following elements:

1. Screening of existing data sets under Kyoto national inventory reports with regard to land use, land use change, land cover and land cover change[1];
2. Expansion of data sets to other countries and categories not included under Kyoto reports to cover all countries of the EXIOPOL database. To this end, international data bases like FAOSTAT or those for land use and land cover like CORINE land cover will be screened. Eventual remaining data gaps may be filled via qualified estimates;
3. Allocation of the land data to the sectors of EXIOPOL and adjustment to the SEEA 2012 structure based on expertise within the project team (Schenau 2009). Hence, a clear effort will be made to obtain global, country and sector specific LULUCF data in such a way that it can be included in an integrated environmental and economic accounting database like the EXIOPOL database.

We feel rather certain this can be achieved for at least most of the Annex 1 countries, but at this stage cannot promise this for non-Annex 1 countries.

[1] Land cover refers to the physical and biological cover over the surface of land, including water, vegetation, bare soil, and/or artificial structures. Land use is a more complicated term. Natural scientists define land use in terms of syndromes of human activities such as agriculture, forestry and building construction that alter land surface processes including biogeochemistry, hydrology and biodiversity. Social scientists and land managers define land use more broadly to include the social and economic purposes and contexts for and within which lands are managed (or left unmanaged), such as subsistence versus commercial agriculture, rented vs. owned, or private vs. public land. While land cover may be observed directly in the field or by remote sensing, observations of land use and its changes generally require the integration of natural and social scientific methods (expert knowledge, interviews with land managers) to determine which human activities are occurring in different parts of the landscape, even when land cover appears to be the same. In this inventory there is no strict differentiation made between land use and land cover, so the commonly used term land use includes both.

2 Approach and results

The general approach follows the DoW and includes in particular detailed analysis of the available national inventory submissions of Annex I countries to UNFCCC and Kyoto Protocol in Tables 5A to 5F (2.1). Another important source for total land use change data in European countries is the CORINE land cover data base which was analysed in a comparative manner, along with a couple of other international and global data bases and approaches potentially fit to estimate land use change (2.2). Allocation of the land data to the sectors of EXIOPOL and adjustment to the SEEA 2012 structure is work in progress (2.3).

2.1 Kyoto national inventory reports

The data were downloaded from the UNFCCC national inventory submission 2012 website[2] as Excel files for one year starting from 1990 to the most recent year. Here, 2007 was chosen as reference year of the CREEA data base (see Table A.1 in Annex for characterisation of completeness of the data for 2007). The original tables 5A to 5F were then transferred into a matrix showing land use conversion in 2007 in a common format (Table 2.1).

Table 2.1 shows as an example land use change data from the Kyoto report for Austria in 2007. White cells show conversion (in 1000 hectares) from one of the six land use categories to another category, grey cells show the remaining land use of the respective category in diagonal. Values from white cells in a row result in total gross conversion to all categories. Values from white cells in a column result in total gross expansion from all categories. From these data, net conversion resp. net expansion can be calculated. Total (final) land area of each category results from the sum of each column of white and grey cells. For settlements, the total land area is further expressed in ha per day which is an indicative value for the territorial land use change rate. The sum value of total land represents the country's final total land area in the given year. The latter value minus the sum of grey cells (remaining land area of categories) gives the land area submitted to land use change which is further expressed as percentage of total land area. The total original land area is given by the sum over the rows of each category (grey marked column "Original land"). From this data the percentage change within each category can be calculated, e.g. forest land in Austria had increased in 2007 by 3.0 % as compared with the original area (column "Change of original land"). It should be noted that this kind of analysis only makes sense where complete and consistent data sets occur (i.e. no data marked NE, IE; see Table A.1 in Annex for characterisation of completeness of the data).

Table 2.1: land use conversion matrix from Kyoto data for Austria 2007

[2] http://unfccc.int/national_reports/annex_i_ghg_inventories/national_inventories_submissions/items/6598.php

Austria
kha

From \ To 2007	Forestland	Cropland	Grassland	Wetland	Settlements	Other land	Gross conversion	Net conversion	Original land	Change of original land
Forestland	3,761.58	5.48	58.06	3.29	16.43	26.29	109.56	-118.00	3,871.14	3.0%
Cropland	36.41	940.33	491.27	NO	42.12	NO	569.80	58.23	1,510.13	-3.9%
Grassland	134.26	506.09	1,267.81	14.42	66.55	NO	721.33	172.00	1,989.13	-8.6%
Wetland	11.38	NO	NO	121.70	NO	NO	11.38	-10.40	133.08	7.8%
Settlements	31.86	NO	NO	NO	331.10	NO	31.86	-139.95	362.96	38.6%
Other land	13.65	NO	NO	4.07	46.70	456.15	64.42	38.12	520.56	-7.3%
Gross expansion	227.56	511.57	549.33	21.78	171.80	26.29				
Net expansion	118.00	-58.23	-172.00	10.40	139.95	-38.12				
Total land	**3,989.14**	**1,451.90**	**1,817.14**	**143.48**	**502.90**	**482.44**	**8,387.00**	**1,508.34**	**17.98%**	
ha per day					383		**Sum**	**change**	**% change**	

NA = not applicable, NE= not estimated, NO = not occurring, IE=included elsewhere

Next, the Kyoto data for absolute land use by category (total land) were compared with FAOSTAT (ResourceSTAT) data (Table 2.2; for all countries see Table A.2 in Annex). It should be noted that Austria is a country with exceptional good data quality and comparability among different sources. Thus, the deviations of Kyoto data from FAO data are small and below ca. 3%.

Table 2.2: Comparison of land use data for Austria 2007 – UNFCCC and FAOSTAT

	Forest area	Arable land and Permanent crops	Permanent meadows and pastures	Other land	Land area	Country area	control
FAO data	3,872.00	1,450.00	1,790.00	1,133.00	8,245.00	8,387.00	0.00
UNFCCC minus FAO	117.14	1.90	27.14	-4.18	142.00	0.00	
UNFCCC versus FAO	3%	0%	2%	-0%	2%	0%	

2.2 Other data bases and comparisons

2.2.1 CORINE land cover (EEA)

Data were downloaded from the website of the European Environment Agency (EEA; an overview of available data is given in Table A.3 in the annex)[3]. A general issue here is that it needs to be clarified to which time frame the CORINE land use change data refer to.

The available data comprise:

- Area in hectare over the entire period (here: 2000 to 2006)
- Hectare per year (annual average over the 6 years period)
- Area in % of total (for entire period 2000 to 2006)
- Area per year in % of total (annual average)

Here, the data referring to the entire period were taken because they are supposed to better represent medium term land use changes avoiding occasional events in one year. To calculate the annual average these data should be divided by 6, and – in the case of settlements area - further by 365 to obtain the average land use change rate in hectares per day.

The settlements land use change rate in hectares per day is used as reference e.g. for a sustainability indicator of the German sustainable strategy, where the goal is formulated to reduce current conversion rates to built-up area of around 80 hectares per day to 30 hectares a day in 2020. Another example is the Austrian sustainability strategy with a formulated goal to reduce the increase of built-up area from a level of 25 ha/day to one tenth at the maximum.

[3] www.eea.europa.eu/data-and-maps/data/data-viewers/land-accounts

Now, taking the CORINE land use change data for the entire period and dividing it by 365 results in 131 ha/day for Germany and 21 ha/day for Austria, and thus close to the official reported values. In turn this would mean that the data in absolute terms do not stand for the entire period but for one year (on average) only.
On the other hand, CORINE data referenced by State of Environment Norway are very clearly described as urban land take between 2000 and 2006 which totalled 9925 hectares, or 1654 hectares per year.
So, there is a clear discrepancy with regard to data interpretation between Germany and Austria on the one hand and Norway on the other hand. This has not further been investigated nor extended towards other countries.
For the time being it is suggested to use the CORINE land use change data in a cross-country comparison mode only with regard to relative changes.

CORINE land use change data (2000-2006) were available at the following main categories and sub-categories:

1 Artificial surfaces	11 Urban fabric 12 Industrial, commercial and transport units 13 Mine, dump and construction sites 14 Artificial, non-agricultural vegetated areas
2 Agricultural areas	21 Arable land 22 Permanent crops 23 Pastures 24 Heterogeneous agricultural areas
3 Forest and semi natural areas	31 Forests 32 Scrub and/or herbaceous vegetation associations 33 Open spaces with little or no vegetation
4 Wetlands	41 Inland wetlands 42 Maritime wetlands
5 Water bodies	51 Inland waters 52 Marine waters

These categories were allocated to the same categories as reported commonly by UNFCCC (see above – table 2.1). The resulting land use change matrix (in ha) for Austria is shown below (Table 2.3). The numbers differ significantly from those resulting from the Kyoto reports (compare table 2.1). The resulting net expansion of settlements area after CORINE amounts to ca. 21 ha per day which is close to official data[4] (see above). The overall percentage change rate for land area is only 0.37% (as compared with 17.98% after Kyoto data).

Table 2.3: land use conversion matrix from CORINE data for Austria 2000-2006, annual average

From \ To	Forestland	Cropland	Grassland	Wetland	Settlements	Other land	Gross conversion	Net conversion	Original land	Change of original land
Forestland	3,710,654	11	111	15	1,759	20,536	22,432.00	21,524.00	3,733,086.00	-0.6%
Cropland		1,233,425	15		3,794	12	3,821.00	3,540.00	1,237,246.00	-0.3%
Grassland	26	7	1,483,490	7	1,407	45	1,492.00	1,012.00	1,484,988.00	-0.1%
Wetland			32	91,132			32.00	-44.00	91,164.00	0.0%
Settlements		263	318	25	400,597	279	885.00	-7,773.00	401,482.00	1.9%
Other land	882		4	29	1,698	1,456,436	2,613.00	-18,259.00	1,459,049.00	1.3%
Gross expansion	908.00	281.00	480.00	76.00	8,658.00	20,872.00				
Net expansion	-21,524.00	-3,540.00	-1,012.00	44.00	7,773.00	18,259.00				
Total land	**3,711,562.00**	**1,233,706.00**	**1,483,976.00**	**91,208.00**	**409,255.00**	**1,477,308.00**	**8,407,015.00**	**31,275.00**	**0.37%**	
ha per day					21		**Sum**	**change**	**% change**	

[4] The absolute extent of settlements area in Austria is about 503 kha after UNFCCC and about 409 kha after CORINE. The value reported by Environment Agency Austria (in German: Bau- und Verkehrsflächen [construction- and traffic area] is 445 kha [of which more than 40% are actually sealed] and thus in between the data from UNFCCC and CORINE.

The comparison of CORINE with FAOSTAT data shows big differences (Table 2.4) which is in contrast to the UNFCCC-FAO data comparison (compare table 2.2). This is probably because of different land use/land cover allocation methods applied for the two data sets (cadastral data versus satellite based data). A proposal for the selection of the proper data set by purpose will be made in the following.

Table 2.4: Comparison of land use data for Austria – CORINE land cover (CLC) and FAOSTAT

	Forest area	Arable land and Permanent crops	Permanent meadows and pastures	Other land	Land area	Country area	control
FAO data	3,872.00	1,450.00	1,790.00	1,133.00	8,245.00	8,387.00	0.00
CLC minus FAO	-160.44	-216.29	-306.02	844.77	162.01	20.01	
CLC versus FAO	-4%	-15%	-17%	75%	2%	0%	

2.2.2 Comparison: CORINE versus UNFCCC

The following table 2.5 shows results of a comparison of three indicators expressed as ratios of values from UNFCCC divided by CORINE:

- Overall land use change (% of total area subjected to land use change)
- Settlements area (% of total area)
- Settlements area net change (ha per day)

Cells marked green indicate good matching of the two data bases (value ≈ 1). The column on the right side shows the proposed data base for land use change in each country which is mostly CORINE for European countries (a detailed characterisation for the comparison UNFCCC-CORINE and the selection of the proposed database for land use change is given in table A.4 in the annex).

Table 2.5: Comparison of land use change and settlements area data from UNFCCC and CORINE and proposed database for land use change

	CREEA		Overall land use change	Settlements	Settlements net change	Proposed
	Code	Name	% of total area	% of total area	ha per day	Database
			UNFCCC / CORINE			LUC
	EU27	European Union				
1	AT	Austria	48	1	18	CORINE
2	BE	Belgium	25	1	24	CORINE
3	BG	Bulgaria	16	1	5	CORINE
4	CY	Cyprus	0	0	0	CORINE
5	CZ	Czech Republic	3	1	4	CORINE
6	DE	Germany	#WERT!	1	0	CORINE
7	DK	Denmark	6	1	6	CORINE
8	EE	Estonia	4	3	0	CORINE
9	ES	Spain	3	1	0	CORINE
10	FI	Finland	1	3	12	CORINE
11	FR	France	44	2	12	CORINE
12	GR	Greece	#DIV/0!	#DIV/0!	#DIV/0!	UNFCCC
13	HU	Hungary	3	1	3	CORINE
14	IE	Ireland	4	1	0	CORINE
15	IT	Italy	1	1	0	UNFCCC
16	LT	Lithuania	2	1	-1	CORINE
17	LU	Luxembourg	13	1	15	CORINE
18	LV	Latvia	0	3	0	CORINE
19	MT	Malta	#WERT!	0	0	CORINE
20	NL	Netherlands	2	1	0	UNFCCC
21	PL	Poland	3	2	0	CORINE
22	PT	Portugal	0	1	2	CORINE
23	RO	Romania	1	1	1	CORINE
24	SE	Sweden	1	3	6	CORINE
25	SI	Slovenia	9	2	1	CORINE
26	SK	Slovak Republic	#WERT!	0	#WERT!	CORINE
27	GB	United Kingdom	#WERT!	#DIV/0!	#WERT!	UNFCCC
28	US	United States				
29	JP	Japan				
30	CN	China				
31	CA	Canada				
32	KR	South Korea				
33	BR	Brazil				
34	IN	India				
35	MX	Mexico				
36	RU	Russian Federation				
37	AU	Australia				
38	CH	Switzerland				
39	TR	Turkey	#WERT!	0	0	CORINE
40	TW	Taiwan				
41	NO	Norway	3	2	7	CORINE
42	ID	Indonesia				
43	ZA	South Africa				
44	RoW	Rest of the world				
		n	22	26	26	
		n	4	15	2	
		%	18%	58%	8%	

2.2.3 Other international land use change projects

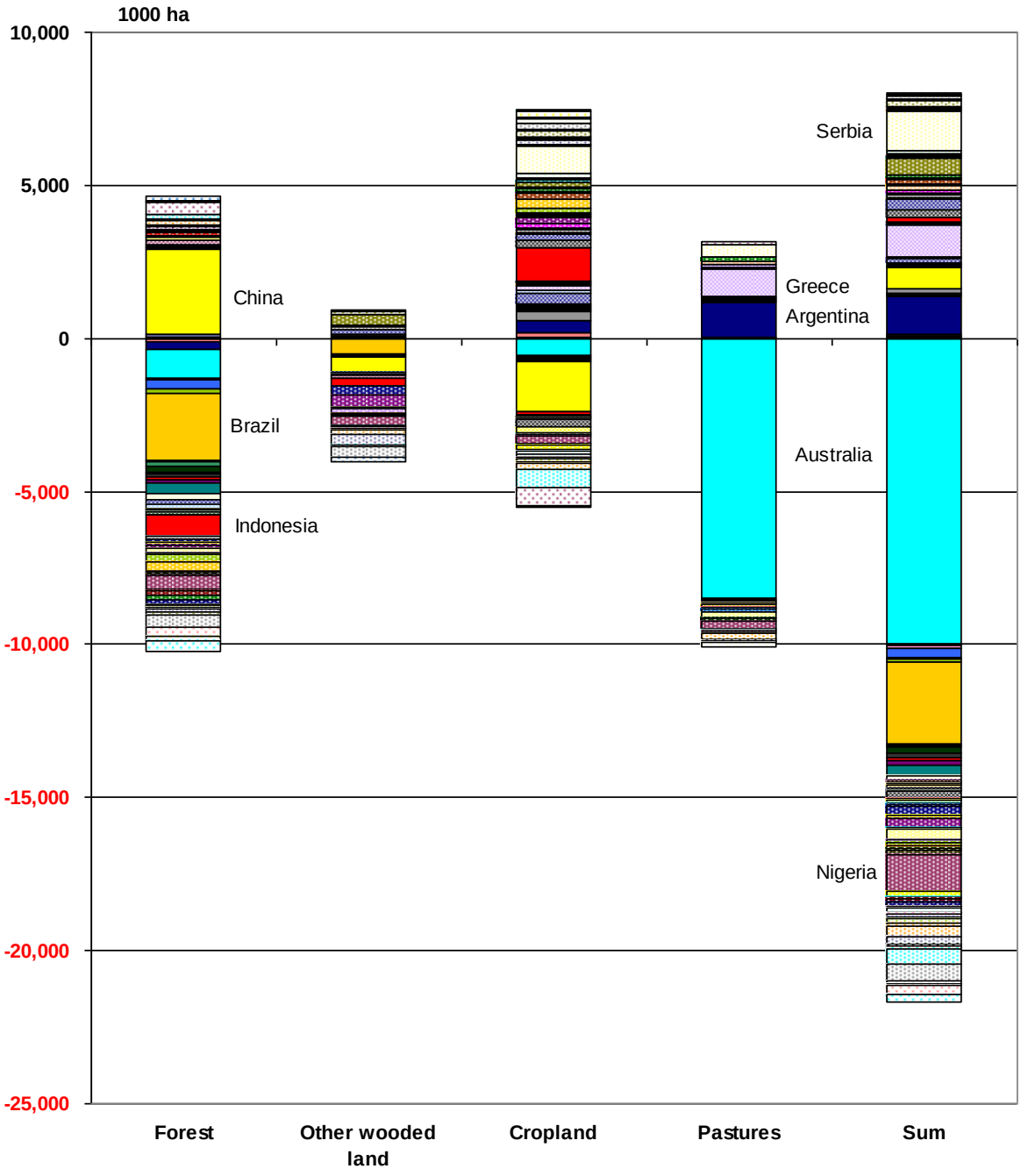
These are listed in Annex A.5 (without claiming completeness of existing data bases). Due to restricted data availability these data bases could not be used to derive values for land use change.

2.2.4 Global Forest Resources Assessment 2010 (FRA)

Data were downloaded from the FAO website[5]. Net land use changes are available for forest land, other wooded land (2005-2010), cropland, pastures (2005-2009), and changes were expressed in % per annum. The following figure 2.1 shows all available data with major countries indicated. Forest land had increased between 2005 and 2010 in particular in China, while it had decreased noticeably in Australia, Brazil and Indonesia. Other wooded land was much less subjected to changes than forest land. Cropland had overall increased and prominently in Indonesia, while it had decreased remarkably in China. Pasture land had increased in particular in Argentina and Greece, but decreased to a large extent in Australia. The total of land use changes shows further remarkable increases in Serbia (cropland) and decreases in Nigeria (all four categories).

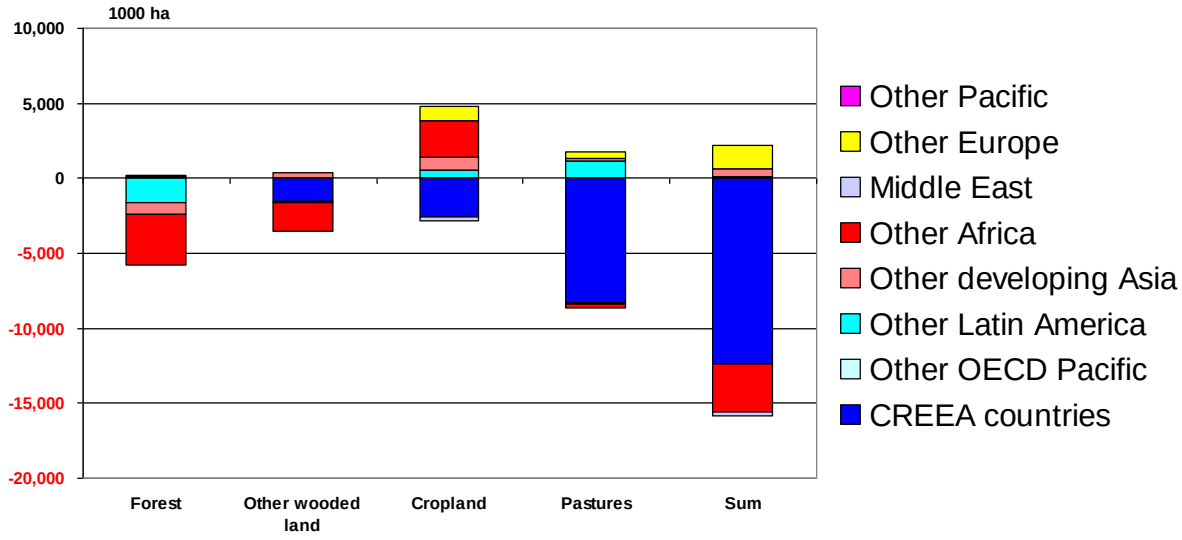
Figure 2.1: Land use change by main categories and by country after FRA 2010

[5] http://www.fao.org/forestry/fra/fra2010/en/



An aggregation of net land use change after FRA 2010 by CREEA countries and other regional aggregates is shown in the following figure 2.2. CREEA countries are characterised by high decreases of pastures (mainly Australia), cropland and other wooded land. Africa (except South Africa) shows up by high losses of forest land and other wooded land while cropland increased, still resulting in an overall significant loss of productive land. Changes in other world regions are less expressed. Latin America (except Brazil and Mexico) lost forest land at the expense of cropland and pastures, a well-documented result also by several investigative studies. Similarly, the rest of Asia lost forest land to mainly cropland. And the rest of Europe had expanded cropland and pasture land obviously from other land not addressed by the FAO categories.

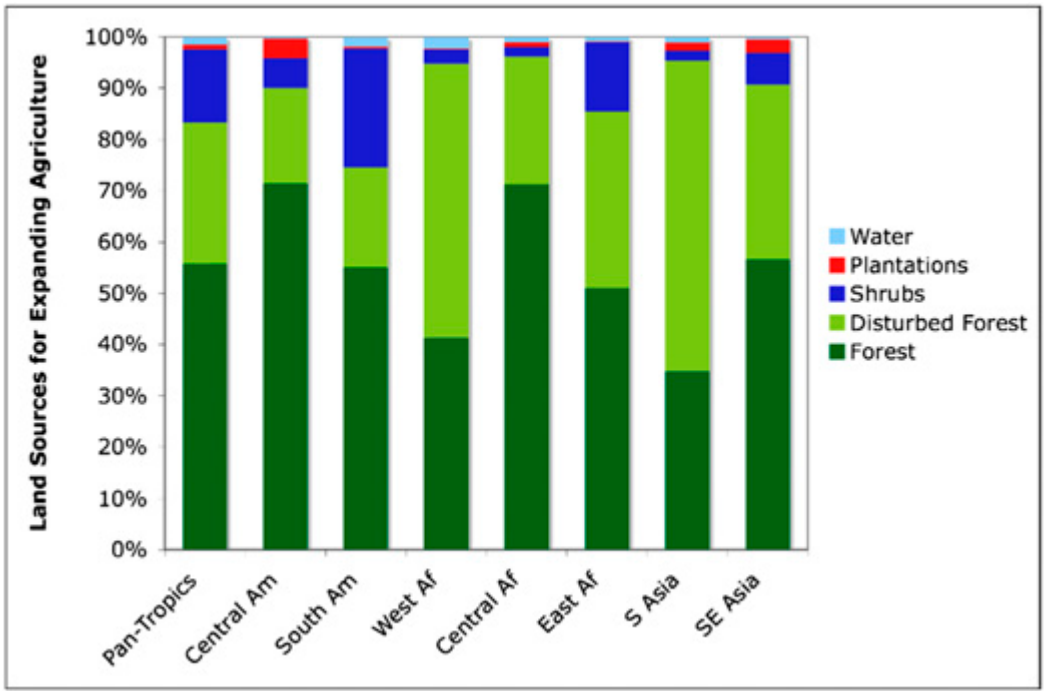
Figure 2.2: Land use change by main categories and by regional aggregates after FRA 2010



Gibbs et al. (2010) analysed the library of classified Landsat scenes originally processed by the FAO as part of the Forest Resources Assessments. Across the tropics, they found that between 1980 and 2000 more than 55% of new agricultural land came from the expense of intact forests, and another 28% came from disturbed forests (using the terminology of FAO).

For regional differences Figure 2 of Gibbs et al. 2010 can serve as illustration (Figure 2.3).

Figure 2.3: Land use change to agriculture by main categories and by region after Gibbs et al. 2010



Note: original Fig. 2 heading: The origins of new agricultural land, 1980–2000. Bars show the average proportion of land sources comprising new agricultural land in major tropical regions.

2.3 Allocation to sectors and alignment with SEEA

Allocation of land use (occupation) to industry sectors in SUTs can be done following the common approach for environmental extension data (see report to WP 7: Provision of data on land use by country and category).

Alignment of land use / land cover accounts with SEEA 2012 is currently hampered due to different classification systems. "In the SEEA, the classifications and accounting structures are defined and described independently of the means by which data are collected. However, in practice, the type of data and the level of detail that can be compiled may depend on the means by which data have been collected." (Central Framework document 2012 p.186 pdf).

Further, available data do not fit with proposed SEEA categories which are characterised as being provisional. "For land, both land use and land cover, interim classifications have been developed" (Central Framework doc 2012 p.18 pdf).

With regard to land use change, our proposal is to keep it in a separate account by country/region which might be aggregated to a global account once comprehensive, harmonised data sets were available. The effects on land use change could then be included by linking the land occupation (as above) to the global market for land (the global LUC matrix).

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Annex

A.1: Status of UNFCCC data for 2007

	Countries/ Regions		UNFCCC		UNFCCC		
	All		Annex I		Annex II	CRF Tables 5 A-F	Code
	European Union		European Union		European Union	complete	euc
1	Austria	1	Austria	1	Austria	complete	aut
2	Belgium	2	Belgium	2	Belgium	complete	bel
3	Bulgaria	3	Bulgaria			complete	bgr
4	Cyprus					data taken from Corine land cover database for change between 2000-2007	
5	Czech Republic	4	Czech Republic			complete	cze
6	Germany	5	Germany	3	Germany	almost complete (area of other land included in settlements area)	deu
7	Denmark	6	Denmark	4	Denmark	almost complete (only minor items not estimated resp. Included elsewhere); data here were taken for mainland only, i.e. excluding in particular Greenland	dke; dnk (Denmark KP; Denmark Kingdom)
8	Estonia	7	Estonia			incomplete (most data not estimated; almost no data at all related to land use change)	est
9	Spain	8	Spain	5	Spain	complete	esp
10	Finland	9	Finland	6	Finland	almost complete (only minor item not estimated)	fin
11	France	10	France	7	France	complete	fra; frk (France KP)
12	Greece	11	Greece	8	Greece	incomplete (several data not estimated; change in settlements area seems far too low)	grc
13	Hungary	12	Hungary			almost complete (only some items of change to forest land included elsewhere)	hun
14	Ireland	13	Ireland	9	Ireland	almost complete (only minor item not estimated; however, net expansion of settlement area seems rather low); total area is too low	irl
15	Italy	14	Italy	10	Italy	complete	ita
16	Lithuania	15	Lithuania			incomplete (most data not estimated; land use change is negative)	ltu
17	Luxembourg	16	Luxembourg	11	Luxembourg	complete	lux

18	Latvia	17	Latvia			incomplete (most data not estimated; almost no data at all related to land use change)	lva
19	Malta	18	Malta			complete	mlt
20	Netherlands	19	Netherlands	12	Netherlands	complete	nld
21	Poland	20	Poland			incomplete (some data not estimated; no data at all related to land use change)	pol
22	Portugal	21	Portugal	13	Portugal	complete	prt
23	Romania	22	Romania			complete	rou
24	Sweden	23	Sweden	14	Sweden	complete	swe
25	Slovenia	24	Slovenia			complete	svn
26	Slovak Republic	25	Slovak Republic			incomplete (no data at all for wetlands and settlements)	svk
27	United Kingdom	26	United Kingdom	15	United Kingdom	incomplete (some data not estimated or included elsewhere; no data at all related to wetlands and to other land; no data for settlements remaining settlements)	gbr
28	United States	27	United States	16	United States	incomplete (several data included elsewhere or not estimated; no wetlands and no other land data)	usa
29	Japan	28	Japan	17	Japan	incomplete (several data included elsewhere; change in settlements area seems far too high)	jpn
30	China						
31	Canada	29	Canada	18	Canada	incomplete (some data not estimated; no data at all related to grasslands and to other land)	can
32	South Korea			19	South Korea		
33	Brazil						
34	India						
35	Mexico						
36	Russian Federation	30	Russian Federation			complete	rus
37	Australia	31	Australia	20	Australia	incomplete (some data included elsewhere; no data for land use change related to settlements)	aus
38	Switzerland	32	Switzerland	21	Switzerland	complete	che
39	Turkey	33	Turkey			incomplete (almost no data at all)	tur
40	Taiwan						
41	Norway	34	Norway	22	Norway	complete	nor
42	Indonesia						
43	South Africa						

44	Rest of the world (by sub-regions)						
45	Belarus	35	Belarus			incomplete (some data not estimated or included elsewhere; almost no data of land use change at all; no data at all related to settlements)	blr
46	Croatia	36	Croatia			incomplete (only very few data at all)	hrv
47	Iceland	37	Iceland	23	Iceland	incomplete (some data not estimated or included elsewhere)	isl
48	Liechtenstein	38	Liechtenstein			complete	lie
49	Monaco	39	Monaco			incomplete (data only for parks and gardens)	mco
50	Ukraine	40	Ukraine			complete	ukr
51	New Zealand	41	New Zealand	24	New Zealand	complete	nzl
52	Kazhakstan	42	Kazhakstan			complete, but total area far too low	kaz
53	Albania						
54	Bosnia and Herzegovina						
55	Former Yugoslav Republic of Macedonia						
56	Kosovo under UNSCR 1244/99						
57	Montenegro						
58	Serbia						

* In accordance with the COP conclusion (FCCC/CP/2001/13/Add.4, section V.C.) and following ratification by **Kazakhstan** of the Kyoto Protocol on 19 June 2009 and its entry into force on 17 September 2009, Kazakhstan is considered an Annex I Party for the purposes of the Protocol but remains to be a non-Annex I Party for the purposes of the Convention.

** In accordance with the COP decision 3/CP.15 and following the notification from the Depositary and Malta's entry into force on 26 October 2010, **Malta** is considered to be an Annex I Party for the purposes of the Convention.

A.2: Comparison of land use data (by totals and main categories) – UNFCCC versus FAOSTAT

	Countries/ Regions	FAOSTAT
	All	Comparison with UNFCCC
	European Union	totals and subcategories match quite well
1	Austria	totals and subcategories match
2	Belgium	totals match, but subcategories differ a lot
3	Bulgaria	totals match, but subcategories differ a lot
4	Cyprus	
5	Czech Republic	totals match, but subcategories differ a lot
6	Germany	totals match, but subcategories differ a lot
7	Denmark	totals match, but subcategories differ a lot
8	Estonia	totals match, but subcategories differ a lot
9	Spain	totals match, but subcategories differ a lot
10	Finland	totals match, but subcategories differ a lot
11	France	totals match, but subcategories differ a lot
12	Greece	totals match, but subcategories differ a lot
13	Hungary	totals and subcategories match quite well
14	Ireland	data do not match at all
15	Italy	data do not match at all
16	Lithuania	totals match, but subcategories differ a lot
17	Luxembourg	totals match, but subcategories differ a lot
18	Latvia	totals and subcategories match quite well
19	Malta	totals match, but subcategories differ a lot
20	Netherlands	totals match, but subcategories differ a lot
21	Poland	totals and subcategories match quite well
22	Portugal	totals match, but subcategories differ a lot
23	Romania	totals match, but subcategories differ a lot
24	Sweden	totals match, but subcategories differ a lot
25	Slovenia	totals match, but subcategories differ a lot
26	Slovak Republic	totals match almost, but subcategories differ a lot
27	United Kingdom	data do not match at all
28	United States	data do not match at all

29	Japan	totals match, but subcategories differ a lot
30	China	
31	Canada	data do not match at all
32	South Korea	
33	Brazil	
34	India	
35	Mexico	
36	Russian Federation	totals match, but subcategories differ a lot
37	Australia	totals match, but subcategories differ a lot
38	Switzerland	totals match, but subcategories differ a lot
39	Turkey	data do not match at all
40	Taiwan	
41	Norway	totals match, but subcategories differ a lot
42	Indonesia	
43	South Africa	
44	Rest of the world	
45	Belarus	data do not match at all
46	Croatia	data do not match at all
47	Iceland	totals match, but subcategories differ a lot
48	Liechtenstein	totals match, but subcategories differ a lot
49	Monaco	data do not match at all
50	Ukraine	totals match, but subcategories differ a lot
51	New Zealand	totals match, but subcategories differ a lot
52	Kazhakstan	data do not match at all
53	Albania	
54	Bosnia and Herzegovina	
55	Former Yugoslav Republic of Macedonia	
56	Kosovo under UNSCR 1244/99	
57	Montenegro	
58	Serbia	

A.3: Availability of CORINE land cover change data and percent per year change 2000-2006

	EXIOPOL		CORINE land cover change		Land take: residential + economic sites	
	Code	Name	1990-2000	2000-2006	2000-2006, percent per year	
	EU27	European Union				
1	AT	Austria			0.4	EU
2	BE	Belgium			0.1	EU
3	BG	Bulgaria			0.1	EU
4	CY	Cyprus			2.6	EU
5	CZ	Czech Republic			0.5	EU
6	DE	Germany *			0.4	EU
7	DK	Denmark			0.6	EU
8	EE	Estonia			0.9	EU
9	ES	Spain			2.7	EU
10	FI	Finland			0.4	EU
11	FR	France			0.5	EU
12	GR	Greece				EU
13	HU	Hungary			0.5	EU
14	IE	Ireland			2.4	EU
15	IT	Italy			0.6	EU
16	LT	Lithuania			0	EU
17	LU	Luxembourg			0.7	EU
18	LV	Latvia			0.1	EU
19	MT	Malta			0	EU
20	NL	Netherlands			1.3	EU
21	PL	Poland			0.3	EU
22	PT	Portugal			1.7	EU
23	RO	Romania			0.1	EU
24	SE	Sweden			0.5	EU
25	SI	Slovenia			0.3	EU
26	SK	Slovak Republic			0.2	EU
27	GB	United Kingdom			0	EU
28	US	United States				nonEU

29	JP	Japan				nonEU
30	CN	China				nonEU
31	CA	Canada				nonEU
32	KR	South Korea				nonEU
33	BR	Brazil				nonEU
34	IN	India				nonEU
35	MX	Mexico				nonEU
36	RU	Russian Federation				nonEU
37	AU	Australia				nonEU
38	CH	Switzerland				nonEU
39	TR	Turkey			0.6	nonEU
40	TW	Taiwan				nonEU
41	NO	Norway			0.7	nonEU
42	ID	Indonesia				nonEU
43	ZA	South Africa				nonEU
44	RoW	Rest of the world (by sub-regions)				nonEU
		Belarus				
		Croatia			1	
		Iceland			3.2	
		Liechtenstein			0	
		Monaco				
		Ukraine				
		New Zealand				
		Kazhakstan				
		Albania			5	
		Bosnia and Herzegovina			1.5	
		Former Yugoslav Republic of Macedonia			0.7	
		Kosovo under UNSCR 1244/99			0.7	
		Montenegro			0	
		Serbia			0.3	

* 0.4% for Germany cannot be confirmed by national statistics (UGR) data (should be rather around 1% p.a.)

A.4: Comparative analysis UNFCCC – CORINE

	CREEA		Comparative analysis:
	Code	Name	UNFCCC vs. CORINE
	EU27	European Union	
1	AT	Austria	Overall, CORINE seems to provide more realistic results. The rate of annual change of land cover is for CORINE (0.37%) by factor 50 lower than after UNFCCC with the latter appearing unrealistically high. Even more striking, the annual sealing rate after CORINE is with 24 ha/day close to the official rate given by Umweltbundesamt Österreich (while it is 18 times higher after UNFCCC). However, CORINE subcategories for land use do not match well with FAOSTAT data (while they do match looking at UNFCCC subcategories).
2	BE	Belgium	Overall, CORINE seems to provide more realistic results. The rate of annual change of land cover is for CORINE (0.57%) by factor 25 lower than after UNFCCC with the latter appearing unrealistically high. Even more striking, the annual rate of increase of settlements area after CORINE is with 8 ha/day close to the official rate derived from Statistics Belgium (while it is 24 times higher after UNFCCC). However, CORINE subcategories for land use do not match well with FAOSTAT data (while they do match looking at UNFCCC subcategories).
3	BG	Bulgaria	Unclear what the best source of LULUC data is. CORINE shows 16 times lower overall land use change rate than UNFCCC, while the increase of settlements area is 5 times higher for the latter. After CORINE, settlements cover 5% of the total area, after UNFCCC it's 7.4%. Both datasets match overall with FAOSTAT land use data but do not match with the subcategories of FAO. No other source for comparison has been found. For the time being CORINE is proposed as primary data source.
4	CY	Cyprus	Only CORINE data available. Cyprus has a relatively high share of settlements area (8.6%), and also a high overall land use change rate of 1.7% in 2007. No other source for comparison has been found.
5	CZ	Czech Republic	Unclear what the best source of LULUC data is. CORINE shows 3 times lower overall land use change rate than UNFCCC, while the increase of settlements area is 4 times higher for the latter. After CORINE settlements cover 6.4% of the total area, after UNFCCC it's 8.5%. Both datasets match overall with FAOSTAT land use data but do not match with the subcategories of FAO. Data for built-up area of Statistics Czech Republic do not match at all, they indicate only 1.7% of total area in 2007, an increase of only 1 ha/day in 2007 (100 ha/day after UNFCCC) and even a decline from 2000 to 2006 (24 ha/day increase after CORINE). For the time being CORINE is proposed as primary data source.

6	DE	Germany	Overall, CORINE seems to provide more realistic results and complete data. UNFCCC in addition does not allow deriving a total number for land use change. Further, the rate of annual change of land cover to settlements is for CORINE (131 ha/day) similar to figures reported by Statistics Germany (for "Siedlungs- und Verkehrsflächen" at ca. 100 ha/day in 2007). Still, CORINE subcategories for land use do not match well with FAOSTAT data (but they also do not match looking at UNFCCC subcategories).
7	DK	Denmark	Unclear what the best source of LULUC data is, CORINE provides complete data. CORINE shows 6 times lower overall land use change rate than UNFCCC, while the increase of settlements area is 6 times higher for the latter. After CORINE settlements cover 7.4% of the total area, after UNFCCC it's 10.3%. Both datasets match overall with FAOSTAT land use data but do not match with the subcategories of FAO. No national source for comparison has been found. According to EEA stating that 10% of Denmark's land is built-up area, rather UNFCCC may be more relevant. However, as UNFCCC is not absolutely complete, it is proposed to take CORINE as reference data base.
8	EE	Estonia	CORINE provides complete data while UNFCCC has gaps and does not e.g. show settlements area change data. Overall settlements area data after CORINE coincide with data from Estonian environment information centre. CORINE data for overall land match with FAOSTAT, but data for subcategories differ a lot.
9	ES	Spain	Unclear what the best source of LULUC data is. CORINE shows 3 times lower overall land use change rate than UNFCCC, while the increase of settlements area is only 0.16 times for the latter. After CORINE settlements cover 2% of the total area, after UNFCCC it's 2.2%. Both datasets match overall with FAOSTAT land use data but do not match with the subcategories of FAO. No national source for comparison has been found. For the time being CORINE is proposed as primary data source.
10	FI	Finland	CORINE is probably the better source for LUC. UNFCCC is not fully complete and results in unrealistically high rate of increase of settlements area. Both CORINE and UNFCCC match with overall land use after FAOSTAT but differ a lot from FAO with regard to subcategories of land use.
11	FR	France	CORINE is probably the better source for LUC. UNFCCC results in unrealistically high rate of increase of settlements area. Both CORINE and UNFCCC match with overall land use after FAOSTAT but differ a lot from FAO with regard to subcategories of land use.
12	GR	Greece	Only UNFCCC data available for 2007 (CORINE data only for 1990-2000), however incomplete. Would need qualified estimates for closing data gaps.
13	HU	Hungary	CORINE provides complete LUC data while UNFCCC has gaps. Both datasets match overall with FAOSTAT land use data but do not match with the subcategories of FAO.
14	IE	Ireland	CORINE provides complete data while UNFCCC has gaps and shows unrealistically low settlements area change data. CORINE data for overall land match with FAO but subcategories differ. UNFCCC data do not match at all with FAO.

15	IT	Italy	Both datasets, CORINE and UNFCCC, are quite similar for overall land use change and share of settlements of total area. They differ however with regard to the latter from data published by ISPRA which are somewhat higher. Taking the ISPRA data as reference, it is UNFCCC settlements area change that comes close, whereas CORINE is significantly higher. CORINE data for overall land match with FAO but subcategories differ. UNFCCC data do not match at all with FAO. For the sake of comparability with ISPRA, it is proposed to take the UNFCCC data for LUC (but not for absolute LU).
16	LT	Lithuania	CORINE provides complete LUC data while UNFCCC has many gaps and even results in negative net settlements area change which seems unrealistic. Both datasets match overall with FAOSTAT land use data but do not match with the subcategories of FAO.
17	LU	Luxembourg	CORINE data coincide better with data published by Statistics Luxembourg than UNFCCC, especially with regard to annual increase of settlements area. Both datasets match overall with FAOSTAT land use data but do not match with the subcategories of FAO.
18	LV	Latvia	CORINE provides complete LUC data while UNFCCC has gaps and almost no land use change data. However, compared with data of Statistics Latvia, CORINE seems far too low in share of settlements area (1.3% vs. 3.5%) while the rate of change is comparable. For the latter, it is proposed to use CORINE for LUC data but not for totals which should rather be taken from Statistics Latvia.
19	MT	Malta	There is hardly any land use change in Malta. CORINE shows small increase of settlements area whereas UNFCCC shows no change at all. CORINE does not match even with FAOSTAT totals (probably not covering all islands), while UNFCCC does but differs with regard to subcategories. Share of settlements area for CORINE coincides with MEPA data (Malta Environment & Planning Authority) but is unrealistically low for UNFCCC. For LUC CORINE is proposed as reference.
20	NL	Netherlands	UNFCCC fits better with PBL historical time series of land use. In particular, CORINE shows much higher net expansion of settlements area than UNFCCC. It is therefore proposed to take UNFCCC for LUC. Both datasets match overall with FAOSTAT land use data but do not match with the subcategories of FAO.
21	PL	Poland	CORINE provides complete LUC data while UNFCCC has gaps and no data at all for LUC related to settlements. CORINE is therefore proposed for LUC.
22	PT	Portugal	CORINE is lower in net expansion of settlements area than UNFCCC, but close to Statistics Portugal (INE) data. CORINE is selected as reference for LUC.
23	RO	Romania	CORINE and UNFCCC are quite similar. CORINE subcategories almost match with FAO, UNFCCC don't. CORINE is prefered.
24	SE	Sweden	CORINE lower in net expansion and share of settlements area than UNFCCC. The latter probably too high in absolute area of settlements. Therefore CORINE is currently prefered. No comparative national data found.
25	SI	Slovenia	CORINE is similar for expansion of settlements area with UNFCCC. The latter probably too high in absolute area of settlements. Therefore CORINE is currently prefered. No comparative national data found.

26	SK	Slovak Republic	CORINE provides complete LUC data while UNFCCC has gaps and no data at all for wetlands and settlements. Both datasets match overall with FAOSTAT land use data but do not match with the subcategories of FAO.
27	GB	United Kingdom	Only UNFCCC data available, however incomplete. Would need qualified estimates for closing data gaps.
28	US	United States	
29	JP	Japan	
30	CN	China	
31	CA	Canada	
32	KR	South Korea	
33	BR	Brazil	
34	IN	India	
35	MX	Mexico	
36	RU	Russian Federation	
37	AU	Australia	
38	CH	Switzerland	
39	TR	Turkey	CORINE provides complete LUC data while UNFCCC has gaps respectively data only related to forestland.
40	TW	Taiwan	
41	NO	Norway	CORINE lower in settlements area, its net expansion, and in overall land use change than UNFCCC. CORINE corroborated by newer figures of State of Environment Norway. CORINE is therefore prefered.
42	ID	Indonesia	
43	ZA	South Africa	
44	RoW	Rest of the world (by region)	
		Belarus	
		Croatia	CORINE provides complete LUC data while UNFCCC has gaps respectively only 3 data points which makes it obsolete.
		Iceland	CORINE provides complete LUC data while UNFCCC has gaps respectively hardly any data of LUC.

A.5: International or global land use change projects

A.5.1 JRC-IES: Global Land Cover 2000

http://bioval.jrc.ec.europa.eu/products/glc2000/glc2000.php

The Global vegetation Monitoring Unit carries out several activities related to Land Cover mapping and monitoring.

In particular the GVM Unit is coordinating and implementing the **Global Land Cover 2000 Project (GLC 2000)** in collaboration with a network of partners around the world.

The general objective is to provide for the year 2000 a harmonized land cover database over the whole globe. The year Two Thousand is considered as a reference year for environmental assessment in relation to various activities, in particular the United Nation's Ecosystem-related International Conventions.

To achieve this objective GLC 2000 makes use of the VEGA 2000 dataset: a dataset of 14 months of pre-processed daily global data acquired by the VEGETATION instrument on board the SPOT 4 satellite, made available through a sponsorship from members of the **VEGETATION programme**, including JRC.

On June 3rd, 2002, Dr. Reid, Director of the Millennium Ecosystem Assessment has informed us that

- GLC 2000 will be used both in the full MA assessment reports and in the various summary and synthesis reports, with full acknowledgment
- GLC 2000 partners will be included in the list of "MA associated scientific organizations and Academies of Sciences
- the GLC 2000 dataset will be included among the core MA datasets

Global Land Cover 2000 - Products

ALL DATASETS ARE NOW AVAILABLE FOR DOWNLOAD

We have now released data for all regional windows of the world, as well as the global landcover classification. These datasets are now available for download in various formats, both at full resolution, and in the form of a poster. In order to gain access to this part of the site, please provide us with some general information about yourself.

The following regional windows are available for download:

South America	France
Africa	China
Northern Eurasia	North America
Asia	Solomon Islands
South Asia	Australia

South and South East Asia	New Caledonia and Vanuatu
South East Asia	New Zealand
Europe All	Fijian Islands
North East Europe	Greenland and Iceland
North West Europe	Hawaii
Southern Europe	

Please **CLICK HERE** to gain access to the full products section.

Our data is available free of charge for non-commercial use, provided it is properly referenced (see the copyright note).

There are 2 types of product:

1. ***The Global Land Cover dataset*** - This is the harmonisation of all the regional products, into a full resolution global product, with a generalised legend.
2. ***Regional Land Cover datasets*** - The classification of these windows have been produced by regional GLC2000 partners, with a regionally specific legend, to provide as much detail as possible.

The GLC2000 digital database, in its entirety, should be referenced as follows:

Global Land Cover 2000 database. European Commission, Joint Research Centre, 2003. http://bioval.jrc.ec.europa.eu/products/glc2000/glc2000.php

The exact quotation for each individual product (global and regional), can be found together with the digital product, on the data download page.

For redistribution of part or the totality of the GLC 2000 database, e.g. in web sites and for commercial applications, please read our disclaimer and copyright notice.

Accuracy of Products

Product accuracy will be defined using a statistical sampling procedure. This operation is still in progress. Information will be provided as soon as it becomes available. See the disclaimer note.

Please consult the metadata of each product for more information.

Global Land Cover 2000 - Legend
LCCS

The GLC2000 project uses the FAO Land Cover Classification System (LCCS). This is a hierarchical classification, which allowed each regional partner to describe the landcover classes at the thematic detail best suited to the landcover in their region of expertise, whilst following a standardised classification approach.

Furthermore, the LCCS allowed the regionally defined legends to be translated into more generalised global landcover classes for the GLC2000 global product. These global classes describe the type of vegetation and the density of the cover, independent of geo-climatic zone, such as temperate or tropical forests.

The mosaicing of 21 regional products, and the translation to a standardised global legend, made it possible to create a consistent global landcover classification based on regional expert knowledge.

GLC2000 Global Legend

A short description of the GLC2000 global legend is available.

For a detailed description of the legend, using the LCCS software, we have also made available for download the LCCS list of classifiers and the LCCS standard class description. The GLC2000 legend, along with the LCCS codes for each global class is also available in either *.htm, *.txt or *.xls formats for importing into the LCCS software[#].

For further information regarding the GLC2000 legend, please contactHans-Jurgen Stibig.

For further information regarding the LCCS, please contact john.latham@fao.org.

[#] Please neglect the 'error' message in the first column of these files. It is a small error in the export of the legend, and does not affect the use of the legend within the LCCS software.

Conclusion: Land use change cannot be obtained from GLC 2000

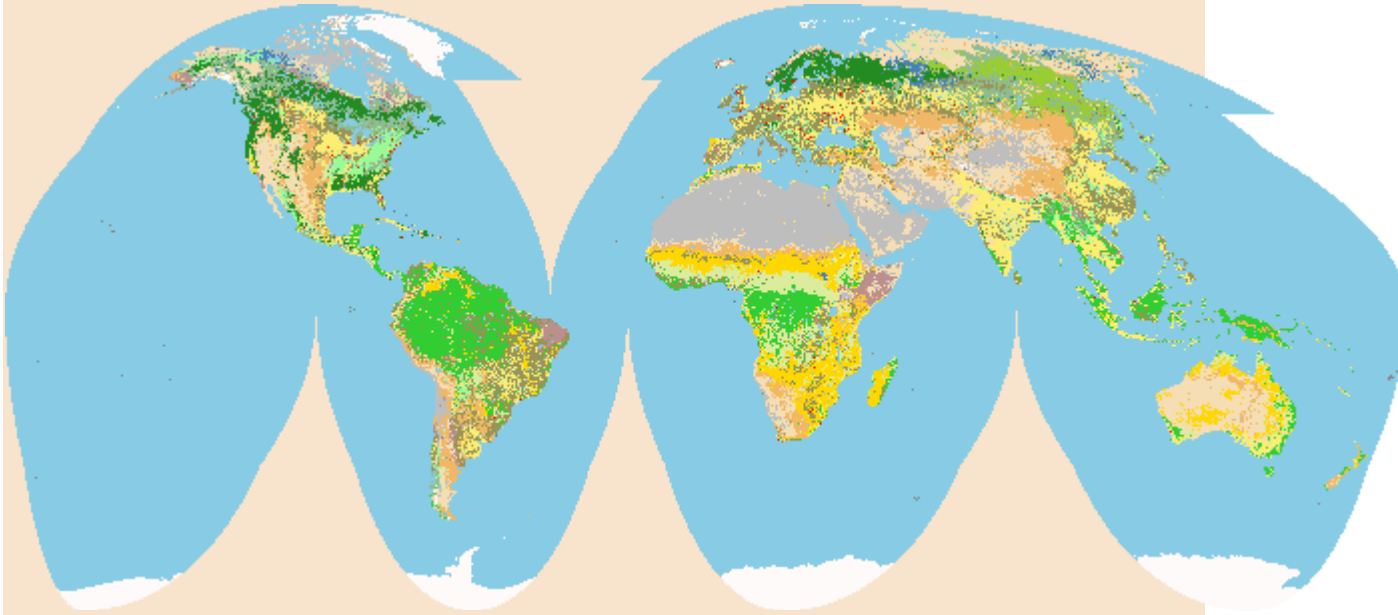
A.5.2 USGS Land Cover Institute (LCI)

http://landcover.usgs.gov/globallandcover.php

Global Land Cover

Land cover studies around the world vary greatly both temporally and spatially. For example, in the Sahel region of West Africa scientists are monitoring, mapping and quantifying changes in natural resources through the use of land cover changes.

The European Environmental Agency produced a land cover database – CORINE - for the 25 EC Member States and other European countries and includes 44 land cover and land use classifications. The Global Land Cover Facility (GLCF), which is housed at the University of Maryland, also provides earth science data and products. The GLCF develop and distribute land cover data with emphasis on determining where, how much and why land cover changes around the world. The International Geosphere-Biosphere Programme (IGBP) provides a quantitive understanding of the Earth's past climate and environment, while the Land Use and Land Cover Change (LUCC) project is a program element of the International Geosphere-Biosphere Programme (IGBP) and the International Human Dimensions Programme on Global Environmental Change (IHDP). Please explore these and other *global land cover study* links and discover what other types of global land cover activities are taking place throughout the world.



International Geosphere Biosphere Programme (IGBP) Global 1km land cover dataset

Conclusion: provides links to other activities related to LUC

A.5.3 Global Land Cover Facility - GLCF

http://esip.umiacs.umd.edu/index.shtml

The Global Land Cover Facility (GLCF) provides earth science data and products to help everyone to better understand global environmental systems. In particular, the GLCF develops and distributes remotely sensed satellite data and products that explain land cover from the local to global scales.

Primary data and products available at the GLCF are free to anyone via FTP. Online datasets may be accessed electronically through the Earth Science Data Interface (ESDI).

The majority of users accessing GLCF datasets (certainly not all) come from the following communities:

- **Science**: geography, Earth science, ecology, climatology, conservation, education
- **Environmental Policy**: global warming, sustainable development, risk management
- **Resource Management**: biodiversity assessment, forestry, protected area management, forest inventory
- **Disaster Management**: fire, flood and drought monitoring, disaster mitigation, food security
- **Computer Science**: data mining, data fusion, computer vision

GLCF research focuses on determining land cover and land cover change around the world. Land cover is the discernible vegetation, geologic, hydrologic or anthropogenic features on the planet's land surface. These features, such as forests, urban area, croplands and sand dunes, can be measured and categorized using satellite imagery. Land cover change can be assessed by comparing one area with two images taken at different dates. Determining where, when, how much and why change occurs with land cover is a crucial scientific concern. It is imperative that appropriate tools be made available to better manage and adapt to change.

Please review available datasets at the GLCF or contact GLCF staff directly for further information.

Conclusion: the usability of this data base remains to be investigated

A.5.4 Land Use and Cover Change - LUCC

http://www.igbp.net/researchprojects/pastprojects/landuseandcoverchange.4.1b8ae20512db692f2a680009062.html

LUCC was launched in 1994 as a Core Project of IGBP to address the question: How do human and biophysical forces affect land use and hence land cover, and what are the environmental and social impacts of this change?

Background

The pace, magnitude and spatial reach of human alterations of the Earth's land surface are unprecedented. Land use and land cover change directly impacts biotic diversity worldwide, contributes to climate change, is the primary source of soil degradation, and, by altering ecosystem services, affects the ability of biological systems to support human needs. Such changes also determine, in part, the vulnerability of places and people to climatic, economic or socio-political perturbations. LUCC research addresses the problem of land use dynamics through comparative case study analysis, addresses land cover dynamics through empirical observations and diagnostic models, and extends the understanding of cause-use-cover dynamics through integrated regional and global modeling. LUCC was co-sponsored by IHDP

LUCC Objectives

- To develop a fundamental understanding of the human and biophysical dynamics of land-use changes ad the impacts of these changes on land cover.
- To develop robust and regionally sensitive global models of land-use/cover change with improved capacities to predict and project use/cover changes
- To develop an understanding of land-use/cover dynamics through systematic and integrated case studies.
- To assist in the development of a global land-use classification scheme LUCC was completed in 2005.

LUCC's science and the community associated with it are now contributing to the current Global Land Project (GLP), which also builds on the legacy of GCTE, another former IGBP Project.

The LUCC International Project office was first hosted by the Clark University, USA from 1994 to 1996, by the Institute Cartografic de Catalunya (ICC) in Barcelona, Spain (1997-1999) and finally by the Université Catholique de Louvain, Belgium (2000-2005) with generous support from the Belgian Federal Science Policy Office.

LUCC Legacy

Land-Use and Land-Cover Change. Local processes and Global Impacts. Lambin, E.F. and H.J. Geist (Eds). The IGBP Series, Springer-Verlag, Berlin, 2006, 222 pp. (A synthesis of LUCC science)

Conclusion: LUCC is a past project now integrated in the following GLP project

A.5.5 Global Land Project - GLP

http://www.globallandproject.org/

Background

The Global Land Project is a joint research project for land systems for the International Geosphere-Biosphere Programme (IGBP) and the International Human Dimensions Programme (IHDP). The Global Land Project Science Plan represents the research framework for the coming decade for land systems. This development of a research strategy is designed to better integrate the understanding of the coupled human-environment system. These integrated science perspectives reflect the recognition of the fundamental nature of how human activities on land are affecting feedbacks to the earth system and the response of the human-environment system to global change. The Global Land Project Science Plan has been defined by scientists sponsored by the IGBP and the IHDP.

The focus of GLP is largely "land-centric" which includes the people, biota, and natural resources (air, water, plants, animals, and soil). The strategy presented here critically emphasizes changes in the coupled human and environmental system. The research planning builds upon the extensive heritage of IGBP I global networks of scientists, data, and largely disciplinary understanding, particularly from the Global Change and Terrestrial Ecosystems (GCTE) project and the Land Use/Cover Change (LUCC) project. Their heritage forms some basic components of the evolving integrative science of IGBP II and strongly promotes the linkage with the research approaches of the IHDP. In addition, during the past decade the value of critical assessments of global change science has proven to be essential in providing timely information to decision makers. Our research strategy will provide research support for the Intergovernmental Panel for Climate Change and the Millennium Ecosystem Assessment in the coming decade.

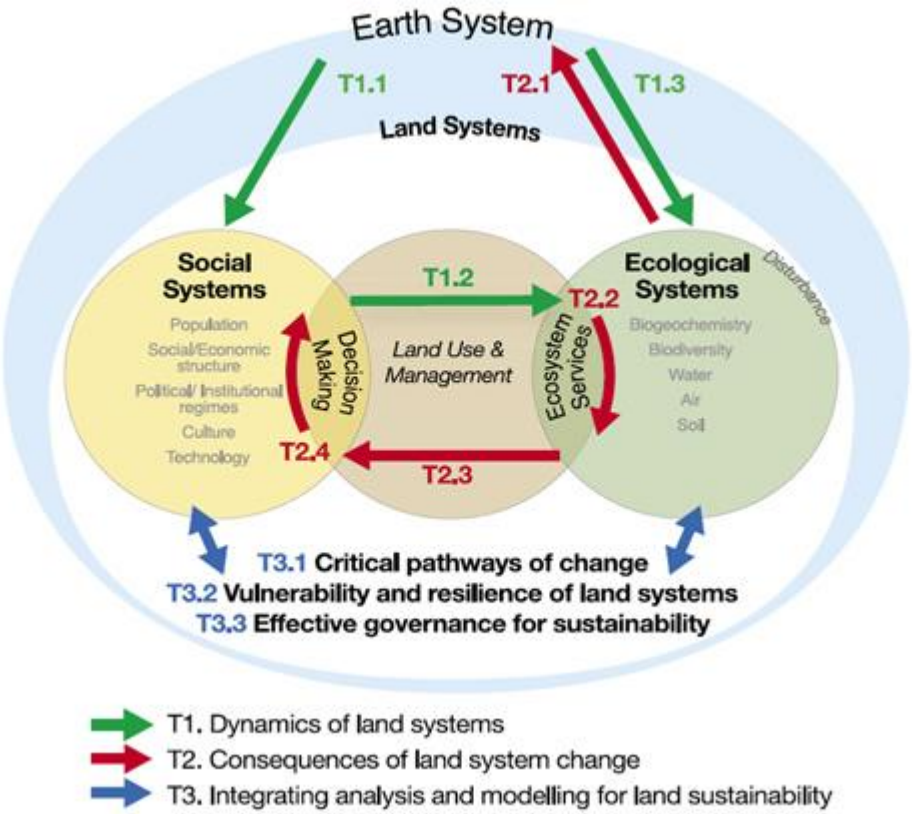
The Science Plan is the outcome of numerous meetings, beginning with an initial scoping meeting in October 2001 at the Max-Planck Institute of Atmospheric Chemistry, Mainz, Germany, where the Global Land Project and the Integrated Land Ecosystem - Atmosphere Processes Study (ILEAPS) were defined. This meeting was followed with a series of Global Land Project meetings at the Natural Resource Ecology Laboratory, Colorado State University, Fort Collins, CO in January of 2002 and again in April of 2003. A critical joint IHDP and IGBP-sponsored meeting in Bilthoven, The Netherlands, in October 2002, enabled scientists from core projects associated with both programs to provide input in the development of the science plan. The GLP science plan was finally published in 2005, and the project became operational with the establishment of the GLP International Project Office (IPO) in Copenhagen at the end of 2006. The IPO was fully funded by the University of Copenhagen from September 2006 to the end of 2011. From the 1st January 2012 the IPO is funded and hosted by the Brazilian National Institute for Space Research (INPE), located in São José dos Campos - SP - Brazil.

GLP has developed a Science Plan around three objectives

i) To identify the agents, structures and nature of change in coupled socio-environmental systems on land and quantify their effects on the coupled system;

ii) To assess how the provision of ecosystem services is affected by these changes; and

iii) To identify the character and dynamics of vulnerable and sustainable coupled socio-environmental land systems to interacting perturbations, including climate change.



Three thematic areas emerge from the objectives, leading to ten research questions:

Theme 1: Dynamics of land-systems

Issue 1.1: How do globalization and population change affect regional and local land use decisions and practices?

Issue 1.2: How do changes in land management, decisions and practices affect biogeochemistry, biodiversity, biophysical properties, and disturbance regimes of terrestrial and aquatic ecosystems?

Issue 1.3: How do the atmospheric, biogeochemical and biophysical dimensions of global change affect ecosystem structure and function?

Theme 2: Consequences of land-system changes

Issue 2.1: What are the critical feedbacks from changes in ecosystems to the coupled

Earth System?

Issue 2.2: How do changes in ecosystem structure and functioning affect the delivery of ecosystem services?

Issue 2.3: How are ecosystem services linked to human well-being?

Issue 2.4: How do people respond at various scales and in different contexts to changes in ecosystem service provision?

Theme 3: Integrating analysis and modelling for land sustainability

Issue 3.1: What are the critical pathways of change in land systems?

Issue 3.2: How do the vulnerability and resilience of land-systems to hazards and disturbances vary in response to changes in human and environment interactions?

Issue 3.3: Which institutions enhance decision making and governance for the sustainability of land-systems?

http://ihdp.unu.edu/article/read/contemporary-land-use-transitions-the-global-oil-palm

Contemporary land-use transitions: The global oil palm expansion

Report | GLP

Kongsager, R. and Reenberg, A. (2012). Contemporary land-use transitions: The global oil palm expansion. GLP Report No. 4. GLP-IPO, Copenhagen.

Abstract

Land is a key parameter in Global Environmental Change. The land change science community has for decades focused on the accelerating pressure on the Earth's limited land resources (e.g. Lambin & Geist, 2006) resulting from contemporary trends in, e.g. globalization, economic wealth, climate change and population increase. Major research efforts have been invested in scrutinizing the proximate and underlying driving forces of land use and land cover changes at local to global scales. Tilman et al. (2001) reported that rapid and widespread agricultural expansion will pose a serious threat to natural ecosystems worldwide over the next 50 years. In addition, Turner et al. (2007) summarized the current state of insight by noting that virtually all land has been affected in some way by human action and that much of this change is a direct consequence of land use: 40% of the Earth's land surface is used for agriculture (including improved pasture and co-adapted grassland), which accounts for almost 85% of the annual fresh water withdrawal globally. The land use changes have, for example, a major impact on the global carbon budget as well as on biological diversity, and changes in land use strategies are increasingly presented as strategic instruments to counteract climatic changes (e.g. in connection with the Reducing Emissions from Deforestation and Forest Degradation (REDD) scheme or as an argument for promotion of biofuel to replace fossil fuel).

Palm oil production is a prominent example of one of the few global land uses that have accelerated in importance as opposed to the majority of major agricultural crops, which have remained remarkably constant with regard to production acreage. It is also one of the land uses characterized by teleconnections. Widespread global demands impact on a limited number of local places. During the past few decades, the oil palm has become one of the most rapidly expanding equatorial crops in the world; oil palms are now grown in 43 countries and their total cultivated area accounts for nearly one-tenth of the world's permanent cropland (Koh & Wilcove, 2008). This impressive and rapid land use alteration caused by palm oil cultivation has been fuelled by the growing demand for vegetable oil on the global market, driven by population growth as well as the general improvement in economic wealth and consumption. The use of palm oil as a biofuel feedstock is still limited, but that may change in the future since palm oil has higher energy efficiency than the current major biofuel crops (soybean and sugarcane). Moreover, the liquid biofuel market is one of the fastest growing markets for agricultural products globally (Gibbs et al., 2008).

Conclusion: there is no download of data possible from the GLP project website

A.5.6 NASA - Land-Cover and Land-Use Change (LCLUC) Program

http://lcluc.umd.edu/

Welcome to the NASA Land-Cover and Land-Use Change (LCLUC) Program website. LCLUC is an interdisciplinary science program in the Earth Science Division of the Science Mission Directorate. LCLUC is part of the Carbon Cycle and Ecosystems Focus Area with links to some programs in other Focus Areas.

Data Initiatives
Data Systems for LCLUC Research

The unprecedented large volumes of data for land use research have necessitated the development of innovative data processing, delivery and analysis systems. The evolving EOS Data and Information System and a number of competed research opportunities such as REASON and ACCESS, have provided support for data systems research and development. The MODIS Advanced Data Processing System (MODAPS) at the Goddard Space Flight Center (GSFC) is generating land-cover related products from the daily MODIS instruments on board the Terra and Aqua platforms. Data products at 250m -1km are being reprocessed as the algorithms are improved to provide consistent data records. This system is currently being enhanced to provide MODIS land product distribution capabilities to augment the services provided by the NASA Distributed Active Archive Center at the Eros Data Center to meet the needs of the MODIS science community.

The Landsat Ecosystem Disturbance Adaptive processing system is developing procedures for automated atmospheric correction and mosaicing of Landsat data and the generation of high resolution disturbance time series. The Global Land Cover Facility (GLCF) at the University of Maryland has developed a low cost system for processing and distribution of large volumes of land-cover data and enhanced data sets. Similarly, the Landsat.org project developed at Michigan State University (MSU) has developed a platform independent user interface and search engine for on-line purchasing, ordering and sharing of Landsat data worldwide. The Tropical Rain Forest Information Center at MSU provides Landsat derived data sets associated with monitoring tropical deforestation.

Global Land Survey

In partnership with the private sector, NASA purchased a global data set of cloud-free Landsat imagery for 1990 and 2000. These data were orthorectified and are easily accessible and freely available. They have greatly increased the use of Landsat data for LCLUC studies worldwide. In May 2003 the Landsat 7 scan line corrector failed and although the instrument continues to receive data, the imagery are of limited use. With no Landsat instrument ready to replace Landsat 7, there is an increasing data gap, posing a critical impediment to LCLUC science. The LCLUC program, working with the USGS is developing a mid-decadal (2004-2006) high resolution global cloud-free data set to extend the previous global data sets. The data set will include data from Landsat 5, ASTER, EO1 and Landsat 7 temporal composites. This data set will include data provided by foreign ground stations and possibly foreign high resolution satellites. It is hoped that international cooperation concerning this data set could provide a prototype for future international efforts to coordinate high resolution global data acquisition from the increasing number of high resolution assets in the framework of GEOSS.

Global Geo-Referenced Field Photo Library

Land use and land cover change studies at regional to global scales require large numbers of field sites for algorithm development and accuracy evaluation. Rapid development in integration of digital camera, hand-held GPS device, computer and internet make it possible for both scientific communities and citizens to collect and share geo-referenced field photos. The Global Geo-Referenced Field Photo Library, developed at the Earth Observation and Modeling Facility of University of Oklahoma, offers the capacity for users to upload, query (by themes and geographically), and download geo-referenced field photos in the library. It offers interactive capacity for users to interpret and classify field photos into relevant land cover types and builds photo-based land cover database. The users can use both photos and associated databases to carry out land use and land cover analysis in a geographical information system. The users who provide field photos can decide whether individual photos are to be shared or not. This tool and the resultant photo library will enable our NASA LCLUC communities to share their field photos, and promote the NASA LCLUC effort in remote sensing.

GLOBAL MAP OF HOTSPOTS OF LAND COVER AND LAND USE CHANGE

Purpose: The goal of this project is to present examples of current hot spots of land cover and land use change around the globe, through an interactive online map. This project was a collaboration between graduate students in the Department of Geography at the University of Maryland, College Park, and was completed in late 2009. The site is periodically updated as new hotspots are identified by scientists from NASA's Land-Use Land-Cover Change Program.

Hotspot Definition: For the purposes of this project, a "hotspot" is defined as existent or potential change to a region or area through land cover and land use change that has regional to global implications. The hotspots were also considered within the context of pressing environmental and social issues such as climate change, biodiversity, human health, and sustainability. Primary considerations were to identify areas of change within the last five years and areas of continued or potential future change.

Hotspot Categories: Seven broad categories of land-cover land-use change were identified for this project. In some cases the categories are related to one another, and other hotspots can be added as needed.

Afforestation / Reforestation

In the present era, where the vast majority of instances of LCLUC are negative in nature, afforestation and reforestation stand as important exceptions with positive impacts on the environment. Afforestation/reforestation can improve soil quality, reduce run off and minimize erosion, and enhance biodiversity (Allen and Chapman 2001). While rates of deforestation far outpace afforestation/reforestation efforts, these two mechanisms do serve to mitigate the negative impacts for example through carbon sequestration (Levy and Milne 2004). Large scale afforestation/reforestation projects include the Green Wall of China, which will eventually lead to nine million new acres of forest cover, or the Brazilian plan to plant one billion trees in the Amazonian state of Pará (Malagonoux, Sene, and Atzmon 2007; Xinhua 2009).

While often treated in the same manner, afforestation and reforestation differ subtly. Afforestation is defined as the planting of new trees in areas which were previously not forested, or at least within the last 50 years (Verchot et al 2007). By contrast reforestation is the replacement of trees in locations where they have traditionally been found in the past 50 years, but have been removed by human or natural forces (Zomer et al 2008). It is also important to note that neither tree plantations nor monocultures are regarded here as either afforestation or reforestation as they have minimal species composition, simple structure, a high degree to disturbance vulnerability, and a specified economic purpose (Lugo 1997).

Large-scale afforestation/reforestation requires a directed and concerted effort. Initiatives to afforest and reforest areas typically have backing from both national and local government, as well as the support of international NGO's and local community organizations. The rationale for these programs typically stem from desires to control storm surges, limit desert encroachment or improve the aesthetic value of a given landscape. While there has been some limited success in afforestation/reforestation projects to-date, there is considerable opportunity for larger scale projects in the context of carbon offsets.

Afforestation References:

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- Lugo, Ariel E. 1997. The apparent paradox of reestablishing species richness on degraded lands with tree monocultures. Forestry Ecology and Management 99:9-19.
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- Zomer, Robert J., A. Trabucco, L.V. Verchot, and B. Muys. 2008. Land area eligible for afforestation and reforestation within the Clean Development Mechanism: a global analysis of the impact of forest definition. Mitigation and Adaptation Strategies for Global Change 13:219-239.

Conclusion: the usability of this data base remains to be investigated

A.5.7 Global Land Cover Network - GLCN

http://www.glcn.org/index_en.jsp

BACKGROUND

The GLCN initiative *(brochure)* is the result of a common effort of partners and sponsors to answer the need, expressed by the international community, for a standardized global land cover database. This initiative has been launched at the conference "Strategies for Global Land Cover Mapping and Monitoring" held in Florence 6-8 May 2002.

OBJECTIVES

- Harmonize land cover definitions, classification systems, mapping and monitoring specifications.
- Develop standards for global mapping.
- Initiate building of a global database.
- Promote outreach initiatives on development methodologies and applications of land cover data.
- Provide advisory services.
- Function as an international, politically neutral and not-for-profit clearinghouse for land cover information at global and regional levels.

GLCN is a global collaboration to develop a fully harmonized approach to make accessible reliable and comparable baseline land cover data required by local, national and international initiatives.

ACTIVITIES SOFTWARE PUBLICATIONS RESOURCES LC ONTOLOGY ABOUT GLCN

Land cover change

Land cover is subject to dynamics driven by anthropogenic and natural alterations. It is possible to monitor cover changes by using time series of satellite imagery.

Kenya Land Cover Change Analysis

The AFRICOVER land cover database for Kenya (1:200,000 scale) was used to detect and quantify changes against the available Geocover set of satellite imagery (three decades, 1980-2000). [Details..]

Senegal Land Cover Change Analysis

Within the LADA framework, an analysis of land cover changes in Senegal was carried out. The analysis covered all the 60 classes present in the Senegal 2005 Land Cover legend; particular attention was given to the more sensitive areas such as Forest, Agricultural land and Urban areas using images taken in two dates: 1990 and 2005. [Details..]

HOME
Land cover
Land cover change
Land cover derived
Satellite imagery
SRTM
Mapping with LCCS
Original legends
Translations

Libya Land Cover Change Analysis

The land cover change assessment of Libya was conducted as one of the activities of the "Mapping of Natural Resources for Agricultural Use and Planning in Libya" (LIB/00/004) project. A comparative analysis between the land cover visual interpretation of 1980's, 1990's and 2000's Landsat dataset (MSS, TM, ETM) and Ikonos satellite data was performed. [Details..]

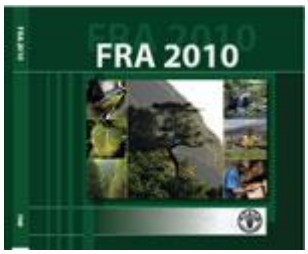
For questions or comments, contact us - *last update: June 8, 2009 1:49 PM*

Conclusion: GLCN provides examples for aggregated land cover change data from the AFRICOVER data base (e.g. Kenya, Senegal, Lybia). The usability of this data base for global coverage remains to be investigated.

A.5.8 FAO - Global Forest Resources Assessment - FRA

http://www.fao.org/forestry/fra/fra2010/en/

Global Forest Resources Assessment
send by email
Global Forest Resources Assessment 2010
NEWS



The FRA 2010 CD-ROM has been released. The CD contains the key findings, main report of the Global Forest Resources Assessment 2010. It also contains all country reports, result tables in Excel format and terms and definitions. It is a multi-lingual CD (Arabic, Chinese, English, French, Russian, Spanish). To receive a copy please send a request to: fra@fao.org

The Global Forest Resources Assessment 2010 (FRA 2010) is the most comprehensive assessment of forests and forestry to date - not only in terms of the number of countries and people involved -but also in terms of scope. It examines the current status and recent trends for about 90 variables covering the extent, condition, uses and values of forests and other wooded land, with the aim of assessing all benefits from forest resources. Information has been collated from 233 countries and territories for four points in time: 1990, 2000, 2005 and 2010. The results are presented according to the seven thematic elements of sustainable forest management. FAO worked closely with countries and specialists in the design and implementation of FRA 2010 - through regular contact, expert consultations, training for national correspondents and ten regional and sub-regional workshops. More than 900 contributors were involved, including 178 officially nominated national correspondents and their teams. The outcome is better data, a transparent reporting process and enhanced national capacity in developing countries for data analysis and reporting. The final report of FRA 2010 was published at the start of the latest biennial meeting of the FAO' Committee on Forestry and World Forest Week, in Rome. [more...]

http://countrystat.org/index.asp?ctry=for&HomeFor=for

Welcome

The database provides access to most of the collected information in the global Forest Resources Assessment 2010 (FRA 2010). The main module has options to change between stub and heading (pivot function), export/save output data in several different formats and generate simple diagrams.

FRA has been discussed in this report

A.5.9 EU - Global Monitoring for Environment and Security - GMES

http://www.gmes.info/

GMES (Global Monitoring for Environment and Security) is the European Programme for the establishment of a European capacity for Earth Observation.

This website is dedicated to the EU-funded R&D activities that support the implementation of the GMES programme.

The views expressed on this website are those of the authors and do not necessarily represent those of the European Commission or of the European Space Agency. Official information on GMES is available on the GMES institutional portal.

GMES in brief

Policymakers and public authorities, the major users of GMES, will use the information to prepare environmental legislation and policies with a particular focus on Climate Change, monitor their implementation and assess their effects. GMES also supports the critical decisions that need to be made quickly during emergencies, such as when natural or man-made catastrophes and humanitarian crises occur.

Users will be provided with information through services dedicated to a systematic monitoring and forecasting of the state of the Earth's subsystems. Six thematic areas are developed: marine, land, atmosphere, emergency, security and climate change. A land monitoring service, a marine monitoring service and an atmosphere monitoring service contribute directly to the monitoring of climate change and to the assessment of mitigation and adaptation policies. Two additional GMES services address respectively emergency response (e.g. floods, fires, technological accidents, humanitarian aid) and security-related aspects (e.g. maritime surveillance, border control). GMES services are all designed to meet common data and information requirements and have global dimension.

In practice, GMES consists in a complex set of systems which collects data from multiple sources (earth observation satellites and in situ sensors such as ground stations, airborne and sea-borne sensors), processes these data and provides users with reliable and up-to-date information through the services mentioned above. Some of these systems and data sources already exist today, as well as prototype services but many developments are still required in all domains.

GMES is an EU-led initiative. The coordination and management of the GMES programme is ensured by the European Commission. The setting up of initial versions of the GMES services have been assigned to several projects partly financed through the 7th Research and Development Framework Programme of the European Union, while the developments related to the observation infrastructure are performed under the aegis of the European Space Agency for the space component (i.e. Sentinel missions) and of the European Environment Agency and the Member States for the in situ component. The sustainability of the GMES operational services will be ensured through public funding from EU, intergovernmental agencies, and Member States. Considered as "public goods", these services should be accessible to any organisation or citizen.

Based on the GMES services, many other value-added services tailored to more specific public or commercial needs (i.e. forecasting services with a local scope, services including socio-economic data, etc.) will certainly be developed. This will stimulate the downstream sector. The public investment will therefore constitute an important contribution to the EU2020 strategy.

For more information on the GMES Programme, please visit the GMES institutional portal.

Land Monitoring

Benefiting from Earth Observation satellite data, the GMES land monitoring service provides accurate and cross-border harmonised geo-information at global to local scales.

The service provides geographical information on land cover including its seasonal and annual changes and monitors variables such as the vegetation state or the water cycle.

It has a wide range of applications for use in land use / land cover change, soil sealing, water quality and availability, spatial planning, forest monitoring and global food security.

The pre-operational land monitoring service of GMES is currently provided through the EU-funded project geoland2. The project develops a set of three *mapping* services which serve as a basis for the provision of a series of *information* services.

EUROLAND (Mapping service)

The European Land Monitoring Service addresses the local (i.e. the Urban Atlas) and the continental component (i.e. high spatial resolution, wall-to-wall land cover parameters and land cover change) of the land monitoring service. EUROLAND contributes developing and implementing an efficient processing chain for future updates of CORINE Land Cover.

BioPar (Mapping Service)

The Biogeophysical Parameters Service provides a series of parameters on regional, European and global scales, both in near-real-time and off-line mode, which describe the continental vegetation state, the radiation budget at the earth's surface and the water cycle.

SATChMo (Mapping Service)

The Seasonal and Annual Change Monitoring Service (SATChMo) aims to close the gap between low-resolution global coverage and the high-resolution by providing seasonal to annual European-wide coverage of physical properties describing bio-geophysical information parameters, such as land cover and land cover change.

Spatial Planning (Information Service)

The Spatial Planning Service provides highly accurate products and tools to describe, explain and forecast urban land use changes, from regional to European scale. Combining geographic information with ancillary geospatial and statistical data, the service helps analysing demographic developments and urban land take trends. It also help describing the state of land consumption and its impact on the environment.

Agri-Environmental Monitoring (Information Service)

The AgriEnvironment Service supports the timely and accurate monitoring of agricultural land use state and its changes at European, national and regional levels. It provides indicators addressing agricultural land use and trends, farming pressure on water and soil resources, and the impact of agricultural land use changes on biodiversity and landscapes.

Water Monitoring (Information Service)

The Water Monitoring Service provides a pan-European model in order to allow an integrated analysis of transnational water bodies. In particular it addresses water balance, flow rates and flow depths in all major streams and rivers, soil moisture level, lake/reservoir depths and levels, snow depths, snow water equivalent and regional snow coverage.

Forest Monitoring (Information Service)

The Forest Monitoring Service provides highly accurate and spatially detailed information on the state and development of forests. It contains information for Forest Area by four forest types (coniferous forest, broad-leafed forest, mixed forest and un-stocked areas/clear-cuts) as well as Forest Area Change.

Land Carbon (Information Service)

The Land Carbon Service aims to set up pre-operational infrastructures for provi- ding variables related to the terrestrial carbon cycle, in near-real-time (NRT), for describing the continental vegetation state (leaf area index and biomass), the surface fluxes (carbon and water), and the associated soil moisture.

Natural Resource Monitoring in Africa (Information Service)

The Natural Resource Monitoring in Africa Service will provide decision makers with factual environmental information. The thematic focus is on natural resource management in a seasonal as well as multi-annual perspective to facilitate decision making processes and medium term planning exercises.

Global Crop Monitoring (Information Service)

The Global Crop Monitoring Service provides objective, near real-time assessments of crop conditions and yield forecasts in support of European policies in the fields of agriculture, trade and food security.

(All credits by geoland2)

Conclusion: the geoland2 product/service portfolio offers data on land use change in European and Sub-Saharan countries/regions. Their usability remains to be investigated.