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Outcome Paper

Outcome Paper for Global Consultation

Issue #19a: Land use classification[1]

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SEEA Editor

[1] This outcome paper has been prepared by the SEEA Editor. It is based on papers presented to the London Group of Experts on Environmental Accounting and discussions among those experts. Investigation and research for this outcome paper was led by Greg Gong during his time at the UN Food and Agriculture Organization

A. Introduction

1. Land is a central feature in any discussion of the environment. It provides the basis for plants, animals and ecosystems to operate, it underlies human infrastructure such as buildings and roads and, perhaps, most importantly, areas of land delineate the space in which we live. It is essential that in the revised System of Environmental and Economic Accounts (SEEA) there is a full discussion of relevant concepts and accounting treatments.

2. Because land is central to so many things the way in which it is considered from an analytical perspective can vary greatly. At times the interest is on how humans use the land surface, at times it is a description of the physical characteristics of the land that is the focus and at still other time it might be the "services" that the land provides that is of main concern.

3. These varying analytical perspectives may often overlap depending on which area of land is being considered. This has lead to the development of a wide range of classifications of different land areas depending on the specific analytical purpose. Generally speaking there are three concepts around which classifications are developed – land use, land cover and land function – but there are very few examples of classifications that stay true to one particular concept.

4. In the process of revising the SEEA it was recognised that there were no internationally agreed classifications of land use or land cover and, given the importance of land in environmental accounting it was recommended that work be undertaken to investigate the possibility of developing standard classifications in these two areas for SEEA purposes.

5. This outcome paper reflects the results of investigation into a classification for land use. A separate outcome paper has also been distributed discussing a proposed classification for land cover (see Issue #19b: Land Cover Classification). The discussion on land functions and the relationships between land and the measurement of ecosystems will not take place in Volume 1 of the revised SEEA. While work in this area is progressing it is not yet developed sufficiently for inclusion as part of an international statistical standard. Rather, this work will be incorporated into Volume 2 of the revised SEEA which will focus on accounting for ecosystems.

6. Discussion on land and related classifications has taken place at all London Group meetings since the 11th London Group meeting in March 2007. The work has been led by the UN Food and Agriculture Organisation (FAO) and the European Environment Agency (EEA).

7. This paper is structured to provide some context to the development of the proposed SEEA land use classification, a presentation of the rules and principles that have been used and then presentation of the classification itself. Annexes to the paper provide additional detail on the classification including detailed definitions and descriptions, and links to other classifications.

B. The context for the SEEA land use classification

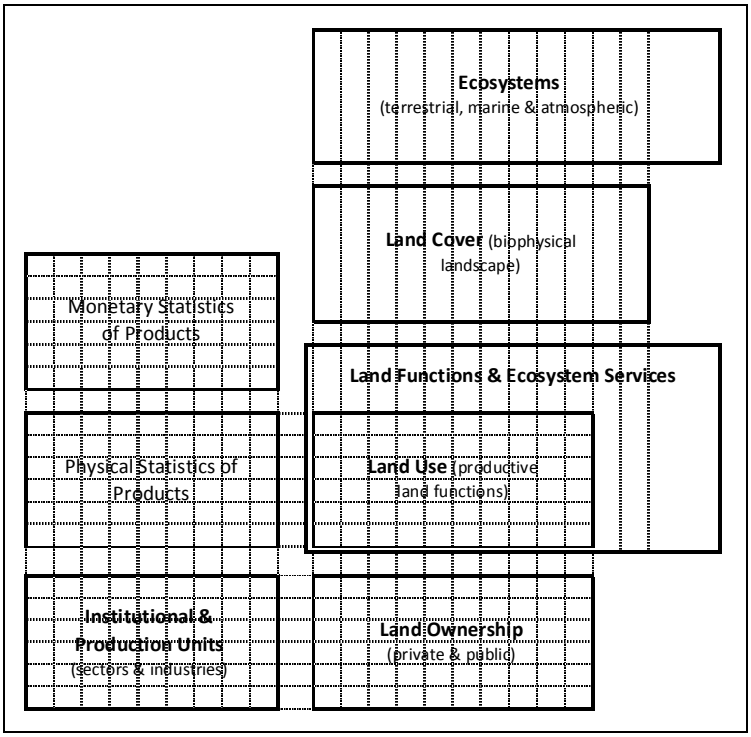
Defining land use and land cover

8. The theoretical distinction between land cover and land use is well established**.** Land Use (LU) reflects the total of arrangements, activities, and inputs undertaken in a certain land cover type (a set of human actions). The social and economic purposes for which land is managed (e.g., grazing, timber extraction, conservation) are land use characteristics[2]. Land Cover (LC) refers to the observed physical and biological cover of the Earth's land as vegetation or man-made features.

9. The following graphic gives a useful description of the links between land cover, land use and other areas of statistical and analytical interest.

[2] This formulation is borrowed from the IPCC glossary of the "Land Use, Land-Use Change and Forestry" webpage. http://www.ipcc.ch/ipccreports/sres/land_use/index.php?idp=13. Similar definition is proposed by FAO (e.g. in *Land Cover vs. Land Use*, Antonio Di Gregorio, FAO – Global Land Cover Network, Global Land Use Data Workshop, Vienna 22 – 23 May 2008

Figure 1: Main nomenclature for land accounting and their relationships



10. There is a long history of intellectual and empirical efforts to find an optimal structure for an international land use classification (LUC). Gong (2009) provides an extensive review and comparison of much of this work. Work by Remmelzwaal (1989), Adamec (1992), Young (1994), and Hadri (2005) was all commissioned by FAO, and all were attempts to design an LUC to be used at the global level. The good features of them were that many main and detailed categories were provided using socio-economic classifiers which themselves are useful reference points for building and designing an LUC for the revised SEEA.

11. However, there are limitations with these classifications in that some are not complete in their coverage, some land uses are missing, attributes used for some divisions are not conceptually aligned with land use such as "small scale farming systems," “irrigation,” “nomadism”, some categories overlap and there is potential confusion with mixed classes between agriculture, grazing and forestry.

12. There are two primary purposes in developing and international LUC. The first purpose is to aggregate available national land use information to the global level in order to generate internationally comparable and compatible data. This can facilitate compilation of regional and global land use databases, permit cross-referencing of different national systems; and preserve national investment in local LUC. The second purpose is to provide a general framework and structure to guide data collection and to aid in the production of effective land use databases especially for countries in the process of establishing and developing their own analysis of land use.

13. These two purposes indicate that the design of an international LUC should not create something completely new which may not be able to be applied in practice. Rather, it is better to take a pragmatic approach to incorporate and consolidate those approaches that have already existed and been used at the global, regional, and national levels. The purposes also define the objective of the proposed LUC to operate at a relatively aggregated level so that it can accommodate the aggregation of the national LU data across countries.

14. Given this starting point the following approach has been used to design, build and test the proposed LUC.

- The LUC sections of land used for agriculture and forestry were based on the LUC used in major global land use databases, including agricultural land use databases in FAOSTAT (collected since 1961); the decennial World Programme for the Census of Agriculture (WCA) (since 1945); the AGRO-MAPS – a global spatial database of sub-national agricultural land-use statistics; and the forestry land use database in the Global Forest Resources Assessment Programme (FRA) (since 1946).
- The LUC sections of "Land with aquaculture facilities," "Inland waters," and "Marine waters" were based on the *Handbook of Fishery Statistical Standards* by the Coordinating Working Party on Fishery Statistics (CWP) (FAO, 1998c), the reports of their sessions, and the final draft of *Handbook of National Accounting: Integrated Environmental and Economic Accounting for Fisheries* (UNSD/FAO, 2004).
- Other sections of the proposed LUC were based on the "Standard International Statistical Classification for Land Use" recommended and adopted by the European Commission for Europe (ECE) in 1989 and the Eurostat version of the Land Use Classification (Eurostat 1993).
- Linkages were constructed with socio-economic classifications such as those for human activities as described in the International Standard Industrial *Classification* of all Economic Activities (*ISIC*) and for products in the Central Product *Classification* (*CPC*). (See Annex 3 for more detail.)
- Linkages were considered relating to the application of the LUC in the construction of land accounts in the revised SEEA and in the study and analysis of climate change, CO_2 emissions, and other environmental issues as in the IPCC reports. (See Annex 4 for more detail.)
- The technical validity and soundness of the proposed LUC was tested through two forms of review: first, against LUC recommended by others in the past; and, second, against LUC used in a selected group of countries - Argentina, Australia, Brazil, Canada, China, India, New Zealand, and the United States. The purpose of this second review was to assess whether the proposed LUC could accommodate varying national LUC in the sense of being able to summarize and aggregate the national land use data for the purpose of international comparison. (See Gong (2009) for details of these reviews.)

C. Conventional Rules and Principles Applied in the development of the Proposed LUC

15. Certain conventional rules and principles considered to be relevant to LU classification have been used as the basis for designing the proposed LUC. These rules and principles have been combined from a number of sources including Di Gregorio and Jansen (1997); Duhamel (1998); Narain and Koroluk (1999) and Young (1994). The principles are also very useful when dealing with practical situations involving the need to assign or allocate a particular piece of land within the proposed LUC.

16. The relevant rules and principles are:

i. Principle of completeness: an LUC should comprehensively cover the total area of land and all forms of land use, including land not presently used for any purpose.

ii. Principle of absence of overlap: categories of an LUC should be mutually exclusive and not overlap. It means that mixed and transitional classes should be avoided to provide a unique dataset descriptor for any piece of land, despite that, on the ground, multiple uses are frequently important; and on maps, composite mapping units may be necessary.

iii. Principle of independence of scale and data-collection tools: a classification should be independent of scale, whether referring to the scale of data collection or the scale of presentation of results; and should be independent of means and methods used for data collection. That is, a classification should be capable of accommodating data obtained from different sources (questionnaire, remote sensing, etc.) and at different scales.

iv. Principle of dominance: this is to account for the multiple-purpose nature of land use. Features related to land use as a whole should be given priority over special and sector interests.

v. Principle of defining land use at the time of observation.

vi. Principle of strict logic: a classification should have a logical and scientifically sound foundation.

vii. Principle of spatial and temporal consistency.

viii. Principle of a system of explanatory notes: a classification should be as pragmatic and easy to understand as possible to promote consistent terminology. Rules for describing and naming headings and classes should be rational and widely recognized. Obscure terminology or definitions, running counter to intuition, will not be accepted by the desired wide-range of users.

D. The proposed Land Use Classification

17. The proposed LUC in Table 1 is a consolidated structure of all the LU classifications. It corresponds fully to each and every one of the databases and datasets mentioned in section B. A complete analysis of the correspondences between the proposed LUC and the ECE LUC, the Eurostat LUC, the ISIC and the IPCC report's LUC is given in Gong (2009).

18. There are three levels in the proposed LUC. The first level has the following 13 categories.

Table 1: First Level of the Proposed LUC

	Code	**Item**
Cultivated, Forest, and Aquacultural Land		
1	A	Agricultural land
2	B	Forests and other wooded land
3	C	Land with aquaculture facilities
Built-Up and Related Land		
4	D	Land used for mining, quarrying, and construction
5	E	Land used for manufacturing
6	F	Land used for technical infrastructure
7	G	Land used for transportation and storage
8	H	Land used for commercial, financial, and public services
9	I	Land developed for recreational purposes
10	J	Residential areas
11	K	Land not in use
Water Area		
12	L	Inland waters
13	M	Marine waters

19. One important note is that the category "Land not in use" appears as one single entry without underlying subclasses to ensure that the total land area is consistent with that of the land cover classification.

20. It is noted that in a number of cases there is no intention of developing the classification below the first level categories at this stage although a more detailed breakdown could be added in the future if needed. This is true for the following first level categories:

- Land used for mining, quarrying, and construction
- Land used for manufacturing
- Land used for technical infrastructure
- Land used for transportation and storage

- Land used for commercial, financial, and public services
- Land developed for recreational purposes
- Residential areas

21. The second level has 14 categories, which provide a further breakdown for categories of Agricultural land (A), Forests and other wooded land (B), Land with aquaculture facilities (C), Inland waters (L), and Marine waters (M). For all of these categories, especially for agriculture and forestry, databases are already available at the global level with this more detailed breakdown.

Table 2: Second Level of the Proposed LUC

	Code	Item
1	A1	Land under temporary crops
2	A2	Land under temporary meadows and pastures
3	A3	Land with temporary fallow
4	A4	Land under permanent crops
5	A5	Land under permanent meadows and pastures
6	A6	Land under protective cover
7	B1	Forest land
8	B2	Other wooded land
9	C1	Hatcheries
10	C2	Managed grow-out sites
11	L1	Areas with aquaculture or holding facilities
12	L2	Other inland water areas
13	M1	Areas with aquaculture or holding facilities
14	M2	Other marine water

22. The third level breakdown with 18 categories is only applied within agriculture (A), forests (B), and fisheries (C, L & M) as proposed in Gong, Marklund, and Tsuji (2009). This level is created with the same justification as presented above, i.e. it is based on the practice at FAO and related databases at the global level.

Table 3: Third Level of the Proposed LUC

	Code	Item
1	A11	*Cereals*
2	A12	*Vegetables and melons*
3	A13	*Temporary oilseed crops*
4	A14	*Root/tuber crops with high starch or inulin content*
5	A15	*Temporary spice crops*
6	A16	*Leguminous crops*
7	A17	*Sugar crops*
8	A19	*Other temporary crops*
9	A41	*Fruit and nuts*
10	A42	*Permanent oilseed crops*
11	A43	*Beverage and permanent spice crops*
12	A49	*Other permanent crops*
13	B11	*Naturally regenerated forest*
14	B12	*Planted forest*
15	L21	*Enhanced areas*
16	L22	*Open access waters without enhancement*
17	M21	*Enhanced areas*
18	M22	*Open access waters without enhancement*

23. Note that, for Agricultural land (A), the breakdown at the third level is finer than the breakdown in the Eurostat LUC as it follows the structure and order of the new version of the CPC. This level identifies groupings that are considered important in terms of economic value, nutritional requirements, and human consumption. It is also noted that some of the categories in the Eurostat LUC are not used in the proposed SEEA LUC, such as the category “industrial crops”.

24. Finally, it is noted that specific effort has been made to align the proposed LUC with the classification of forests at all levels of the hierarchy. In particular the use of classes of forest rather than classes based on the type of tree has been considered more appropriate.

25. Overall, the proposed LUC is considered to be complete and ready for inclusion in SEEA Volume 1.

Recommendation 19a.1: That the revised SEEA should adopt the land use classification presented in Tables 1, 2 and 3 of the outcome paper and the associated definitions and descriptions presented in Annex 2 of the outcome paper.

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Annex 1: Proposed Land Use Classification (Structure)

CODE			TITLE
Cultivated, Forest, and Aquacultural Land			
A			**Agricultural land**
	A1		Land under temporary crops
		A11	*Cereals*
		A12	*Vegetables and melons*
		A13	*Temporary oilseed crops*
		A14	*Root/tuber crops with high starch or inulin content*
		A15	*Temporary spice crops*
		A16	*Leguminous crops*
		A17	*Sugar crops*
		A18	*Other temporary crops*
	A2		Land under temporary meadows and pastures
	A3		Land with temporary fallow
	A4		Land under permanent crops
		A41	*Fruit and nuts*
		A42	*Permanent oilseed crops*
		A43	*Beverage and permanent spice crops*
		A44	*Other permanent crops*
	A5		Land under permanent meadows and pastures
		A51	*Cultivated permanent meadows and pastures*
		A52	*Naturally grown permanent meadows and pastures*
	A6		Land under protective cover
B			**Forest and other wooded land**
	B1		Forest land
		B11	Naturally regenerated forest
		B12	Planted forest
	B2		Other wooded land
C			**Land with aquaculture facilities**
	C1		Hatcheries
	C2		Managed grow-out sites
Built-Up and Related Land			
D			**Land used for mining, quarrying, and construction**
E			**Land used for manufacturing**
F			**Land used for technical infrastructure**
G			**Land used for transportation and storage**
H			**Land used for commercial, financial, and public services**
I			**Land developed for recreational purposes**
J			**Residential areas**
K			**Land not in use**
Water Area			
L			**Inland waters**
	L1		Areas with aquaculture or holding facilities
	L2		Other inland water areas
		L21	*Enhanced areas*
		L22	*Open access waters without enhancement*
M			**Marine waters**
	M1		Areas with aquaculture or holding facilities
	M2		Other marine water
		M21	*Enhanced areas*
		M22	*Open access waters without enhancement*

Annex 2: Proposed Land Use Classification (Definitions and Descriptions)

CATEGORY	DEFINITION
A. Agricultural land	The total of areas under “Land under temporary crops,” “Land under temporary meadows and pastures,” “Land with temporary fallow,” “Land under permanent crops,” “Land under permanent meadows and pastures,” and “Land under protective cover”. Thus, this category includes tilled and fallow land, land under grass used for agricultural purposes. Scattered land under farm buildings, yards and their annexes, permanently uncultivated land, such as uncultivated patches, banks, footpaths, ditches, headlands, and shoulders are traditionally included.
A1. Land under temporary crops	Land used for crops with a less than one-year growing cycle, which must be newly sown or planted for further production after the harvest. Some crops that remain in the field for more than one year may also be considered as temporary crops. Asparagus, strawberries, pineapples, bananas and sugar cane, for example, are grown as annual crops in some areas. Such crops should be classified as temporary or permanent according to the custom in the country. Excludes: - Herbaceous forage crops.
A11. Cereals	Land used for the related activities of Classes: - 0111 - Growing of cereals (except rice), leguminous crops and oil seeds - 0112 - Growing of rice as in ISIC Rev.4.
A12. Vegetables and melons	Land used for the related activities of Classes: - 0113 - Growing of vegetables and melons, roots and tubers as in ISIC Rev.4.
A13. Temporary oilseed crops	Land used for the related activities of Classes: - 0111 - Growing of cereals (except rice), leguminous crops and oil seeds as in ISIC Rev.4.
A14. Root/tuber crops with high starch or inulin content	Land used for the related activities of Classes: - 0113 - Growing of vegetables and melons, roots and tubers as in ISIC Rev.4.
A15. Temporary spice crops	Land used for the related activities of Classes: - 0128 - Growing of spices, aromatic, drug and pharmaceutical crops as in ISIC Rev.4.
A16. Leguminous crops	Land used for the related activities of Classes: - 0111 - Growing of cereals (except rice), leguminous crops and oil seeds as in ISIC Rev.4.
A17. Sugar crops	Land used for the related activities of Classes: - 0113 - Growing of vegetables and melons, roots and tubers

	- 0114 - Growing of sugar cane as in ISIC Rev.4
A18. Other temporary crops	Land used for the related activities of Classes: - 0119 - Growing of other non-perennial crops as in ISIC Rev.4.
A2. Land under temporary meadows and pastures	Land cultivated with temporary herbaceous forage crops for mowing or pasture. A period of less than five years is used to differentiate between temporary and permanent meadows.
A3. Land with temporary fallow	Agricultural land that is not seeded for one or more growing seasons. The maximum idle period is usually less than five years. Land remaining fallow for too long may acquire characteristics requiring it to be reclassified, such as “Land not in use” (K). This land may be in the form sown for the exclusive production of green manure.
A4. Land under permanent crops	Land cultivated with long-term crops which do not have to be replanted for several years (such as cocoa and coffee); land under trees and shrubs producing flowers (such as roses and jasmine); and nurseries (except those for forest trees, which should be classified under "Forest land"). Land under permanent meadows and pastures are excluded from “Land under permanent crops.” Excludes: - Herbaceous forage crops.
A41. Fruit and nuts	Land used for the related activities of Classes: - 0121 - Growing of grapes - 0122 - Growing of tropical and subtropical fruits - 0123 - Growing of citrus fruits - 0124 - Growing of pome fruits and stone fruits - 0125 - Growing of other tree and bush fruits and nuts as in ISIC Rev.4.
A42. Permanent oilseed crops	Land used for the related activities of Classes: - 0126 - Growing of oleaginous fruits as in ISIC Rev.4.
A43. Beverage and permanent spice crops	Land used for the related activities of Classes: - 0127 - Growing of beverage crops - 0128 - Growing of spices, aromatic, drug and pharmaceutical crops) as in ISIC Rev.4.
A44. Other permanent crops	Land used for the related activities of Classes: - 0129 - Growing of other perennial crops as in ISIC Rev.4.
A5. Land under permanent meadows and pastures	Land used to grow permanent (five years or more growth cycle) herbaceous forage crops through cultivation or naturally (wild prairie or grazing land). Permanent meadows and pastures on which trees and shrubs are grown should be recorded under this heading only if the growing of forage crops is the most important use of the area. Measures may be taken to keep or increase productivity of the land (i. e. use of fertilizers, mowing or systematic grazing by domestic animals.)

	This category includes: - Grazing in wooded areas (agro-forestry areas, for example). - Grazing in shrubby zones (heath, maquis, garigue). - Grassland in the plain or low mountain areas used for grazing: land crossed during transhumance where the animals spend a part of the year (approximately 100 days) without returning to the holding in the evening: mountain and sub-Alpine meadows and similar; steppes and dry meadows used for pasture.
A51. Cultivated permanent meadows and pastures	Land under permanent meadows and pastures that is managed and cultivated.
A52. Naturally grown permanent meadows and pastures	Land under naturally grown permanent meadows and pastures used for grazing, animal feeding or agricultural purpose.
A6. Agricultural land under protective cover	Surfaces occupied by dwellings on farms etc.: dwellings, operating buildings (hangars, barns, cellars, green houses, silos), buildings for animal production (stables, cow sheds, pig sheds, sheep pens, poultry yards), family gardens, farmyards. Excludes - Buildings in rural areas for exclusive residential purpose (J) - Buildings for agro-food manufacture (E)
B. Forest and other wooded land	Land spanning more than 0.5 hectares with trees higher than 5 m and a canopy cover of at least 5 percent, or trees able to reach these thresholds *in situ*; or with a combined cover of shrubs, bushes and trees above 10 percent. It does not include land that is predominantly under agricultural or urban use.
B1. Forest	Land spanning more than 0.5 hectares with trees higher than 5 m and a canopy cover of more than 10 percent, or trees able to reach these thresholds *in situ*. It does not include land that is predominantly under agricultural or urban land use. Explanatory notes 1. Forest land is determined both by the presence of trees and the absence of other predominant land uses. The trees should be able to reach a minimum height of 5 m *in situ*. 2. Includes areas with young trees that have not yet reached but which are expected to reach a canopy cover of 10 percent and tree height of 5 m. It also includes areas that are temporarily unstocked due to clear-cutting as part of a forest management practice or natural disasters, and which are expected to be regenerated within 5 years. Local conditions may, in exceptional cases, justify that a longer time frame is used. 3. Includes forest roads, firebreaks and other small open areas; forest in national parks, nature reserves and other protected areas such as those of specific environmental, scientific, historical, cultural or spiritual interest. 4. Includes windbreaks, shelterbelts and corridors of trees with an area of more than 0.5 hectares and width of more than 20 m. 5. Includes abandoned shifting cultivation land with a regeneration of trees that have, or is expected to reach, a canopy cover of 10 percent and tree height of 5 m. 6. Includes areas with mangroves in tidal zones, regardless whether this area is classified as land area or not.

	7. Includes rubber-wood, cork oak and Christmas tree plantations. 8. Includes areas with bamboo and palms provided that land use, height and canopy cover criteria are met. 9. Some agroforestry systems such as the "Taungya" system where crops are grown only during the first years of the forest rotation should be classified as forest. Excludes tree stands in agricultural production systems, such as fruit tree plantations, oil palm plantations and agroforestry systems when crops are grown under tree cover.
B11. Naturally regenerated forest	Forest predominantly composed of trees established through natural regeneration. In this context, predominantly means that the trees established through natural regeneration are expected to constitute more than 50% of the growing stock at maturity. Includes: - Coppice from trees established through natural regeneration. - Naturally regenerated trees of introduced species. o Primary forest: i.e. naturally regenerated forest of native species, where there are no clearly visible indications of human activities and the ecological processes are not significantly disturbed. Some key characteristics of primary forests are: o They show natural forest dynamics, such as natural tree species composition, occurrence of dead wood, natural age structure and natural regeneration processes. o The area is large enough to maintain its natural characteristics. o There has been no known significant human intervention or the last significant human intervention was long enough ago to have allowed the natural species composition and processes to have become re-established. - Other naturally regenerated forest: i.e. forest where there are clearly visible indications of human activities. Includes: o Selectively logged-over areas, areas regenerating following agricultural land use, areas recovering from human-induced fires, etc. o Forests where it is not possible to distinguish whether planted or naturally regenerated. o Forests with a mix of naturally regenerated trees and planted/seeded trees, and where the naturally regenerated trees are expected to constitute more than 50% of the growing stock at stand maturity.
B12. Planted forest	Forest predominantly composed of trees established through planting and/or deliberate seeding. In this context, predominantly means that the planted/seeded trees are expected to constitute more than 50% of the growing stock at maturity. Includes: - Coppice from trees that were originally planted or seeded. Excludes: - Self-sown trees of introduced species.

	- Tree stands in agricultural production systems, such as fruit tree plantations, oil palm plantations and agroforestry systems when crops are grown under tree cover. - Land that is predominantly under agricultural or urban use.
B2. Other wooded land	Land not classified as "Forest", spanning more than 0.5 hectares; with trees higher than 5 meters and a canopy cover of 5-10 percent, or trees able to reach these thresholds *in situ*; or with a combined cover of shrubs, bushes and trees above 10 percent. It does not include land that is predominantly under agricultural or urban land use. The definition above has two options: - The canopy cover of trees is between 5 and 10 percent; trees should be higher than 5 meters or able to reach 5 meters *in situ.* or - The canopy cover of trees is less than 5 percent but the combined cover of shrubs, bushes and trees is more than 10 percent. Includes areas of shrubs and bushes where no trees are present. Includes: - Areas with trees that will not reach a height of 5 meters *in situ* and with a canopy cover of 10 percent or more, e.g. some alpine tree vegetation types, arid zone mangroves, etc. - Areas with bamboo and palms provided that land use, height and canopy cover criteria are met.
C. Land with aquaculture facilities	Land used for aquaculture facilities including supporting facilities. Aquaculture refers to the farming of aquatic organisms: fish, molluscs, crustaceans, aquatic plants, crocodiles, alligators, turtles, and amphibians. Farming implying some form of intervention in the rearing process to enhance production, such as regular stocking, feeding, protection from predators, etc. Aquaculture facilities include ponds and tanks (artificial units of varying sizes constructed above or below ground level capable of holding and interchanging waters), raceways and silos (artificial units constructed above or below ground level capable of high rate of water interchange in excess of 20 changes per day) and hatcheries (housing facilities for breeding, nursing and rearing seed of fish, invertebrates or aquatic plants to fry, fingerlings or juvenile stages).
C1. Hatcheries	Housing facilities for breeding, nursing and rearing seed of fish, invertebrates or aquatic plants to fry, fingerlings or juvenile stages.
C2. Managed grow-out sites	Land with aquaculture facilities other than "Hatcheries."
Built-up and related land	Land affected or adapted by man, under buildings, roads, mines and quarries and any other facilities, including their auxiliary spaces, deliberately installed for the pursuit of human activities. Included are also certain types of open land (non- built- up land), which are closely related to these activities, such as waste tips, derelict land in built-up areas, junk yards, city parks and gardens. Land under closed villages or similar rural localities are included.
D. Land used for mining, quarrying, and construction	Land mainly occupied by mines, quarries, construction building sites, tips, man-made wasteland, i.e. abandoned areas (residential, industrial, commercial, infrastructures, and burned areas); including installations for the extraction of solid fuels, petroleum, natural gas, minerals, salt, construction stone, and sand and clay; including their associated areas (slag heaps, dumps and storage areas, loading and unloading sites, shafts or head gear).
E. Land used for manufacturing	Land occupied by activities of manufacturing including heavy industries. This category includes coking plants, cracking and refining of petroleum, installations for producing and processing of metals, installations producing

	non-metallic minerals; industrial installations in the field of basic chemistry, agro-chemistry, the production of synthetic and artificial fibres and other products; installations working in the fields of agro-food products, beverages and tobacco, textile manufacturing, leather, footwear and clothing manufacturing, wood, paper and production of paper articles, rubber and transformation of plastics, as well as construction companies and public works. Excludes - Actual construction sites (D). - Harbour areas and their storage facilities (G).
F. Land used for technical infrastructure	Land occupied by technical installations for the generation, distribution, and transmission of electrical energy; the distribution of hydro-carbons, including oil and gas pipelines, and water; the recovery and purification of water; the collection and treatment of waste; Land occupied by telecommunications networks, such as relay stations, TV aerials, radio telescopes, radars, and major protective works, e.g. water retention dams, protective dykes. Included is also the land used for related offices and other service buildings and installations, as well as any space needed, according to national practices, for the operation of such technical infrastructure.
G. Land used for transport and storage	Land occupied by infrastructures and service enterprises in the field of transport and storage. Includes transport infrastructures for road traffic; rail networks; airport installations; installations connected with river and maritime transport. Included is also the land used for transport-related offices and other service buildings and installations, such as stations, airport buildings, storage facilities for equipment and repair workshops, space used for sidewalks, grass slopes along railways, windshelter belts along roads, open noise abatement areas round airports as well as any other space needed, according to national practices, for the provision of the related infrastructure. This category does not include: - military aerodromes (H) - dockyards (E) - waterways (L)
H. Land used for commercial, financial, and public services	Land mainly used for commerce, trade, and related services, public administrations and judicial services, public order and safety services, social security and social work services, professional and trade associations; including private roads and other auxiliary spaces located in the areas concerned. This category includes wholesale and retail trade; hotel and catering services; banks and insurance; personal services; installations for national defence; education and research/development; land occupied by religious buildings.
I. Land developed for recreational purposes	Land developed for and occupied by leisure or recreational purposes, including cultural sites: archaeological sites; historic sites, classified monuments, ruins and stately homes; museums, libraries, media centres; concert halls and theatres; cemeteries, and associated areas (water, wooded areas, lawns, gardens) SPORT facilities: public beaches and swimming pools, gymnasiums, sports halls; stadiums and games fields; assembly and dancing halls; golf courses; riding tracks; car racing circuits; green or leisure areas: urban parks, public gardens, zoological and botanical gardens, hobby gardening; major burial grounds used as walking places with considerable vegetation; facilities for tourism: camping and caravanning sites; amusement parks, circuses, youth hostels and country centres; marinas; secondary residences or vacation houses; and casinos. This category does not include areas that can be used for recreation but this is not the main utilization:

	- agricultural areas (A) - forests and other wooded land (B) - secondary dwellings (J) - natural or semi-natural areas not specifically developed (K) - ski runs (K) - beaches (K)
J. Residential areas	Land mainly covered by residential buildings, irrespective of whether they are actually occupied or temporarily vacant, including residential land attached private gardens and small green areas and parking facilities and small playgrounds mainly reserved and used by the inhabitants of the buildings. This category includes: - continuous and dense residential areas (dense to very dense urban core where a large proportion of the buildings are higher than three stories) - continuous residential areas of moderate density (suburban kind, found commonly in old villages attached to a town.) - discontinuous residential areas of moderate density ("housing area" type, formed by individual houses) - isolated residential areas (hamlets, groups of a few houses, small villages, isolated buildings) - collective residential areas (collective dwellings generally higher than three stories) This category does not include: - land used for purposes specified elsewhere, even if it is mainly used by the local population.
K. Land not in use	Land where there are no clearly visible indications of human activities and ecological processes are not significantly disturbed. <u>Includes</u> - Land with trees not used for the purpose of agriculture and not classified as Forest and other wooded land; - Bushes and shrub not used for the purpose of agriculture and not classified as Other wooded land; - Open areas with low vegetation of the herbaceous type, not used for agricultural purposes; - Natural and non-built-up land surface with little or no vegetation, which precludes its inclusion in other categories of the classification; included are old quarries and abandoned sandpits. - Bare soils (areas where bedrock crops out) including rocks and scree, and dunes and sand and pebble beaches. - Land covered by glaciers (generally measured at the time of their greatest expansion in the season) or eternal snow; and burned areas. - Land under water or areas covered by wet land, which are flooded or likely to be so over a large part of the year by fresh, brackish or saline, or stagnating water, bearing a vegetation cover of the low shrub, semi-woody or herbaceous type (bogs and marshes); and occupied by intermediate zones between the solid and liquid state, among which blanket or raised peat lands, such as peat bogs (moors). <u>Excludes</u>

	- Peat bogs in use for fuel harvesting (D).
WATER AREA	This relates to the part of the national territory (= country area) to be reported, which is covered by surface waters (i.e. inland and internal waters), and to territorial waters and exclusive economic zone. The national territory to be reported is defined as the surface enclosed by all inland borders and, if applicable, the normal base-line (low-water mark) on the seaward side.
L. Inland water	Areas corresponding to natural or artificial water courses, serving to drain natural or artificial bodies of water, including lakes, reservoirs, rivers, brooks, streams, ponds, inland canals, dams, and other land-locked (usually freshwater) waters. The banks constitute limits whether the water is present or not. This category does not include: - industrial bodies of water (D) - hydro-electric dams (F) - marinas (I) - moats (I) - swimming pools (I)
L1. Areas with aquaculture or holding facilities	Inland bodies of water used for fish farming activities (aquaculture).
L2. Other inland water areas	Other natural or artificial water courses (rivers, canals), serving to drain natural or artificial bodies of water (lakes, ponds, reservoirs). The banks constitute limits whether the water is present or not.
L21. Enhanced areas	Areas with enhancement including stocking, fertilization, engineering, predator control, habitat modifications, and/or access limits.
L22. Open access waters without enhancement	Area without any enhancements and access limitation.
M. Marine waters	Oceans and seas including adjacent saltwater areas including internal waters, within national exclusive economic zone. Internal waters is considered as those waters of the sea on the landward side of the baseline used by the national authorities of the coastal country to measure further seawards the width of the territorial sea and any adjacent marine waters, whether salt, brackish, or fresh in character. This category does not include: - ports (G) - marinas (I)
M1. Areas with aquaculture or holding facilities	Water surface areas above, on or below which are used for marine aquaculture facilities including supporting facilities. Aquaculture refers to the farming of aquatic organisms: fish, molluscs, crustaceans, aquatic plants, crocodiles, alligators, turtles, and amphibians. Aquaculture facilities include enclosures and pens (water areas confined by net, mesh and other barriers allowing uncontrolled water interchange), cages (open or covered enclosed structure constructed with net, mesh or any porous materials allowing natural water interchange), barrages (semi-permanent or seasonal enclosures formed by impervious man-made barriers and appropriate natural features), and rafts, ropes, stakes (raft, long lines or stakes used to culture shellfish and seaweeds). This category includes: - oyster beds and other types of shellfish (mussels, clams, abalones, scallops)

	- bodies of water used for seaweed production - bodies of water used for fish rearing
M2. Other marine water	This category includes: - water surfaces in estuaries (the wide portion of rivers at their mouths subject to the influence of the sea into which the water course flows: the limit is fixed at the point where width is less than 5 km at high tide and greater than 3 km at low tide). - lagoons (cut off from the sea by coastal banks or other forms of relief with, however, certain possible openings).
M21. Enhanced Area	Areas with enhancement including stocking, fertilization, engineering, predator control, habitat modifications, and/or access limits, including Marine Protected Area.
M22. Open access waters without enhancement	All waters (other than inland waters), brackish or marine, lying on the landward side of the "normal base-line" (LOS) along the coast, and in estuaries between this low-water mark base-line and the seaward side of the line at the mean tidal level. (Additional criteria may have to be applied in special cases, where this definition would lead to inappropriate results).

Sources: FAOSTAT Resources Questionnaire; WCA2010; and Specification of National Reporting Tables for FRA 2010; and CWP Handbook; ECE (1993), Eurostat (1993); and Article 8 of the Informal Composite Negotiating Text/Revision 2 (A/CONF.62/WP.10/Rev.2, 11 April 1980) of the United Nations Third Conference on the Law of the Sea.

Annex 3: Linkages to Human Activities as described in ISIC and to Products in CPC

As shown in Table 3a below, human activities in ISIC can be grouped into ten major categories for the purposes of land use. One application of the linkage with ISIC is to facilitate data collection in the field. The area of land can be divided into segments. Each segment can be further divided into smaller units that can be identified through ownership and associated with economic activities on it. In building these associations, one can easily use principles laid down in ISIC for classifying activities into principal, secondary and ancillary activities and their association to the owner of the unit. To meet the needs of multiple users and satisfy the "Principle of completeness", one may consider taking ISIC classes at the first level and incorporating purposes at the second or third level, where the "purposes" are connected with the kinds of objectives an activity pursues. This approach would help to establish a one-to-one correspondence between land and labor, capital, and goods and services produced.

The link with CPC and ISIC as described in Gong, Marklund, and Tsuji (2009) relates particularly to the agricultural sector at the third level of the proposed LUC. Several national LU classifications as well as global statistical databases use the detail at this level. This is especially relevant in the study of climate change and other environmental issues as in the IPCC reports.

Table A3.1: Comparison between Proposed LUC and ISIC

CODE	PROPOSED LUC	CODE	ISIC
A	Agricultural land	01	Crop and animal production, hunting and related service activities
B	Forest and other wooded land	02	Forestry and logging
C	Land with aquaculture facilities	03	Fishing and aquaculture
D	Land used for mining, quarrying, and construction	05–09 41–43	Mining and quarrying Construction
E	Land used for manufacturing	10–33	Manufacturing
F	Land used for technical infrastructure	35 36–39 58–63	Electricity, gas, steam and air conditioning supply Water supply; sewerage, waste management and remediation activities Information and communication
G	Land used for transportation and storage	49–53	Transportation and storage
H	Land used for commercial, financial, and public services	45–47 55–56 64–66 68 69–75 77–82 84 85 86–88 94–96 99	Wholesale and retail trade; repair of motor vehicles and motorcycles Accommodation and food service activities Financial and insurance activities Real estate activities Professional, scientific and technical activities Administrative and support service activities Public administration and defence; compulsory social security Education Human health and social work activities Other service activities Activities of extraterritorial organizations and bodies
I	Land developed for recreational purposes	90–93	Arts, entertainment and recreation
J	Residential areas	97–98	Activities of households as employers; undifferentiated goods- and services-producing activities of households for own use
L1	Areas with aquaculture or holding facilities	03	Fishing and aquaculture
M1	Areas with aquaculture or holding facilities	03	Fishing and aquaculture

Annex 4: Linkages between the Proposed Land Use Classification and the LUC used in IPCC Report

The IPCC Guidelines use six broad land-use categories to report emissions and removals from land use and land use conversions, namely Forest Land, Cropland, Grassland, Wetlands, Settlements, and Other Land. These land uses are considered top-level categories for representing land use area with subcategories describing the special circumstances affecting national emissions or removals. The IPCC Guidelines only provide very broad and non-prescriptive definitions for these land use categories and allow countries to use their national definitions that may incorporate land cover or land use or both depending upon national circumstances. For example, the IPCC Guidelines use the term "managed land," defined as "…land where human interventions and practices have been applied to perform production, ecological or social functions," as a proxy for anthropogenic emissions and removals, leaving countries to provide transparent and consistent national definitions in the national Greenhouse Gas (GHG) Reporting.

The following Table 4a is extracted from the *IPCC Special Report on Land Use, Land-use Change and Forestry* under the title of "Table 2-1. Land-use categories recognized in FAO's World Census of Agriculture (FAO, 1986, 1996a; FAO/UNEP, 1999).

Table 4a: Comparison between FAO and IPCC LU Classifications

FAO Classification (In Sequence of Increasing Intensity of Use)	IPCC Report
(a) Deserts (barren land and waste land)	-
(b) Non-Forest Wooded Lands	-
(c) Wetlands, Non-Forest	Wetlands
(d) Land under Forest	Forest Land
(e) Land under Forestry/Silviculture	Forest Land
(f) Land under Shifting Cultivation	Agroforestry Land
(g) Land under Agroforestry	Agroforestry Land
(h) Land with Temporary Fallow	Cropland
(i) Land under Permanent Meadows and Pastures	Rangeland/Grasslands
(j) Land under Temporary Meadows and Pastures	Rangeland/Grasslands
(k) Land under Permanent Crops	Agroforestry Land
(l) Land under Temporary Crops	Cropland
(m) Land under Temporary Crops Requiring Wetland Conditions	Wetlands
(n) Land under Protective Cover	Peri-Urban Land
(o) Land under Residential/Industrial/Transportation Facilities	Peri-Urban Land

Sources: http://www.grida.no/publications/other/ipcc_sr/?src=/Climate/ipcc/land_use/ ; *FAO's World Census of Agriculture (FAO, 1986, 1995a; FAO/UNEP, 1999)*

The table is shown here to demonstrate the high relevance of the FAO land use categories in the climate change and other environmental issues as in the IPCC reports. Note that some of the categories cited here have been revised and updated in the proposed SEEA LUC.