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Land use classification proposed for SEEA

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Proposal

The structure and definitions and descriptions for each of the categories in the proposed Land Use Classification (called "the proposed LUC" thereinafter) can be found in Tables 1 and 2 in the Annex of this paper.

Background

Upon the request of the London Group and the United Nations Statistics Division (UNSD), FAO prepared and presented a paper entitled "Land Use Classification Proposed to Be Used in the System of Integrated Environmental and Economic Accounting (SEEA)" (by Xiaoning Gong, FAO Statistics Division, Lars Gunnar Marklund, FAO Forestry Department, Sachiko Tsuji, FAO Fisheries and Aquaculture Department) (LG/14/10) on 23 April 2009 to the 14th Meeting of the London Group on Environmental Accounting on 27-30 April 2009 in Canberra, Australia.

The paper proposed a consolidated land use (LU) classification to be used in the SEEA based on the major LU databases at the global level and the work of FAO across various Departments and Divisions, including FAOSTAT, World Programme for the Census of Agriculture 2010 (WCA 2010) in Statistics Division, the Global Forest Resources Assessment 2010 (FRA2010) in the Forestry Department, efforts made by members of the Natural Resources Management and Environment Department, and Fisheries and Aquaculture Department. The proposal thus has brought together the different classifications of LU used by FAO for agriculture, forestry and fisheries.

At the meeting, the London Group re-affirmed the importance of having standardized classifications for land cover and land use and the need to formulate concrete proposals in this area for Volume 1 of the revised SEEA. It also requested EEA and FAO to prepare a paper to review and describe the existing and state of the art in land cover, land use, and land function classifications, and to present a concrete proposal and a work programme to solve the issue of land classifications.

Accordingly, a paper jointly prepared by EEA and FAO entitled "Land Cover and Land Use Classifications in the SEEA Revision" (by Xiaoning Gong (FAO) & Jean-Louis Weber (EEA)) (UNCEEA/4/11) on 16 June 2009 was submitted and presented at the Fourth Meeting of the United Nations Committee of Experts on Environmental-Economic Accounting on 24-26 June 2009 in UN Headquarters, New York. The paper revisited the relationship between LU, land cover, related classifications, and land accounts, as well as the purpose of developing them and their roles in environmental policies and in SEEA. The paper also laid out a concrete work plan on how to move forward in this area: "<u>one</u>, to build the land use

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classification based on the FAO land use classification in agriculture, forestry, and fisheries, and combined with UNECE land use classification for other land use; and two, to build the land cover classification by taking into account the advantages of both LCCS and Corine Land Cover."

The follow-up decisions of the UNCEEA were summarized in the email of Ivo Havinga, Chief of Economic Statistics Branch, UNSD, to Jacqueline McGlade (EEA), Pietro Gennari (FAO), Jean-Louis Weber (EEA), Jock Martin (EEA), Xiaoning Gong (FAO), Mark De Haan (CBS), Peter Harper (ABS), and Alessandra Alfieri (UNSD) on 26 October 2009:

- The UNCEEA is very pleased with the leading role of the EEA and the FAO in developing land accounts given their obvious policy relevance. The UNCEEA at its last meeting in June agreed with the proposal by the EEA and FAO suggesting the way forward in finalizing the classifications of LU and land cover and requested EEA and FAO to prepare a paper with a concrete proposal for these classifications for discussion at the next London Group meeting. It considered important that LU and land cover classifications are included in Volume 1 of the SEEA, taking into consideration the link between the SEEA and the SNA land accounts. More recently, the Bureau of the UNCEEA discussed the issue at the request of the Chair of the London Group and reiterated the decisions of the UNCEEA.

- Understanding that from an ecosystem approach perspective, land should be seen in a holistic way providing a wide range of services from food provision to regulatory services. As such, land cover, LU and land functions classifications should be seen in a common classification system. However, following this approach requires substantial time considering that the classification of ecosystem functions/services is in the process of being developed and would not be possible to include it in Volume 1. The proposal is that, at this stage, considering the timeline for the revision of the SEEA and the decision of the UNCEEA and its Bureau, classifications of LU and land cover are included in Volume 1 and an explanation is included in the text to clarify the relationships between the LU, land cover and land functions.

Outline of This Paper

The proposed LUC is prepared for SEEA Volume 1. The purpose of such a LUC can be twofold: the first is to be used for compilation and aggregation of available national LU information at the global level in order to arrive at international comparable and compatible data. That is to facilitate compilation of regional-global LU databases, permits cross-referencing of different national systems; and, at the same time, to preserve national investment in local classification. The second can be used to provide a general framework and structure to guide data collection and generation of effective LU databases especially for countries in the process of establishing and developing a LU classification.

To meet this purpose, the principle and approach guiding the design of such a LU classification is not intended to create something completely new, which may end up to be fancy and exotic in appearance but superficial and useless in practice. Rather, it is better to take a pragmatic approach to incorporate and consolidate those that have already existed and been used at the global, regional, and national levels. It thus also defines the feature of the LU classification to be somehow more aggregated so that it can accommodate the aggregation of the national LU data across countries.

Accordingly, the following are the steps to be taken and elements to be considered when designing and developing the proposed LUC:

- Taking LU classification for the sectors of agriculture, forestry, and fisheries from Gong, Marklund, and Tsuji (2009), built on several important and solid databases at the global level.

- Supplemented by LU classification for other sectors based on the LU classifications recommended and used by ECE and Eurostat.

- Building linkage with other socio-economic classifications such as human activities as described in ISIC and product production as in CPC.

- Taking into account the use of LU classification for the land accounts in SEEA and in the study and analysis of climate change and CO_2 emission as in the IPCC report.

- Observing and following the conventional rules and principles in the construction of global LU classification.

- Examining the validity of the proposed LUC through two reviews and comparisons: LU classifications recommended by others in the past and LU classifications used in countries, such as in Argentina, Australia, Brazil, Canada, China, India, New Zealand, and US.

In the rest of this paper, a brief discussion on each of the above points is presented.

LUC for Agriculture, Forestry, and Fisheries Based on Major Global LU Databases

As described in Gong, Marklund, and Tsuji (2009), the sections of land used for agriculture and forestry are based on the LU classifications used in major global LU databases, including agricultural LU 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 <http://www.fao.org/corp/statistics/en/>; and forestry LU database in the Global Forest Resources Assessment Programme (FRA) (since 1946). In fact, the proposed LUC in Table 1 is a consolidated structure of all the LU classifications in abovementioned databases/datasets and can be directly applied to each and every one of them perfectly without any problem. The sections of "Land with aquaculture facilities," "Inland waters," and "Marine waters" are based on the Handbook of Fishery Statistical Standards by the Coordinating Working Party on Fishery Statistics (CWP), the reports of their sessions, and the final draft of Handbook of National Accounting: Integrated Environmental and Economic Accounting for Fisheries.

Proposed LUC Constructed Based on ECE and Eurostat Land Use Classifications

The other sections of the proposed LUC in Tables 1 and 2 are developed based on the Standard International Statistical Classification for Land Use recommended and adopted by the United Nations Economic Commission for Europe (UNECE) in 1989 and the Eurostat version of LU Classification (Eurostat 1993).

In the early year, the previous versions of the ECE classification was tested wholly or partly with the help of the joint Food and Agricultural Organization (FAO) and ECE working partly on forest economics and statistics and of the Organization of Economic Co-operation and Development (OECD).

The LU classification used by Eurostat comes with more substantial contents in terms of definitions and descriptions.

As shown in <u>Table 3</u>, in order to meet the needs of the LU classifications of both ECE and Eurostat, the proposed LUC is more aggregate than either of them. The order of the proposed LUC follows the order of ISIC v.4.0.

There are three levels in the proposed LUC. The first level has the following 16 categories.

Table 1a: First Level of the Proposed LUC

	Code	**Item**
1	*Area in Use*	
2	A	Agricultural land
3	B	Forest land
4	C	Land with aquaculture facilities
5	D	Land used for mining, quarrying, and construction
6	E	Land used for manufacturing
7	F	Land used for technical infrastructure
8	G	Land used for transportation and storage
9	H	Land used for commercial, financial, and public services
10	I	Land developed for recreational purposes
11	J	Residential areas
12	*Area Not in Use*	
13	K	Dry open land with special vegetation cover
14	L	Dry open land without, or with insignificant, vegetation cover
15	M	Wet open land
16	N	Other land, n.e.s.
17	*Water Area*	
18	O	Inland waters
19	P	Marine waters

The second level has 18 categories, which provide a further breakdown for categories of Agricultural land (A), Forestry land (B), Land with aquaculture facilities (C), Dry open land with special vegetation cover (K), Dry open land without, or with insignificant, vegetation cover (L), Inland waters (O), and Marine waters (P) at the first level. For agriculture (A), forestry (B), and fisheries (C, O, and P), and especially for agriculture and forestry, there are already databases available at the global level with the more detailed breakdown. For other three categories: Dry open land with special vegetation cover (K), Dry open land without, or with insignificant, vegetation cover (L), such a detailed level are in both ECE and Eurostat classifications.

Table 1b: 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	Naturally regenerated forest land
8	B2	Planted forest land
9	C1	Hatcheries
10	C2	Managed grow-out sites
11	K1	Bushes and shrubs
12	K2	Herbaceous vegetation
13	L1	Barren and sandy land
14	L2	Glaciers and perpetual snow
15	O1	Areas with aquaculture or holding facilities
16	O2	Other inland water areas
17	P1	Areas with aquaculture or holding facilities
18	P2	Other marine water

As one may find the following categories in the first level are recommended to be kept in one level only:

- 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

The reason can be due to the fact that most of them are of only one level in ECE Standard Classification of LU. To be used at the global level, it is better to take a conservative approach to start with at the more aggregate level. Further breakdown can be added in the future if needed.

The third level breakdown with 18 categories again is only applied to agriculture (A), forestry (B) and fisheries (C) land and water use as were proposed in Gong, Marklund, and Tsuji (2009) with the same justification as presented above based on the practice at FAO and related databases at the global level.

Note that, first, for Agricultural land (A), the breakdown at the third level here is superior compared with the breakdown in the Eurostat LU Classification because it follows the structure and order of the new version of CPC, which are identified as important grouping in terms of economic value and nutrition requirements and consumption by human being while some of the categories in the Eurostat LU Classification are outdated and obsolete such as the terminology of industrial crops.

Table 1c: 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	*Primary forest*
14	B12	*Other naturally regenerated forest*
15	O21	*Enhanced areas*
16	O22	*Open access waters without enhancement*
17	P21	*Enhanced areas*
18	P22	*Open access waters without enhancement*

Second, to break down the Forestry land (B) into "Naturally regenerated forest land" and "Planted forest land" at the second level, and further break down "Naturally regenerated forest land" into "*Primary forest*" and " *Other naturally regenerated forest*" *consider to be more appropriate for LU than to have a breakdown of* "Deciduous trees," "Predominantly Coniferous," "Sclerophyllous trees," "Predominantly broadleaved," "Conifers," "Predominantly other" as in Eurostat and ECE classifications. In practice, it is possible to collect data on production and products of forestry according to types of leaves and trees; but is very difficult to collect data on LU of forestry according to types of leaves and trees.

Related to Human Activities as Described in ISIC and to Products in CPC

As shown in Table 3 in the Annex, human activities in ISIC are grouped into ten major categories for the purpose of land use. Accordingly, there are ten different types of LU categories are associated with them.

One of the applications of the linkage with ISIC is in the field for the data collection. The area of land can be divided into segments. Each segment is further divided into smaller units that can be identified through ownership and associated with the economic activities that are being performed 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 comprehensiveness criteria, one may consider taking ISIC classes at the first level and incorporating purpose at the second or third level (where the "purpose" is connected with the kind of objective an activity pursues.) This approach would provide a one-to-one correspondence between land and labor, capital, and goods and services produced.

The link with CPC as described in Gong, Marklund, and Tsuji (2009) is particularly for the agricultural sector at the third level of the proposed LUC. Several national LU classifications and a few global statistical databases use the details at this level.

Table 3a: Comparison between Proposed LUC with ISIC

CODE	PROPOSED LUC	CODE	ISIC
A	Agricultural land	01	Crop and animal production, hunting and related service activities
B	Forest 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
O1	Areas with aquaculture or holding facilities	03	Fishing and aquaculture
P1	Areas with aquaculture or holding facilities	03	Fishing and aquaculture

Related to LU Classification Used in IPCC Report

The IPCC Guidelines use six broad land-use categories to report emissions and removals from LU and LU conversions: Forest Land, Cropland, Grassland, Wetlands, Settlements, and Other Land.

They are considered to be a "robust, implementable and complete" way of classifying the land area of the countries. These land uses can thus be considered top-level categories for representing LU 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 LU categories and allow the countries to use their national definitions that may incorporate land cover or LU or both depending upon national circumstances. Further as the IPCC Guidelines use "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 GHG reporting.

The correspondence and linkage of these six land use categories with the FAO LU Classification is provided by a recent IPCC Special Report on *Land Use, Land-Use Change and Forestry* and shown below.

Table 3b: Comparison between FAO LU Classification and IPCC Report

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)*

Conventional Rules and Principles Applied to the Proposed LUC

There are certain conventional rules and principles considered to be relevant to LU classification (e.g. Di Gregorio and Jansen, 1997; Duhamel, 1998; Narain and Koroluk, 1999; Young, 1994). The following have been taken as a basis for the proposed LUC.

- Principle of completeness: a LU classification should comprehensively cover the total area of land and all forms of land use, including land not presently used for any purpose.

- Principle of absence of overlap: categories of a LU classification should be mutually exclusive and not overlap. It means that mixed and transitional classes should be excluded 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.

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

- 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.

- Principle of use at the time of observation.

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

- Principle of spatial and temporal consistency.

- Principle of a system of explanatory notes: 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 users. A classification should be as pragmatic and easy to understand as possible to promote consistent terminology.

A Review of Land Use Classification Systems Recommended in the Past

There is a long history of intellectual and empirical quest for the optimal structure of an international LU classification. Table 4 in the Annex shows a comparison of the proposed LUC with those that were recommended in the past by different researchers, including the following:

1. WLUSC: Classification system from the "Ethiopian Guideline for Land-Use Planning" (1949)
2. ANDERSON: Classification system from Anderson (1976)
3. CHAPIN & KAISER: An initial approach to an international framework for classification of land uses (1979)
4. KLECKER: From the Geological survey land use and land cover classification system for use with remote sensor data (1981)
5. REMMELZWAAL: Remmelzwaal Approach commissioned by FAO (1989)
6. ITC: Classification system from ITC Journal (1991-1993)
7. ADAMEC: Adamec Approach commissioned by FAO (1992)
8. MUECHER: Classification system from Muecher et. al Approach (1993)
9. YOUNG: Classification system from A.Young, Consultancy report to UNEP/FAO (1994)
10. Mediterranean: Classification system from Medalus III Project
11. DUHAMEL: Reference/international land use classification systems (1998)
12. HADRI: Table 7 Land use classification proposal (2005)
13. USGS: USGS Land Use and Land Cover Data

Among them, Remmelzwaal (1989), Adamec (1992), Young (1994), and Hadri (2005) were commissioned by FAO, all of which were in an attempt to design an international LU classification to be used at the global level. The good features of them are that many main and detailed categories are given with the approach of socio-economic classifiers which are useful reference for building and designing a LU classification. Some limitations of these classifications as observed by earlier commentators include some of the classifications are not complete and some land uses are missing; attributes used for divisions are not inherent to LU such as "small scale farming system," "covered" vs. "non-covered," "irrigation," "grazing,"

"nomadism;" some categories are overlapped and there are potential confusions with mixed classes between agriculture, grazing and forestry.

In Table 4 in the Annex, the dot "•" indicates that the category matches well with the corresponding category in the proposed LUC. The asterisk "∗" indicates that the category is more aggregate than the corresponding category in the proposed LUC. Therefore, in order to establish the correspondence with the proposed LUC, that particular category has to be split. In general, the proposed LUC seems to be more detailed than those recommended in the past. This is especially so for the sectors of agriculture, forestry, and fisheries.

Categories do not match between the proposed LUC and the above 13 LU Classifications previous recommended by others are listed in the following Table 4a:

Table 4a: Other LU Classification Categories Unmatched with Proposed LUC

AUTHOR	CATEGORY
WLUSC (1949)	Unimproved grazing
Anderson (1976)	Transitional areas NS
Chapin & Kaiser (1979)	Institutional Mixed livestock and crop production *Shifting cultivation* Uses based on mixed natural and managed ecosystems *Plant and animal products* *Animal products* *Plant products* Collection Partial conservation Total conservation Conservation Uses based on natural ecosystem
Klecker (1981)	Transitional areas
Remmelzwaal (1989)	Conservation Hunting and fishing
6) ITC Journal (1991-93)	Conservation Hunting, fishing and gathering Semi-permanent cultivation Nature reserve Hunting Game reserve Irrigated cultivation Watershed management Food gathering Dune stabilization Fibre gathering Firewood collection
Adamec (1992)	Conservation
Muecher (1993)	Plant biomass production Production of plant biomass Biomass-extraction Primary production through introduced natural cover: Animal biomass production Production of animal biomass Biomass production Support
Young (1994)	Land use based on natural ecosystems Conservation Total conservation

	Partial conservation Collection Of plant products Of animal products Of plant and animal products Land use based on managed ecosystem Livestock production Shifting cultivation Fisheries production Fishing (capture) Land use phase: Irrigated land use
8) Mediterranean - Medalus III Project	Low intensity
Duhamel (1998)	Conservation areas Strict nature reserve - IUCN Wilderness area - IUCN National park - IUCN Natural feature (monument) protection - IUCN Habitat/ species management area - IUCN Landscape/seascape -IUCN Resource protected areas - IUCN Tangible products Secondary products Primary products Non-organic products Organic products Extracted vegetal products Fire wood Extracted animal products Fishing Crustaceans, molluscs Hunting, trapping animals Products from a productive (vs. extractive) process (continuation Level VI - VIII) Products from trees outside forests Animal products Livestock products

In general, there are three types of categories that do not match with the proposed LUC:

(a) The first type of mismatch is categories in the previously recommended LU classifications are more aggregate and broader than the ones in the proposed LUC.

(b) The second type of mismatch is the criteria used for delineating groups are different.

- "Conservation" and "reserve" are not categories in the proposed LUC. First, they do not appear in the ECE and Eurostat classifications. Second, they are not easy to be defined. They cross cut through several categories in the proposed LUC, such as the "primary forest," and many areas under the categories of "area not in use."

- "Grazing" is not a good criterion for classifying LU because livestock can be grazing in all places including both "ands under meadows and pastures," "forest land," and even "lands under crops."

- "Hunting and fishing," "hunting, fishing, and gathering," and "gathering" are not good criteria for LU classification because they are cutting through different categories in the proposed LUC. They look more like a category in ISIC.

- "Row crops" and "Non row crops" are not the normal way of classifying crops.

- "Irrigation" as described in Gong, Marklund, and Tsuji (2009) is considered to be not an inherent attribute to LU and thus not used as a criterion for LU classification.

- "Firewood collection" is cutting through different categories in the proposed LUC. They look more like a category in ISIC.

- The way of products classified in Duhamel (1998) by "tangible," "primary," "secondary," "organic," "non-organic," are a different way of classifying products from the ones in the proposed LUC.

- "Transitional areas" covers for example forest land cleared to agriculture, wetlands drained for development, planned constructions. It is not included in the proposed LUC because it is considered to be not consistent with the principle of use at the time of observation rather it is kind of the intended use and forward-looking.

- "Cropland and pastures" is a composite category with fuzzy boundary conditions with other classes (for example with shrubland-bushland).

(c) The third type of mismatch is categories with the feature of mixed used land. There is no category in the proposed LUC for mixed used land.

- "Mixed livestock and crop production"

- "Shifting cultivation"
- "Uses based on mixed natural and managed ecosystems"

- "Mixed urban or built-up land"

A Review of LU Classification Systems Used in Selected Countries

A small group of countries including Argentina, Australia, Brazil, Canada, China, India, New Zealand, and US are selected to examine the LU classifications used in their countries and compared with the proposed LUC to see if the proposed LUC can accommodate these LU classifications in the sense that it can summarize and aggregate the national LU data into international and global datasets.

The study of national LU classifications here is still very preliminary. For one thing, the information about the national LU classifications is quite limited in the public domain. Thus, the accuracy of the information regarding of the forms and versions of the national LU classifications below is subject to be confirmed. The national LU classifications of the selected countries are as follows.

1. ARGENTINA: Agricultural Census 2002 Questionnaire

2. AUSTRALIA: Australia ALUM classification 6 (land use classification), Australian Government, Department of Fisheries and Forestry
3. BRAZIL: Censo Agropecuario de 1995-1996, Questionnaire
4. CANADA: Agricultural Census 2006, Questionnaire
5. CANADA: Canada Land Use Monitoring Program (CLUMP), The Government of Canada, Natural Resources Canada
6. CHINA: Agricultural Census 1997, Questionnaire
7. CHINA: National/provincial land use classification systems, International Institute for Applied Systems Analysis (IIASA)
8. INDIA: Agricultural Census 1995-1996, Questionnaire
9. INDIA: Directorate of Economics & Statistics, Ministry of Agriculture, Government of India, quoted in "India National Action Programme (NAP) to Combat Desertification in the Context of United Nations Convention to Combat Desertification (UNCDD)"
10. NEW ZEALAND: Ministry of the Environment, Land Use and Carbon Analysis System (LUCAS)
11. USA: USDA, Major Land Uses
12. USA: Atlanta Regional Commission: Land Use System from Land-Based Classification Standards

Table 5 in the Annex shows the relationship of the proposed LUC with the ones that have been used in these countries.

As in Table 4, the dot "•" indicates that the category matches well with the corresponding category in the proposed LUC. The asterisk "∗" indicates that the category is more aggregate than the corresponding category in the proposed LUC. Therefore, in order to establish the correspondence with the proposed LUC, that particular category has to be split. In general, the proposed LUC seems to be more detailed than those recommended in the past. This is especially so for the sectors of agriculture, forestry, and fisheries.

Categories that are not matched between the proposed LUC and the LU classifications used in the above countries are the following: ARGENTINA: "Area planted in first occupation (rotation)," "Area planted in second occupation (rotation)," "Industrial cultivars," and "Cultivars for seeds" are different criteria in terms of classifying crops. USA: "Rural parks and wildlife areas" needs to be checked its contents and coverage and then to be matched with the proposed LUC.

And others: "Cropland," "Rangland/Grassland," "Woodland," and "wetland" as used in the IPCC Report are more aggregate than and cross cutting with the classification used at FAO.

Summary and Conclusion

To summarize the above discussion, the proposed LUC is prepared based on the major LU databases at the global level for the sectors of agriculture, forestry, and fisheries. For the other sectors it is derived from the LU classifications recommended and used by ECE and Eurostat. It observes and follows the conventional principles and rules for LU classifications and takes into account of the LU classification used by researchers and analysts, particularly the IPCC Report. Linkages are established between the proposed LUC and other economic-social classifications such as the ISIC and CPC. Through a literature review of the LU classifications recommended by others in the past and a review of the national LU classifications used by selected countries, the validity of the proposed LUC is checked by

both intellectual and empirical tradition and practice. As a result, it seems the structure and the definitions and descriptions of the categories in the proposed LUC to be proper and appropriate.

Questions to the London Group

1. Do you agree with the proposed LUC for SEEA? Specifically,

    (a) Do you agree with the three-level structure in <u>Table 1</u>?

    (b) Do you agree with the definitions and descriptions of the categories of the proposed LUC in <u>Table 2</u>?

2. Is it necessary to have a residual category such as "Other land, n.e.s."?

3. Some LU classifications put "land use for transportation" and "land use for communication" together as one category. The proposed LUC in this paper suggests putting "land use for communication" with "land use for technical infrastructure." Do you agree with the latter?

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Annex

Table 1: Proposed LUC (The Structure)

CODE			TITLE
Area in Use			
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
	A6		Land under protective cover
B			**Forest land**
	B1		Naturally regenerated forest land
		B11	*Primary forest*
		B12	*Other naturally regenerated forest*
	B2		Planted forest land
C			**Land with aquaculture facilities**
	C1		Hatcheries
	C2		Managed grow-out sites
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**
Area Not in Use			
K			**Dry open land with special vegetation cover**
	K1		Bushes and shrubs
	K2		Herbaceous vegetation
L			**Dry open land without, or with insignificant, vegetation cover**
	L1		Barren and sandy land
	L2		Glaciers and perpetual snow
M			**Wet open land**
N			**Other land, n.e.s.**

Table 1: Proposed LUC (The Structure) (Cont'd)

CODE			TITLE
Water Area			
O			**Inland waters**
	O1		Areas with aquaculture or holding facilities
	O2		Other inland water areas
		O21	*Enhanced areas*
		O22	*Open access waters without enhancement*
P			**Marine waters**
	P1		Areas with aquaculture or holding facilities
	P2		Other marine water
		P21	*Enhanced areas*
		P22	*Open access waters without enhancement*

Table 2: Proposed LUC (Definitions and Descriptions)

CATEGORY	DEFINITION AND DESCRIPTION
Country area	The total of areas under "Land area" and "Inland water," excluding offshore territorial waters.
Land area	The total of areas under "Agricultural land," "Forest land," "Land with aquaculture facilities," and other "Built-up and related land" i.e. A+B+C+D+E+F+G+H+I+J+K+L+M+N.
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. It also includes land under scattered farm buildings, yards and their annexes, permanently uncultivated land, such as uncultivated patches, banks, footpaths, ditches, headlands, and shoulders.
Arable land	Land used for growing temporary crops, temporary meadows for mowing or pasture, land under market and kitchen gardens and land temporarily fallow (less than five years). It does not include land under permanent crops or land that is potentially cultivable but is not normally cultivated.
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.
Land under temporary meadows and pastures	Land temporarily cultivated with herbaceous forage crops for mowing or pasture. A period of less than five years is used to differentiate between temporary and permanent meadows.
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 under permanent meadows and pastures" (if used for grazing), "Dry open land with special vegetation cover," or "Wet open land" (if overgrown with shrubs), or "Barren and sandy land" (if it becomes wasteland). This land may be in the form sown for the exclusive production of green manure.
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."
Land under permanent meadows and pastures	Land used permanently (for five years or more) to grow 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.
Agricultural land under protective cover	Land 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, and farmyards.
Forest land	**Land spanning more than 0.5 hectares with trees higher than 5 meters 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 meters *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 meters. 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 meters. 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 meters. 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. 10. <u>Excludes</u> tree stands in agricultural production systems, such as fruit tree plantations, oil palm plantations and agroforestry systems when crops are grown under tree cover.
Naturally regenerated forest land	**Forest predominantly composed of trees established through natural regeneration.** Explanatory notes 1. 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. 2. Includes coppice from trees established through natural regeneration. 3. Includes naturally regenerated trees of introduced species.

Primary forest land	**Naturally regenerated forest of native species, where there are no clearly visible indications of human activities and the ecological processes are not significantly disturbed.** Explanatory note Some key characteristics of primary forests are: 1. They show natural forest dynamics, such as natural tree species composition, occurrence of dead wood, natural age structure and natural regeneration processes. 2. The area is large enough to maintain its natural characteristics. 3. 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 land	**Naturally regenerated forest where there are clearly visible indications of human activities.** Explanatory notes 1. Includes selectively logged-over areas, areas regenerating following agricultural land use, areas recovering from human-induced fires, etc. 2. Includes forests where it is not possible to distinguish whether planted or naturally regenerated. 3. Includes 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.
Planted forest land	**Forest predominantly composed of trees established through planting and/or deliberate seeding.** Explanatory notes 1. In this context, predominantly means that the planted/seeded trees are expected to constitute more than 50% of the growing stock at maturity. 2. Includes coppice from trees that were originally planted or seeded. 3. Excludes self-sown trees of introduced species.
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).
Hatcheries	Housing facilities for breeding, nursing and rearing seed of fish, invertebrates or aquatic plants to fry, fingerlings or juvenile stages.
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.
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).
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; but excludes actual construction sites (D), harbour areas and their storage facilities (G).
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.
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 (O)
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.
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 (B) - Secondary dwellings (J)

	- Natural or semi-natural areas not specifically developed (K or L)
	- Ski runs (K or L)
	- Beaches (L)
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
Dry open land with special vegetation cover	Open or semi-open areas, not wooded or only slightly so, with low or very low vegetation, This category does not include: - Areas used for agricultural purposes (A) - Agricultural fallow land (land formally cultivated but not used for agricultural purposes for several crop years) (A)
Bushes and shrubs	Semi-open areas covered and occupied by vegetation consisting mainly of bushes, bushy or woody species in temperate, mountainous and arctic zones, and xerophyte associations of the matorral type where no trees as classified in "Forest land" are present. This category includes: - Heath (gorse, heather, ferns or broom from the Atlantic, sub-Atlantic and sub-continental regions; broom from the supra-Mediterranean region) - Heather and dwarf juniper vegetation in the sub-Alpine region - Arctic heath with lichen, moss and dwarf shrubs: dwarf birches, willows - Thickets and shrub land in temperate regions - Scrub land in the Alpine region: pines, rhododendrons - Thickets and open bush woodland with dwarf birches and willows in the arctic region - Maquis (self-contained formations with shrubs, strawberry trees, large briars) - Garrigues (open formations with strawberry trees, thyme, white rock rose, lavender and rosemary) - Other xerophyte shrubs (heath with rock rose and lavender; rock rose thickets, matorral with oak; xerophyte shrubland of the chaparral type, thorny brush with acacia characteristic of a sub-desert environment).
Herbaceous vegetation	Open areas with low vegetation of the herbaceous type, not used for agricultural purposes, including grassland in temperate, mountainous and arctic regions and steppes and dry meadows not used for agricultural purposes. This category includes: - Plain and mountainous grassland - Alpine meadows - Arctic meadows (tundra: meadows with gramineae and cryptogams) - Xerophytic mediterranean type meadows - Dry edaphic meadows

	- Steppes with gramineae and artemisia (Alfa) from the sub-desert region - Grassy savanna as found in north America and pampas
Dry open land without, or with insignificant, vegetation cover	Natural and non-built-up land surface covered with little or no vegetation, which precludes its inclusion in other categories of the classification; Included are old quarries and abandoned sandpits.
Barren and sandy land	Land covered with bare soils (areas where bedrock crops out) including rocks and scree, and dunes and sand and pebble beaches.
Glaciers and perpetual snow	Land covered by glaciers (generally measured at the time of their greatest expansion in the season) or eternal snow; and burned Areas.
Wet open land	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 peatlands, such as peat bogs (moors). Other wet areas are land covered by other type of wet land: salt marshes, mud flats, salicornia meadows in the Mediterranean zone; also included are wet tundra, temporarily inundated, treeless flood region with arctic climate and vegetation and mires. This category includes: - Moors with hypnacea (bogs where water permanently covers the substrate: presence of carex willows, alders) - Acid sphagnum moors (convex profile) - Arctic moors This category does not include: - Water meadows (A) - Rice fields (A) - Plantations of plants for plaiting (A) - Peat land exploited for agricultural (A) or industrial (D) purposes
Other land, n.e.s.	This category is reserved for land to which no other category elsewhere can be ascribed.
WATER AREA	This relates to the part of the national territory to be reported, which is covered by surface waters. 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.
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)
Areas with aquaculture or holding facilities	Inland bodies of water used for fish farming activities (aquaculture).
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.
Enhanced areas	Areas with enhancement including stocking, fertilization, engineering, predator control, habitat modifications, and/or access limits.
Open access waters without enhancement	Area without any enhancements and access limitation.
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)
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
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)
Enhanced Area	Areas with enhancement including stocking, fertilization, engineering, predator control, habitat modifications, and/or access limits, including Marine Protected Area.
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.

Table 3: Comparison between Proposed LUC with ECE and Eurostat LUC, ISIC, and LUC Used in IPCC Report

Code	Proposed LUC		Eurostat Classification for Land Use Stat: Remote Sensing Program (1993)		ECE STANDARD CLASSIFICATION OF LAND USE	ISIC Code		IPCC Report on LU and LUC
Code	Title	Code	Title	Code	Title		Code	Title
	Country area							
	~~LAND AREA~~							
Area in Use								
A	**Agricultural land**	B	Utilised agricultural areas	1	AGRICULTURAL LAND	01 - Crop and animal production, hunting and related service activities		
	~~-~~							
	~~Arable land~~			1.1	Arable land			
A1	**Land under temporary crops**	B1	Tilled and fallow land				14	Cropland
	Cereals	B11 B110	Cereals				15	Wetlands
		B13	Vegetables and flowers					
	Vegetables and melons	B132	Fresh vegetables					
	Temporary oilseed crops							
		B12	Root and industrial crops					
	Root/tuber crops with high starch or inulin content	B121	Root crops					
	Temporary spice crops							
	Leguminous crops	B131	Dry pulses					
	Sugar crops							
	Other temporary crops	B133	Floriculture					
		B122	Non-permanent industrial crops					
		B2	Areas under grass used for agricultural purposes					

Table 3: Comparison between Proposed LUC with ECE and Eurostat LUC, ISIC, and LUC Used in IPCC Report (Cont'd)

A2	**Land under temporary meadows and pastures**	B21 B210	**Temporary and artificial grazing**				12	Rangeland/Grasslands
	-	B21 B210	Temporary and artificial grazing					
A3	**Land with temporary fallow**	B14 B140	Fallow land, including green manure	1.5	Fallow agricultural land		10	Cropland
A4	**Land under permanent crops**	B3	Permanent crops	1.2	Land under permanent crops		13	Agroforestry Land
	Fruit and nuts	B31 B310/ B32 B320/ B34 B340	Fruit trees and berries/ Citrus fruit/ Vines					
	Permanent oilseed crops	B33B330	Olive trees					
	Beverage and permanent spice crops							
	Other permanent crops	B35/ B350	Nurseries					
		B36/ B360	Permanent industrial crops					
A5	**Land under permanent meadows and pastures**	B22 B220/ B23 B230	Permanent pastures and grazing/ Rough grazings	1.3	Land under permanent meadows and pastures		11	Rangeland/Grasslands
	-	B22 B220/ B23 B230	Permanent pastures and grazing/ Rough grazings					

Table 3: Comparison between Proposed LUC with ECE and Eurostat LUC, ISIC, and LUC Used in IPCC Report (Cont'd)

A6	Land under protective cover	A204	Agricultural holdings				16	Peri-Urban Land
	Other agricultural land, nes			1.4	All other agricultural land, n. e. s.			
	–	C	Forests	2	FOREST AND OTHER WOODED LAND			
B	Forest land	C1	Wooded forest areas			02 - Forestry and logging		
B1	Naturally regenerated forest land						6	Forest Land
	Primary forest							
	Other naturally regenerated forest							
B2	Planted forest land	C14 C140	Intensively managed plantations				7	Forest Land
		C2	Non-wooded forest areas					
		C21 C210	Clear-cut zones					
		C22 C220	Other unproductive forestry areas					
		C11 C110	Deciduous trees	2.1	Predominantly Coniferous			
		C12 C120	Sclerophyllous trees	2.2	Predominantly broadleaved			
		C13 C130	Conifers	2.3	Predominantly other			
				2.4	Mixed forest			
C	Land with aquaculture facilities					03 - Fishing and aquaculture		
C1	Hatcheries							
C2	Managed grow-out sites							
	Other land							
	Built-up and related land	A	Man-made areas	3	BUILT- UP AND RELATED LAND			

Table 3: Comparison between Proposed LUC with ECE and Eurostat LUC, ISIC, and LUC Used in IPCC Report (Cont'd)

D	Land used for mining, quarrying, and construction	A4	Extractive industries; building sites; tips and wasteland	3.3	Land used for quarries, pits, mines and related facilities	05-09 - Mining and quarrying 41-43 - Construction		
		A41	**Extractive industries**					
		A410	Extractive industries					
		A42	**Building sites, tips and wasteland**					
		A421	Building sites					
		A422	Tips					
		A423	Wasteland				3	Deserts
	~~Industrial or commercial activities~~	A2	Industrial or commercial activities					
E	Land used for manufacturing	A20	**Industrial or commercial activities**			10-33 - Manufacturing	17	Peri-Urban Land
		A201	Heavy industry	3.2	Industrial land, excluding land used for quarries, pits, mines and related facilities			
		A202	Manufacturing industrial activities	3.2	Industrial land, excluding land used for quarries, pits, mines and related facilities			
F	Land used for technical infrastructure	A31	**Technical infrastructures**	3.8	Land used for technical infrastructure	35 - Electricity, gas, steam and air conditioning supply 36-43 - Water supply; sewerage, waste management and remediation activities		
		A311	Technical networks, protective structures					
		A312	Water and waste treatment					
	~~Technical and transport infrastructures~~	A3	Technical and transport infrastructures					

Table 3: Comparison between Proposed LUC with ECE and Eurostat LUC, ISIC, and LUC Used in IPCC Report (Cont'd)

G	Land used for transportation and storage	A32	**Transport**	3.7	Land used for transport and communication	49-53 - Transportation and storage	17	Peri-Urban Land
		A321	Road transport					
		A322	Rail networks					
		A323	Airports and aerodromes					
		A324	River and maritime transport					
H	Land used for commercial, financial, and public services	A203 A12	Commercial and financial activities and services Public services, local authorities	3.4	Commercial land	45-47 - Wholesale and retail trade; repair of motor vehicles and motorcycles 55-89, 94-96 - Service activities 99 - Activities of extraterritorial organizations and bodies		
				3.5	Land used for public services (excluding transport, communications and technical infrastructure)			
	~~Land developed for recreational purposes~~	A5	Land developed for recreational purposes	3.9	Recreational and other open land		4	Non-Forest Wooded Lands
I	Land developed for recreational purposes	**A50**	**Land developed for recreational purposes**			90-93 - Arts, entertainment and recreation		
		A501	Cultural sites					
		A502	Sport facilities					
		A503	Green or leisure areas					
	~~Residential areas~~	A1	Residential areas; public services					

J	Residential areas	A11	Residential areas	3.1	Residential land	97-98 - Activities of households as employers; undifferentiated goods- and services-producing activities of households for own use	17	Peri-Urban Land
		A111	Continuous and dense residential areas					
		A112	Continuous residential areas of moderate density					
		A113	Discontinuous residential areas of moderate density					
		A114	Isolated residential areas					
		A115	Collective residential areas					
Area Not in Use								
K	Dry open land with special vegetation cover	D	Bush or herbaceous areas	5	DRY OPEN LAND WITH SPECIAL VEGETATION COVER			
				5.1	Heathland			
				5.2	Dry tundra			
K1	Bushes and shrubs	D1	Bushes				4	Non-Forest Wooded Lands
		D10	Bushes					
		D101	Bushy areas in temperate, mountainous, arctic regions					
		D102	Xerophyte bushes					

K2	Herbaceous vegetation	D2	Herbaceous vegetation					
		D20	Herbaceous vegetation					
		D201	Grassland in temperate, mountainous and arctic regions	5.3	Mountainous grassland			
		D202	Steppes and dry meadows					
				5.4	Other n. e. s.			
L	Dry open land without, or with insignificant, vegetation cover	E	Surfaces with little or no vegetation	6	OPEN LAND WITHOUT, OR WITH INSIGNIFICANT, VEGETATION COVER		3	Deserts
		E0	Surfaces with little or no vegetation					
L1	Barren and sandy land	E01	Bare soils	6.1.1	Bare rocks			
		E011	Rocks and scree					
		E012	Dunes and beaches	6.2	Sand-beaches, dunes, other sandy land			
L2	Glaciers and perpetual snow	E02	Glaciers and eternal snow	6.1.2	Glaciers and perpetual snow			
		E020	Glaciers and eternal snow					
		E03	Burned areas					
		E030	Burned areas					
M	Wet open land	F	Wet surfaces and surfaces under water	4	WET OPEN LAND		5	Wetlands
		F1	Wet surfaces					
		F10	Wet surfaces	4.2	Wet tundra			
		F101	Bogs and marshes	4.1	Mires			
		F102	Moors	4.1	Mires			
		F103	Other wet areas	4.3	Other wet open land, n.e.s.			
N	Other land, n.e.s.			6.3	Other n.e.s.			
				3.6	Land of mixed use			

Table 3: Comparison between Proposed LUC with ECE and Eurostat LUC, ISIC, and LUC Used in IPCC Report (Cont'd)

Water Area								
	WATER AREA			7	WATER			
O	Inland waters	F2/ F20	Inland waters	7.1	Inland waters			
		F201	Inland water courses and bodies of water					
				7.1.1	Natural watercourse			
				7.1.2	Artificial watercourse			
				7.1.3	Inland sea ((freshwater or saline), lakes, ponds, coastal land-locked bodies of water			
O1	Areas with aquaculture or holding facilities	F202	Ponds for fish			03 - Fishing and aquaculture		
O2	Other inland water areas			7.1.5	Other inland waters n.e.s.			
	Enhanced areas			7.1.4	Artificial water impoundment			
	Open access waters without enhancement			7.2.	Tidal waters			
P	Marine waters	F3/ F30	Coastal waters	7.2.1	Coastal lagoons			
P1	Areas with aquaculture or holding facilities	F302	Bodies of water with fish or shellfish			03 - Fishing and aquaculture		
P2	Other marine water	F301	Estuaries, lagoons	7.2.2	Estuaries			
	Enhanced areas							
	Open access waters without enhancement			7.2.3	Other tidal waters n.e.s.			

Table 4: Comparison between Proposed LUC with LUC Recommended by Others

CODE	TITLE	A	B	C	D	E	F	G	H	I	J	K	L	M
	Country area													
	LAND AREA												●	
	Area in Use			*										
A	Agricultural land		●	●	●	*	●	●					●	●
	Arable land												●	
A1	Land under temporary crops	*	*	●	*	*	●		*	*	●	*	●	*
	Cereals													
	Vegetables and melons													
	Temporary oilseed crops													
	Root/tuber crops with high starch or inulin content													
	Temporary spice crops													
	Leguminous crops													
	Sugar crops													
	Other temporary crops													
A2	Land under temporary meadows and pastures		*		*	*	*	*	*	*	●	*	●	*
A3	Land with temporary fallow	●	*						*			●	●	
A4	Land under permanent crops	*	*	●	*	*	●		*	*	●	*	●	*
	Fruit and nuts									●				
	Permanent oilseed crops									●				
	Beverage and permanent spice crops													
	Other permanent crops													
A5	Land under permanent meadows and pastures	●	*	●	*	*	*	*	*	*	●	*	●	*
A6	Land under protective cover		●	●	●		●		*	●		●		●
	Other agricultural land, nes				●									*
B	Forest land	●	●	●	●	*	●	●	*	●	●	●	●	●
B1	Naturally regenerated forest land			●					*	●		●	●	
	Primary forest													
	Other naturally regenerated forest													
B2	Planted forest land			●					*	●		●	●	
C	Land with aquaculture facilities			*			*	*		*		*		
C1	Hatcheries													
C2	Managed grow-out sites													
	Other land													
	Built-up and related land	●	*	●	*			*		●	●		●	●

CODE	TITLE	A	B	C	D	E	F	G	H	I	J	K	L	M
D	Land used for mining, quarrying, and construction		●	●	●	●	*	●	*	●		●		●
	Industrial or commercial activities													
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		●	●	●	●	●			●		●		●
	Area Not in Use			●		●	●	*	*	●				
K	Dry open land with special vegetation cover	●											●	
K1	Bushes and shrubs	●	●		●						●		●	●
K2	Herbaceous vegetation	●	●		●								●	
L	Dry open land without, or with insignificant, vegetation cover												●	
L1	Barren and sandy land		●		●						●			●
L2	Glaciers and perpetual snow		●		●									●
M	Wet open land	●	●	●	●					●	●	●	●	●
N	Other land, n.e.s.												●	
	Water Area													
O	Inland waters		●	*	●		*	*		*	●	*	●	●
O1	Areas with aquaculture or holding facilities									●		●		
O2	Other inland water areas													
	Enhanced areas													
	Open access waters without enhancement													
P	Marine waters			*			*	*		*		*		
P1	Areas with aquaculture or holding facilities			*								*		
P2	Other marine water				●									●
	Enhanced areas													
	Open access waters without enhancement													

Legend

A - WLUSC: Classification system from the "Ethiopian Guideline for Land-Use Planning" (1949)

B - ANDERSON: Classification system from Anderson (1976)

C - CHAPIN & KAISER: An initial approach to an international framework for classification of LU (1979)

D - KLECKER: From the Geological survey LUC and LCC system for use with remote sensor data (1981)

E - REMMELZWAAL: Remmelzwaal Approach commissioned by FAO (1989)

F - ITC: Classification system from ITC Journal (1991-1993)

G - ADAMEC: Adamec Approach commissioned by FAO (1992)

H - MUECHER: Classification system from Muecher et. al approach (1993)

I - YOUNG: Classification system from A.Young, Consultancy report to UNEP/FAO (1994)

J - Mediterranean: Classification system from Medalus III Project

K - DUHAMEL: Reference/international land use classification systems (1998)

L - HADRI: Table 7, Land use classification proposal (2005)

Table 5: Comparison between Proposed LUC with LUC in Selected Countries

CODE	TITLE	A	B	C	D	E	F	G	H	I	J	K	L
	Country area												
	LAND AREA												
	Area in Use												
A	Agricultural land												●
	Arable land												
A1	Land under temporary crops		●	●		●	●		●	●	*	*	*
	Cereals	●	●		●		●						
	Vegetables and melons	●	●		●		●						
	Temporary oilseed crops	*	●				●						
	Root/tuber crops with high starch or inulin content						●						
	Temporary spice crops	*	●										
	Leguminous crops	●	●				●						
	Sugar crops		●		●		●						
	Other temporary crops	*	●				●						
A2	Land under temporary meadows and pastures	●	*	*		*	*				*	*	*
A3	Land with temporary fallow	●		●	●				●	●		●	
A4	Land under permanent crops	*	●	●	●	*	●			●	*	*	*
	Fruit and nuts	●	●		●	●	●						
	Permanent oilseed crops	*	●										
	Beverage and permanent spice crops	*					●						
	Other permanent crops	*	●										
A5	Land under permanent meadows and pastures	●	*	*	●	*	*		●	●	*	*	*
A6	Land under protective cover		●		●	*							
	Other agricultural land, nes				●					●		●	●
B	Forest land	●	●	●	*	●	●		●	●	●	●	●
B1	Naturally regenerated forest land	●	●	●				●					
	Primary forest												
	Other naturally regenerated forest												
B2	Planted forest land	●	●	●	●								
C	Land with aquaculture facilities												
C1	Hatcheries												
C2	Managed grow-out sites												
	Other land												
	Built-up and related land			*		●		●	*	*		●	●
D	Land used for mining, quarrying, and construction		●			●		●					●
	Industrial or commercial activities												
E	Land used for manufacturing		●									*	*

Table 5: Comparison between Proposed LUC with LUC in Selected Countries (Cont'd)

CODE	TITLE	A	B	C	D	E	F	G	H	I	J	K	L
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		●										●
	Area Not in Use			*				*	*				
K	Dry open land with special vegetation cover		*		*	●	*				*		●
K1	Bushes and shrubs												●
K2	Herbaceous vegetation							●					●
L	Dry open land without, or with insignificant, vegetation cover					●		●			●		
L1	Barren and sandy land					●			●				●
L2	Glaciers and perpetual snow							●					●
M	Wet open land		●		*	●		●			●		●
N	Other land, n.e.s.		●					●		●	●	●	●
	Water Area		●	*		●	●		*	*			
O	Inland waters		●				●						*
O1	Areas with aquaculture or holding facilities							*					
O2	Other inland water areas												
	Enhanced areas												
	Open access waters without enhancement												
P	Marine waters		●				●						*
P1	Areas with aquaculture or holding facilities							*					
P2	Other marine water												
	Enhanced areas												
	Open access waters without enhancement												

Legend
A – Argentina: Agricultural Census 2002 Questionnaire
B – Australia: Australia ALUM classification 6 (land use classification), Australian Government, Department of Fisheries and Forestry
C – Brazil: Censo Agropecuario de 1995-1996, Questionnaire
D – Canada: Agricultural Census 2006, Questionnaire
E – Canada: Canada Land Use Monitoring Program (CLUMP), the Government of Canada, Natural Resources Canada
F – China: Agricultural Census 1997, Questionnaire
G – China: National/provincial land use classification systems, International Institute for Applied Systems Analysis (IIASA)
H – India: Agricultural Census 1995-1996, Questionnaire
I – India: Directorate of Economics & Statistics, Ministry of Agriculture, Government of India, quoted in "India National Action Programme (NAP) to Combat Desertification in the Context of United Nations Convention to Combat Desertification (UNCDD)"
J – New Zealand: Ministry of the Environment, Land Use and Carbon Analysis System (LUCAS)
K – USA: USDA, Major Land Uses
L – USA: Atlanta Regional Commission: Land Use System from Land-Based Classification Standards.