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LULUCF-TR
GHG Monitoring and Reporting System

D1.1 Basics of consistent land representation, land use categories and land use conversion

8th workshop style training, 26-28 February 2019, Ankara (based on **3rd workshop style training)**
"**Technical Assistance for Developed Analytical Basis for Land Use, Land Use Change and Forestry (LULUCF) Sector**"
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AESA CONSORTIUM

Basics for “activity data”

- Estimation of GHG in LULUCF sector inventory requires “AD” and “EF”

Practice 01: what do we do with activity data ?

- *“AD” – allows linking pieces of land to official administrative territory of the country*
- Types of “activity data”
  - **Area**: majority of CO2 estimates (area is explicit)
  - **Stock/volume from statistic sampling**: non-CO2/GHG emission from fires; stocks when Stock-Difference method is used on FL (area is implicit)
  - **Number of units**: trees in urban areas

Basics for “activity data”

- “AD” is a proxy for “**area”** with a certain “**representation**” of **homogenous land-use ground surface** with **relevance for estimation CSC and GHG emissions and CO2 removals**;
- land representation lead to territory stratification by “bio-physical feature of terrestrial cover”;
- land representation is hierarchical (e.g. categories, subcategories, breakdowns);
- data collection methods (e.g. annual census, periodic surveys and remote sensing);
- methods yields different types of information (e.g. maps or tabulations), with different reporting frequencies and attributes

Basics for “activity data”

- IPCC guidance assists countries in making **best use of available data** toward **reducing possible overlaps and omissions of land** in national GHG inventory reporting

Descriptions of “land use” categories

- **category** - broad land use (one of the **six** major land-use categories) reported as either *remaining* or *converted to* a new land-use category;

- **sub-category** - refers to *special circumstances* (e.g., orchards, arable, unmanaged land, areas of grazing within Forest Land) that are estimated and reported individually as disaggregation of the broad land-use category, *includes conversions within category*;

- **divisions/strata**: further stratified toward *homogeneous spatial units*, e.g. soil/land management practices and biophysical characteristics;

Generic guidance for land representation – three approaches

- **Approach 1** relies on **total area ("net" area** at the end of year**)** for each individual land-use category within a country territory, but **does not provide detailed information on conversions between land uses;**

- **Approach 2** is based on data reflecting actual **conversions** between land-use categories **("gross" areas for all conversions)** but **not in a spatially explicit manner**;

- **Approach 3 tracks land-use conversions on a spatially explicit basis ("gross" area)**.

Generic guidance for land representation – **data sources**

- **Approach 1** => **net area** of land use category at the end of year or attributed to a certain year
  - Census (list/table of ownership records), maps

- **Approach 2** => **gross area** of land use at the end of year, incl. all areas which start conversion in the year (time of occurrence is implicitly provided)
  - Cadastre (GIS based)
  - Sectoral statistics (e.g. afforestation, natural disturbances, deforestation)

- **Approach 3** => **gross area in a time dynamic** of land use identified, e.g. where and (at least approximately) when it has occurred
  - Remote sensing (aerial, satellite, airborne)
  - Sampling grids

Practice 1: which approach is better in tracking timing of events (e.g. in case of land conversions)?

Generic guidance for land representation

Approaches are not mutually exclusive, countries may use a **mix of Approaches** for different regions over time, for various land use categories

Same three Approaches **apply for any other GHG sources** related to land which need “area” as “activity data” (e.g. wildfire)

Data sources do not exclude each other, i.e. one is primary source of data, the others are used for verification

Six broad land-use categories: definitions

- **broad non-prescriptive definitions** for the land-use categories, and of managed and unmanaged lands;
- **countries to implement own definitions**, which may or may not refer to internationally accepted definitions;
- definitions and classifications should be **specified at the national level**, described in a transparent manner
- definitions and classifications should be **applied consistently over time by the data source or sampling method selected**;
- Definitions to include **quantitative descriptors** (e.g. min. height, duration, etc.)

Example: forest parameters

Table NIR 1.1 Additional information
Selection of parameters for defining "Forest"under the Kyoto Protocol

Parameter	Range	Selected value
Minimum land area	0.05 - 1 ha	?
Minimum crown cover	10 - 30 %	?
Minimum height	2 - 5 m	?

Example for "duration": 5 years of non-disturbed soils for conversion between arable land to grasslands

- **LAND USE CATEGORIES: (i) Forest Land; (ii) Cropland; (iii) Grassland; (iv) Wetlands; (v) Settlements; (vi) Other Land**

- **LAND USE CATEGORIES relevant for land CONVERSIONS:**

FF	=	Forest Land Remaining Forest Land	LF	=	Land Converted to Forest Land
GG	=	Grassland Remaining Grassland	LG	=	Land Converted to Grassland
CC	=	Cropland Remaining Cropland	LC	=	Land Converted to Cropland
WW	=	Wetlands Remaining Wetlands	LW	=	Land Converted to Wetlands
SS	=	Settlements Remaining Settlements	LS	=	Land Converted to Settlements
OO	=	Other Land Remaining Other Land	LO	=	Land Converted to Other Land

Discussion on where following strata should be classified:

Recently forest cut area? **Drained areas?** **Irrigated areas?**

barren lands? **Free flooding areas of lakes?** **Forest burned in wildfire?**

Further stratification of subcategories

- ***top down* or *bottom up*** for stratification;
- where particular C data is **expected to be needed later** in the inventory (or mitigation effort);
- **relevant divisions are highlighted in default tables throughout the IPCC guidelines**, ex. col.2 in Table 6.1;
- soil/land management information is usually in Approach 1 format;
- interactions between management practices that affect emission/stock change factors captured by **Tier 1 complicates the GHG inventory** ….

TABLE 6.1
DEFAULT EXPANSION FACTORS OF THE RATIO OF BELOW-GROUND BIOMASS TO ABOVE-GROUND BIOMASS (R) FOR THE MAJOR GRASSLAND ECOSYSTEMS OF THE WORLD

Land-use category	Vegetation type	Approximate IPCC climate zone[1]	R [tonne d.m. below-ground biomass (tonne d.m. above-ground biomass)$^{-1}$]	n	Error[2]
Grassland	Steppe/tundra/prairie grassland	Boreal – Dry & Wet Cold Temperate – Wet Warm Temperate – Wet	4.0	7	± 150%
	Semi-arid grassland	Cold Temperate – Dry Warm Temperate – Dry Tropical – Dry	2.8	9	± 95%
	Sub-tropical/ tropical grassland	Tropical – Moist & Wet	1.6	7	± 130%
Other	Woodland/savannah		0.5	19	± 80%
	Shrubland		2.8	9	± 144%

[1] Classification of the source data was by grassland biome types and thus correspondence to the IPCC climate zones are approximations.
[2] Error estimates are given as two times standard deviation, as a percentage of the mean.

Data (source) features (IPCC, Ch.3):

- *adequate*, i.e., capable of representing land-use categories, and conversions between land-use categories;
- *consistent*, i.e., capable of representing land-use categories consistently over time and concerned territory;
- *complete*, which means that all land within a country's administrative territory should be included, with increases in some areas balanced by decreases in others;
- *transparent*, i.e., data sources, definitions, methodologies and assumptions should be clearly described in reporting

It is preferable that data used should be capable of producing input to uncertainty calculations!

Source of uncertainty for land area in Approach 3

- Georeferenced “statistical sampling grid” or “wall-to-wall”
- Largest list of sources under Approach 3, but uncertainty lower than Approach 1 (if known at all) or Approach 2
- Major uncertainty is generated by land use conversions
- Knowing sources >> **ways to reducing uncertainty**

>>> see Practice 2

	Sources of uncertainty	Ways to reduce uncertainty	Indicative uncertainty following checks
Approach 3	• error in interpretation of remote sensing • sampling design (full/partial cover on some land use or land use events, or time gaps) • partial territorial coverage by “wall to wall” • use of only one source of data ……..	• correct for differences in definitions (method vs. requirement) • add additional phases of checks with ancillary information (incl. field checks) • check for consistent relationship with national area • consult statistical agencies on likely uncertainties involved • compare with international datasets • use of most modern devices and methods ……	• errors are mapped and can be tested against independent data/field checked, • errors reduced by resampling after a period of time ……

TURKEY'S LAND USE MATRIX

What: a complete, consistent, accurate, transparent and comparable national GHG inventory

How: CRF tables (unique tool for GHG calculations) + National Inventory Report (methodologies, descriptive)

Level of performance: Approach 3 for land representation and area estimation

GHG calculations: integrated Land Use Matrix for entire LULUCF sector

- updated and spatially explicit land tracking
- data for C stock changes from various sources

Focus over this workshop: understanding and using the matrix

- Landsat to mapping – Geoville training (to come soon)
- From AD data to GHG estimation: calculation flow
- Estimating GHG for year 2017 by the participants