

# Reporting, monitoring and verification of GHG Inventory of Bulgaria

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# GHGI Preparation and National Arrangements

# GHGI and reporting requirements



Under UNFCCC (United Nation Convention on Climate Change) – Annex I countries, annually



Under Kyoto Protocol (KP) – more detailed reporting requirement for countries participating under the KP



National communication and biennial report

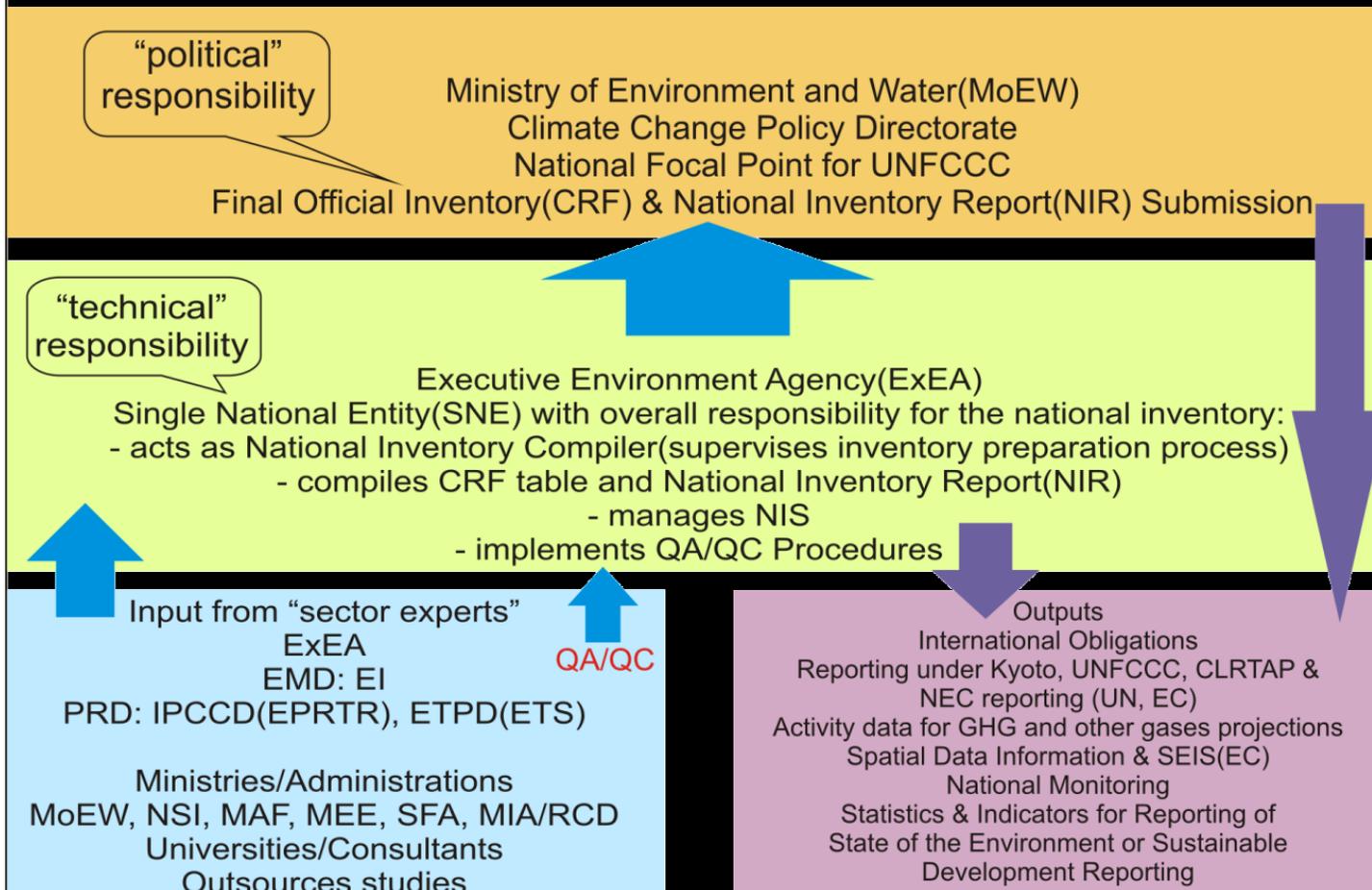


Under Paris Agreement – GHGI all countries every two years

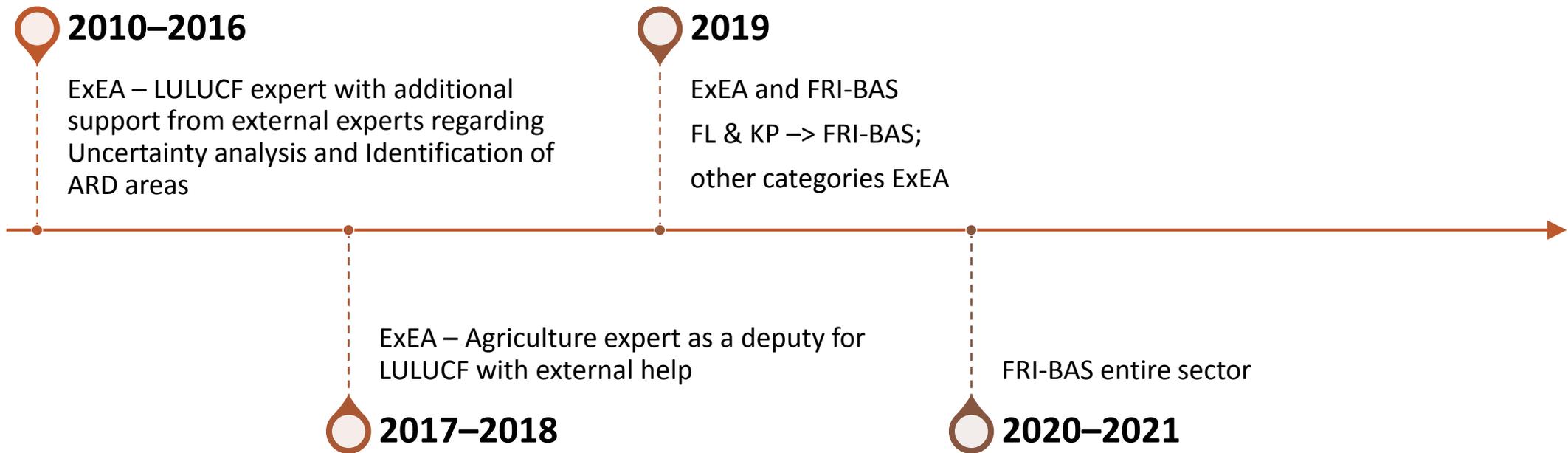


Regulation 1999/2018; Regulation 841/2018 LULUCF Regulation

## National Inventory System - Organisation Chart



# National Inventory System (NIS) Bulgaria



# LULUCF Inventory system

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LULUCF

# LULUCF Overview

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**Six LU categories and changes between them:**

Forest land  
Cropland  
Grassland  
Wetlands  
Settlements  
Other land

**Carbon pools:**

**Biomass** – aboveground and belowground;  
**Dead organic matter** – dead wood and litter  
**Soil**

***Harvested wood product***

# Definitions

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**Forest land** - area over 0.1 ha, covered with forest tree species higher than 5 meters and tree crown cover over 10% or with trees which can reach these parameters in natural environment



**Cropland** - consists of annual crops (cornfields and kitchen gardens) and perennials (vineyards, fruit and berry plantation and nurseries)



**Grassland** - permanent grasslands, natural meadows, low productive grasslands, permanent lawns and grassland (2 subcategories: Permanent grasslands and meadows; Shrubs and grasslands)



**Wetlands** - natural or artificial water-courses serving as water drainage channels, natural or artificial stretches of water, coastal lagoons, wetlands areas and peatbogs



**Settlements** - refer to all classes of urban formation



**Other land** - bare soil, rock and all area that do not fall into any of other five land-use categories



# LULUCF

## Input parameters

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**Activity data** – annual data on area of 6 land use categories and changes between them and relevant stratification

**Emission factors (EFs)** – annual C stock changes in the carbon pools



Usually the **data comes from different sources** of information:

- random assessment/observation
- models outputs
- studies
- IPCC guidelines or other literature sources
- expert judgment



# Land representation – approaches and data

# LUC and subcategories

## Definitions and importance

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Information, in terms of classification, **area data**, and sampling that represents various land-use categories, is needed for LULUCF inventory. It represents the **activity data** for the estimates

Data on area of land use and land-use changes cannot be obtained from IPCC guidelines as it is possible with EFs



# LUC and subcategories

## Definitions and importance

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Development and implementation of land use and land-use change assessment **system** have a high priority in LULUCF inventory preparation.

Look for **improvements** of the assessment system, data used, assumptions made and etc.



# LUC and subcategories

## Definitions and importance

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### Land use data and reporting principles

**adequate** – capable of representing land-use categories, and conversions between land-use categories, as needed to estimate carbon stock changes and greenhouse gas emissions and removals;

**consistent** – capable of representing land-use categories consistently over time, without being unduly affected by artificial discontinuities in time-series data;

**complete** – which means that all land within a country should be included;

**transparent** – data sources, definitions, methodologies and assumptions should be clearly described.



# Stratification of land use data

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The six land-use categories may be further stratified.  
It is needed if Tier 1 Efs are used.

- Areas of different climate zones
- Areas of different vegetation types
- Areas of different soil types (e.g. mineral and organic soils)
- Areas of different management practices (e.g. different cropland and grazing land management)

For higher Tier methods other ways of further stratification may be more appropriate



# Area representation

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## Three approaches:

**Approach 1** identifies the **total change in area**, but does not provide information on area of conversions between land uses.

**Approach 2** introduces **tracking of land-use conversions** between categories (but is not spatially explicit).

**Approach 3** extends Approach 2 by allowing land-use conversions to be tracked on a **spatially explicit** basis.

Consider that the Approaches :

- are not hierarchical tiers
- do not imply any increase or decrease in accuracy
- reflect collection methods and attributes
- provide appropriate ways to use the data
- are not mutually exclusive, mix of Approaches is possible

# Information on data sources and providers

Land use category	Main data source		Data provider	
<b>4A Forest land</b>	Forest Inventory, Forestry Management Plans and its Forestry fund reports		Executive Forest Agency (ExFA)	
<b>coniferous</b>				
<b>deciduous</b>				
<b>forests out of yield</b>				
<b>4B Cropland</b>	National Statistical Yearbooks	BANSIK and LPIS	National Statistical Institute (NSI)	Ministry of agriculture, food and forestry (MAFF)
<b>annual cropland</b>				
<b>perennial cropland</b>				
<b>4C Grassland</b>	National Statistical Yearbooks	BANSIK and LPIS	National Statistical Institute (NSI)	Ministry of agriculture, food and forestry (MAFF)
<b>4D Wetlands</b>	Cadastral maps of the agricultural fund for single years 1994 and 1996; LPIS, CLC		Cadastre Agency, MAFF, Executive Environment Agency	
<b>4E Settlement</b>				
<b>4D Other land</b>	Forest Inventory		Executive Forest Agency (ExFA)	

**NO COPERNICUS DATA IS USED**

Top priority is given to the most reliable data which comes from systematically measured statistics and ortho photoimages. This data is used to present the total area of each particular land use category for the whole time series

Concerning estimation of LUCs between categories, priority is given to estimates based on specific information on land-use changes rather than to estimates of LUCs based on expert judgement

Estimates of LUCs between categories based on expert judgement are with higher priority than estimates of LUCs based on data gaps

Data gaps

# Area data processing - hierarchical treatment

# Known LUCs

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1. FL to Other land uses -> **FL to SM** -> also reported as **D**
2. Agricultural land (e.g CL&GL) to Other land uses -> **CL to SM, GL to SM**
3. LUC perennial cropland in annual cropland
4. LUC annual cropland in perennial cropland
5. Grassland in annual cropland
6. Grassland in perennial cropland
7. Annual cropland in grassland
8. Perennial cropland in grassland

# LUC matrix 2019 (NIR 2021)

TO:	Forest land (managed)	Forest land (unmanaged)	Cropland	Grassland (managed)	Grassland (unmanaged)	Wetlands (managed)	Wetlands (unmanaged)	Settlements	Other land	Total unmanaged land	Initial area
<b>FROM:</b>	<b>(kha)</b>										
Forest land (managed) <sup>(2)</sup>	3921.89	NO	NO	NO	NO	NO	NO	0.65	NO	NO	3922.55
Forest land (unmanaged) <sup>(2)</sup>	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO
Cropland <sup>(2)</sup>	1.47	NO	3671.57	2.26	NO	NO	IE	0.93	NO	NO	3676.21
Grassland (managed) <sup>(2)</sup>	11.30	NO	NO	2541.73	NO	0.18	NO	0.46	NO	NO	2553.68
Grassland (unmanaged) <sup>(2)</sup>	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO
Wetlands (managed) <sup>(2)</sup>	NO	NO	NO	NO	NO	231.78	NO	NO	NO	NO	231.78
Wetlands (unmanaged) <sup>(2)</sup>	NO	NO	NO	NO	NO	NO	IE	NO	NO	NO	NO,IE
Settlements <sup>(2)</sup>	NO	NO	NO	NO	NO	NO	NO	533.71	NO	NO	533.71
Other land <sup>(2)</sup>	0.04	NO	NO	7.30	NO	0.03	IE	0.10	174.79	NO	182.26
Total unmanaged land <sup>(3)</sup>	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO
<b>Final area</b>	3934.71	NO	3671.57	2551.29	NO	231.99	NO,IE	535.85	174.79	NO	11100.19
<b>Net change<sup>(4)</sup></b>	12.16	NO	-4.65	-2.39	NO	0.21	NO,IE	2.14	-7.47	NO	0.00



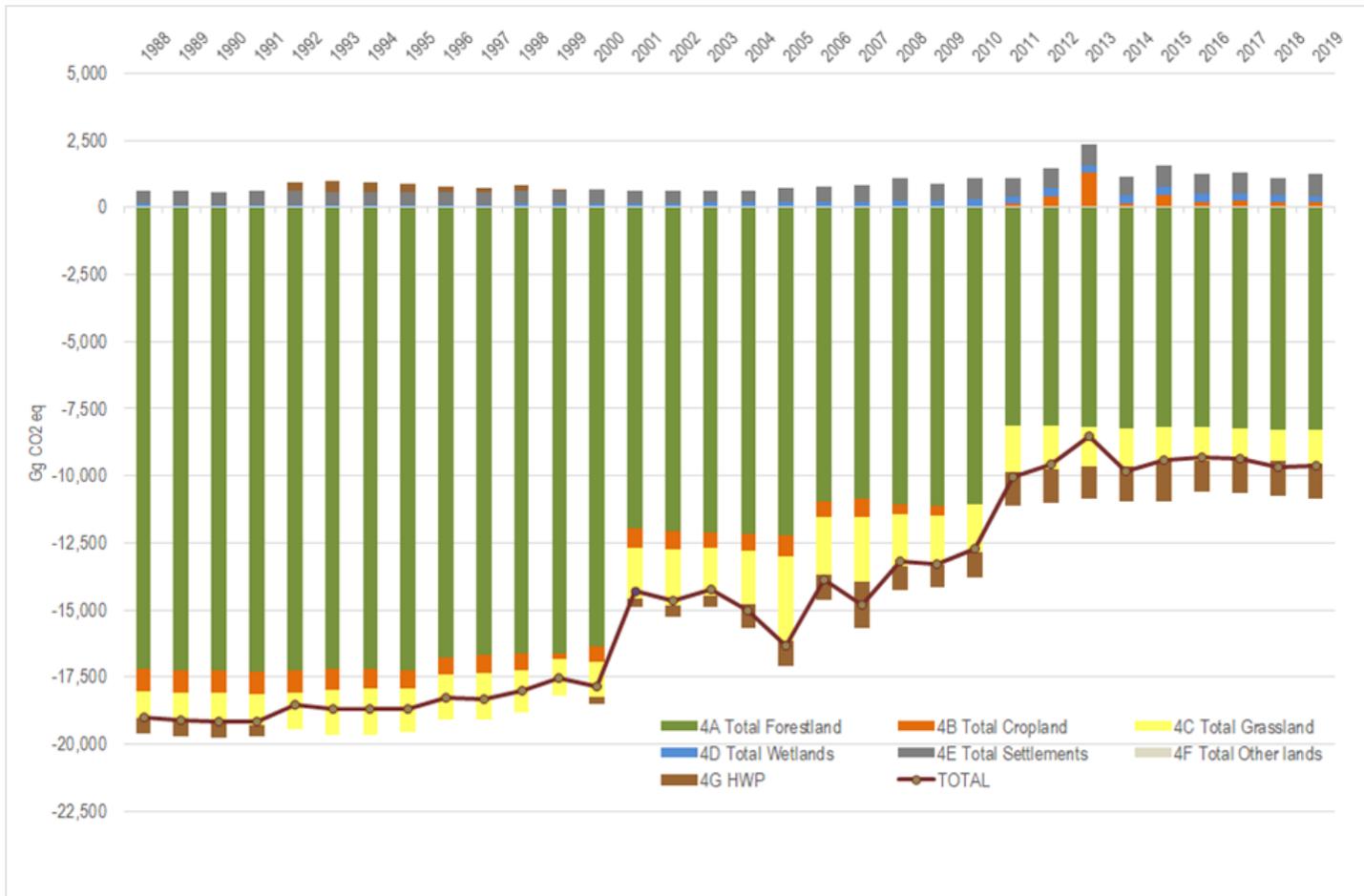
# Emissions and removals calculation – methods and data

# Overview of methods used

IPCC Categories	Carbon pools					Non-CO2	
	Living biomass	Dead wood	Litter	Mineral Soil	Organic soil	CH4	N2O
4A1 FLrFL	Tier 2	Tier 2	Tier 1	Tier 1	NO	Tier 1	Tier 1
4A2 LUC to FL	Tier 2	NO	Tier 2	Tier 2	NO	Tier 1	Tier 1
4B1 CLrCL	Tier 1	Tier 1		Tier 2	NO	NO	
4B2 LUC to CL	Tier 1, Tier 2	Tier 1		Tier 2	NO	NO	Tier 1
4C1 GLrGL	Tier 1	Tier 1		Tier 2	NO	NO	Tier 1
4C2 LUC to GL	Tier 1, Tier 2	Tier 1		Tier 2	NO	NO	
4D1 WLrWL	NO	NO		NO	NO	NO	Tier 1
4D2 LUC to WL	Tier 1, Tier 2	Tier 1, Tier 2	Tier 1, Tier 2	Tier 2	NO	NO	
4E1 SMrSM	Tier 1	Tier 1		Tier 1	NO	NO	
4E2 LUC to SM	Tier 1, Tier 2	Tier 1, Tier 2	Tier 1, Tier 2	Tier 2	NO	NO	Tier 1
4F OL							

Tier 1 – simplest method, default parameters used; shaded – IPCC assumes equilibrium in net carbon stock

Tier 2 - applies emission and stock change factors that are based on country- or region-specific data



Trend in  
emissions  
from  
LULUCF, NIR  
2019



# Needs and challenges

## Towards Spatial explicit land use and Tier 3

Reduced Uncertainty

Tier 3 High res. data (e.g. model)	Not applicable	Modelled data combined with LUC matrix (not necessarily spatially dis-aggregated)	Geo-information at high-resolution, detailed time series, country-specific disaggregated data based on inventories and/or models
Tier 2 Country specific values	National area statistics, combined with country-specific values – typical 1 <sup>st</sup> improvement	Annual LUC stats, combined with country-specific values	Geo-information, time series, country specific values – good coverage, detailed analysis
Tier 1 IPCC default values	National area statistics, combined with IPCC default values – basic entry level	Annual (or annualised) LUC stats presented as national matrix – applied using default IPCC values	Geo-information, time series, default values – weak, but better than App 1 and 2
	Approach 1 National statistics	Approach 2 Land Use Change matrix	Approach 3 Geo-tracked

Improved Coverage and Representation

*Source: Simon Kay  
EC DG CLIMA*

# Needs

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Develop a complete and consistent time series on land representation (1988-xx) and land use changes (1968-xx) based on geo-referenced data

Looking forward to understand how Copernicus products and services could be used in this process

Possible application of Copernicus data

- Direct application where relevant
- Monitoring and verification if other geo-referenced data is used in constructing the time series