

**PROGRESS REPORT ON LULUCF ACTIONS
UNDER ARTICLE 10(2) OF DECISION 529/2013/EU**

ITALY

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Authors

EXECUTIVE SUMMARY

ISPRA¹

ENHANCED COMMUNICATION AND STAKEHOLDER CONSULTATION

ISMEA²

OVERVIEW OF NATIONAL CIRCUMSTANCES

ISPRA, ISMEA (§3.2)

PAST EMISSIONS AND REMOVALS

ISPRA

PROJECTIONS

ISPRA

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1. Executive Summary

Based on an agreement by the Council and the European Parliament, the Decision n. 529/2013/EU sets out accounting rules applicable to greenhouse gas emissions and removals from the LULUCF sector, with the aim of a future inclusion of the LULUCF sector in the Union's emission reduction commitment. The Decision 529/2013/EU also requires Member States to draw up and transmit to the Commission information on their current and future LULUCF actions to limit or reduce emissions and maintain or increase removals resulting from the activities referred to in Article 3.1, 3.2 and 3.3 of abovementioned Decision (*Afforestation, Reforestation and Deforestation (ARD)*, *Forest Management (FM)*, *Cropland Management (CM)*, *Grazing Land Management (GM)*, *Wetland Drainage and Rewetting (WDR)*, and *Revegetation (RV)*). Italy has decided to transmit the progress report on LULUCF actions under Article 10(2) of Decision 529/2013/EU as a separate document, following art. 10.1 of the abovementioned Decision.

The progress report on LULUCF actions includes information and data on the key aspects of LULUCF reporting. The area of managed land used in the estimation process under UNFCCC and the Kyoto Protocol (KP) is detailed, with a focus on the management practices taken into account to estimate emissions and removals from cropland and grassland categories and related art. 3.4 of the Kyoto Protocol activities (*cropland management* and *grazing land management*). Emissions and removals related to the period 1990-2018 have been reported, coherently with the data submitted to UNFCCC and related Kyoto Protocol, considering the mandatory carbon pools.

Finally, data and the information on emission projections, as reported under UNFCCC and UE, have been provided.

In particular the for the activity *Forest Management*, in relation to second commitment period of the Kyoto Protocol (2013-2020) the technical correction to the *Forest Management Reference Level (FMRL)* is included, being the FMRL the averages of the projected forest management (FM) data series for the period 2013-2020, as well as the Forest Reference Level (FRL) for the period from 2021 to 2025 as submitted by Italy with the National Forestry Accounting Plan.

Projections for the cropland and grassland categories have been estimated on the basis of 1990-2018 trend, subcategory by subcategory, considering a Business As Usual (BAU) scenario consistently with the official Reporting reported under Article 3(2) of the Monitoring Mechanism Decision (Commission Decision 280/2004/EC) and the incoming Italian 2050 long-term strategy.

2. Enhanced communication and stakeholder consultation

2.1 Communication between ministries / government departments

A national expert panel was set up under the coordination of Ministry of Environment and in cooperation with the Ministry of Agriculture, Food and Forestry Policies. The aforementioned panel involves the relevant national experts and the main stakeholders, at the national and regional levels. The key issue of the panel is to achieve a streamlining among the UNFCCC/KP framework, LULUCF Decision and CAP Regulations and promoting the best practices and synergies with other policies and measures relating to forest and agriculture.

Much information relating to LULUCF actions is already part of different frameworks and reporting (i.e. Forest Management Reference Level submission, National Communication under UNFCCC, reporting under Article 3(2) of the Monitoring Mechanism Decision, Rural Development Programmes, Ministerial Conference on the Protection of Forests in Europe (MCPFE) reporting, Agricultural policy strategy, National Renewable Energy Action Plan, etc.).

2.2 Consultation with stakeholders

In 2009 the Ministry of Agriculture Food and Forest Policies, in conjunction with National Rural Network, held a national workshop involving public and academic officials to evaluate the role of agriculture and forestry sectors in post-Kyoto climate change adaptation and mitigation.

A position paper was published, which, taking into account the importance of the agriculture sector on emission balance, showed the strategies of the Italian rural development and agro-food chain for climate policies. The aim was to enhance not only the contribution of agriculture to emission reduction, but also to play an active role in economic development. Soon after, the Ministry began working on a “White paper on climate change” which was published in 2011. This document presented the national framework for opportunities and challenges for rural development on mitigation and adaption to climate change, taking into account various possible climatic scenarios.

Around eighty experts contributed to this document, highlighting detailed proposed actions which the Italian agriculture and forestry sector could adopt, not only in LULUCF, but also in the animal husbandry, agro-food and energy sectors. During 2012 and 2013 the involvement of stakeholders continued as evidenced by the publication of further relevant magazine articles, as well as on line, at www.pianetapsr.it.

In addition to this, a technical report concerning the baseline indicators n.24 and n.25 (renewable energy and agricultural and forestry biomass) for the monitoring and evaluation of the regional RDP 2007-2013 was published.

On the international level, ISMEA (Italian Institute for agricultural and agro-food market) represented the Italian Rural network at a workshop entitled “Climate Change mitigation and adaptation in RDP’s”, organized by the European Evaluation Network, held in Cyprus on 10-11 February 2014.

On 13 March 2014, more than 170 stakeholders from NRN partners, government institutions, universities and research organizations attended a workshop in Rome organized by Rete Rurale - the Italian NRN - regarding the contribution of the 2014-2020 RDP to the efficient use of resources and the transition to a low-carbon economy in the food industry³. Delegates heard presentations on climate indicators and the strategic framework for support from Ministry of Agricultural, Food and Forestry Policies representatives. These were followed by sessions covering practical ways to monitor and reduce emissions at both regional and farm levels. On the 22nd April 2014 the Partnership Agreement (document that defines the strategies and priorities of the Member State) has been notified to the European Commission. The Agreement, as indicated in the Commission Regulation (EU) No. 1303/2013, was the result of an intensive consultation with a specific focus on the drafting of the Objective no. 4 (“support the transition towards a low-carbon economy in all sectors”) and no. 5 (“Promote adaptation to climate change, the prevention and risk management”). On the 1st

³ http://enrd.ec.europa.eu/publications-and-media/enrd-magazine/it/enrd-magazine_it.cfm

December 2015 ISMEA presented to the Cypriot representatives of European project “ORGANIKO LIFE+” the Italian methodology to calculate the sinks/emissions of CM e GM, in particular for the organic agriculture.

In 2016-2018 the University of Tuscia (Italy), in collaboration with the Portuguese Environment Agency (APA) and the Spanish Ministry of Agriculture, has been involved in the LIFE project “Mediterranean Network for Reporting Emissions and Removals in Cropland and Grazing land Management” MEDINET. The aim of this project was to create a “Mediterranean Network for Reporting Emissions and Removals in Cropland and Grazing land Management”, under UNFCCC, Kyoto and EU obligations, involving the most relevant Institutions and/or Universities working on these themes, sharing information on Italian experience with the EU Mediterranean countries. Life Medinet has also involved local stakeholders such as farmers and farmers associations for enhancing awareness of climate mitigation potential of agricultural activities. The event involved 50 participants, took place in Viterbo in June 2017.

During a meeting held on 18 December 2019, the Italian Ministry of Agriculture Food and Forest Policies shared with the regions the decision to include in the National Greenhouse Gas Inventory (submission 2020, second commitment period of the Kyoto Protocol, 2013-2018), further management practices for cropland management and grazing land management. The methodology already implemented in 2016 KP submission for organic grazing land (‘improved grazing land’), has been extended to organic arable land, organic perennial woody crops, conservative practices, sustainable arable land, woody crops-sustainable and set aside.

3. Overview of national circumstances

3.1 Areas of managed land

The area of managed lands included in the current report is the same reported in the UNFCCC reporting and consistent with the Kyoto Protocol (KP) reporting, as land subject to KP activities have been identified as a subcategory of one of these six IPCC main categories. In Italy all land use categories (including cropland, grazing land, and forest) are to be considered managed under the UNFCCC reporting.

Land uses and land use changes have been assessed, on the basis of the IUTI⁴ data; IUTI adopts sampling procedures to estimate the area covered by IPCC land use categories in Italy at four points in time (1990, 2008, 2012 and 2016). 1990, 2008 assessments were carried out using a sampling grid with 1,206,000 points. The 2012 land use assessment has been carried out in the framework of the III NFI, on a IUTI's subset of plots (i.e. 301,300 plots, covering the entire country). The 2016 IUTI assessment has been carried out using a 1% subsample within the whole national territory (about 13,000 sample points). IUTI data are collected according to the 6 IPCC land use categories, although for forest land the data collected by the national forest inventories (1985, 2005, 2012) are used. From IUTI and NFI data consistent time-series of areas of each land-use and land-use change category are derived, as well as of each land subject to art. 3.3 and art. 3.4 of the Kyoto Protocol. Further details on the land representation are reported in National Inventory Report-NIR (ISPRA, 2020).

3.1.1 Forest land

National forest definition⁵ under the Kyoto Protocol has been fully implemented also in the LULUCF⁶ sector of the UNFCCC inventory, to ensure consistency between the two forest-related reporting. The forest definition has been set up, and included in the determination of Italy's assigned amount under Article 7, paragraph 4, of the Kyoto Protocol, and the election of the art. 3.3 and 3.4 activities, by a national expert panel⁷ set up under the coordination of Ministry of Environment and in cooperation with the MIPAAF.

Forest Land is therefore defined as a land containing trees and fulfilling the national forest definition's thresholds. Forest land also includes systems with vegetation that currently fall below, but are expected to exceed, the threshold of the forest land category; it may be temporarily unstocked. Forest roads, cleared tracts, firebreaks and other open areas within the forest as well as protected forest areas are included in forest. All forests fulfilling the definition of forest, as given above, are considered as managed and are under forest management. The total Italian forest area is eligible under forest management activity, since the entire Italian forest area has to be considered managed forest lands. Forest land area, for the period 1990-2018, is shown in Figure 1, disaggregated into forest land remaining forest land and land converting to forest land subcategories.

⁴ Detailed information on IUTI is reported in Annex 10 of National Inventory Report 2020, ISPRA 2020, <https://unfccc.int/sites/default/files/resource/ita-2020-nir-12apr20.zip>

⁵ National forest definition is the same applied by the Food and Agriculture Organization of the United Nations for its Global Forest Resource assessment (FAO FRA 2000). This definition is consistent with definition given in Decision 16/CMP.1. Forest is a land with following threshold values: a minimum area of land of 0.5 hectares; tree crown cover of 10 per cent; minimum tree height of 5 meters.

⁶ LULUCF sector include the following categories: *Forest land, Cropland, Grassland, Wetlands, Settlements, Other Land.*

⁷ The panel involves, on a voluntary basis, the relevant national experts, including the [forest inventory](#) experts and members of the [FAO-FRA Italian panel](#) and other national researchers.

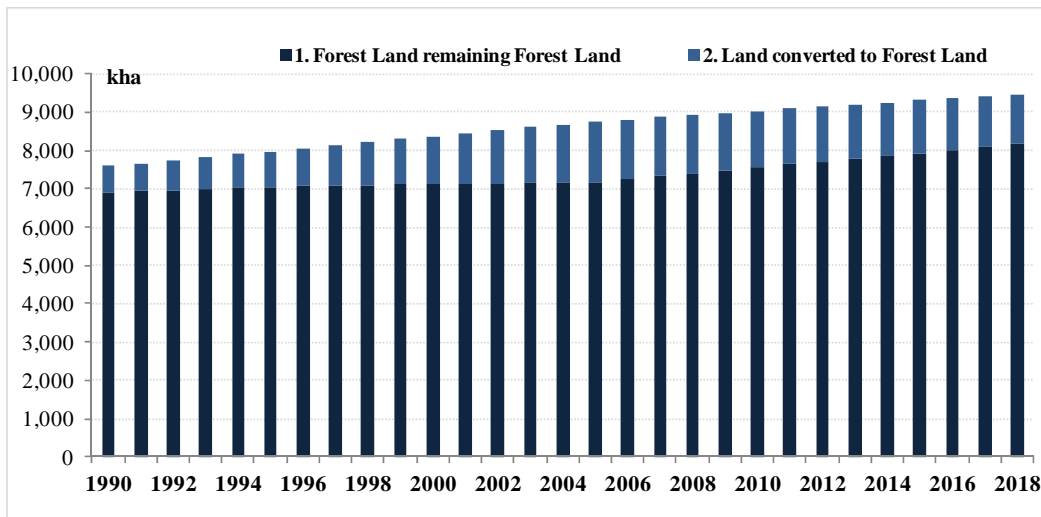


Figure 1: Forest land area for the period 1990-2018 [kha]

In table 1, the area of land subject to the KP art. 3.3 activities (*afforestation/reforestation* – AR and *deforestation* – D) and *forest management* (FM) activity under art. 3.4 is reported for period 2008-2018.

Table 1: Area of land subject to KP art. 3.3 and FM under art. 3.4 activities

kha	2013	2014	2015	2016	2017	2018
art. 3.3 - AR	1,728	1,787	1,845	1,903	1,962	2,020
art. 3.3 - D	44	48	51	55	59	63
art. 3.4 - FM	7,468	7,464	7,460	7,457	7,453	7,449

3.1.2 Agricultural land: cropland and grassland

Cropland is defined as a land that with cropping systems, including trees that fall below the forest definition's thresholds. Lands subject to *cropland management* (CM) activity are consistent with the cropland lands in the UNFCCC reporting. CM data related to the whole activity have assessed on the basis of the IUTI data, available for the years 1990, 2000, 2008, 2013 and 2016; 2017 and 2018 data have been deduced by a linear extrapolation for the period 2013-2016. Lands subject to *cropland management* correspond to the cropland reported under the Convention in the year 1990 minus any land converted to forest or grassland plus settlements, wetlands and other land, if any, converted to cropland. The total area subject to the *Cropland management* activity has been disaggregated into annual crops and woody crops subcategories, which, in turn, have been subdivided into specific management practices. The list of the management practices considered, as well as their definitions, the underlying CAP Regulations and data sources, is reported in Table .

Table 2: cropland management: management practices, definitions and data sources

CM activities	management practices	definition	CAP regulations	Data source
CM -annual crops	Arable land (Ordinary)	A kind of agriculture that doesn't evidence any kind of soil carbon stock technical maintenance		ISTAT
	Organic arable land	Management of waste crop; Organic manure; Extended crop rotation; Selection of better crop varieties; Cover crops	Reg. (EEC) n. 2078/92, Reg. (EC) n. 834/2007 and Reg. (EC) n. 889/2008, RDPs 2000-2006: Reg. (EC) n. 1257/99, RDPs 2007-2013: Reg. (EC) n. 1698/2005 and Reg. (EC) n. 74/2009	National Information system on organic agriculture (SINAB)
	Sustainable arable land	Crop rotation; Grassing; Specific erosion prevention; Cover crops; Minimum tillage	National decree on sustainable agriculture n. 2722/2008; RDPs 2000-2006: Reg. (EC) n. 1257/99; RDPs 2007-2013: Reg. (EC) n. 1698/2005 and Reg. (EC) n. 74/2009	Annual Implementation Reports (RAE) and Annual Report on Operational Programs: 2000-2018
	Set aside	Natural grassing; At least one mowing	Reg. (EEC) N. 1765/1992; National decree on cross compliance implementation n. 30125/2009 and subsequent revisions; national decree 20/3/2020 on cross compliance implementation	Eurostat: 1990-2016
	Conservative practices	Zero tillage; Organic manure; Grassing; Cover crops; Minimum tillage; Crop rotation	RDPs 2007-2013: Reg. (EC) n. 1698/2005 and Reg. (EC) n. 74/2009	Annual Implementation Reports (RAE): 2008-2018
CM - woody crops	woody crops (Ordinary)	A kind of agriculture that doesn't evidence any kind of soil carbon stock technical maintenance		ISTAT
	Organic perennial woody crops	Management of waste crop; Organic manure; Extended crop rotation; Selection of better crop varieties; Cover crops	Reg. (EEC) n. 2078/92, Reg. (EC) n. 834/2007 and Reg. (EC) n. 889/2008, RDPs 2000-2006: Reg. (EC) n. 1257/99, RDPs 2007-2013: Reg. (EC) n. 1698/2005 and Reg. (EC) n. 74/2009	National Information system on organic agriculture (SINAB)
	woody crops - Sustainable management	Crop rotation; Grassing; Specific erosion prevention; Cover crops; Minimum tillage	National decree on sustainable agriculture n. 2722/2008; RDPs 2000-2006: Reg. (EC) n. 1257/99; RDPs 2007-2013: Reg. (EC) n. 1698/2005 and Reg. (EC) n. 74/2009	Annual Implementation Reports (RAE) and Annual Report on Operational Programs: 2000-2018

Area of land subject to CM, for the period 1990-2018, is reported in Table , disaggregated into woody crops and annual crops subcategories.

Table 3: Area (in kha) of land subject to CM under art. 3.4 activities

Subcategory	management practice	1990	2013	2014	2015	2016	2017	2018
					<i>kha</i>			
Annual Crops	conventional	7,401.39	5,175.61	5,031.94	4,928.24	5,003.91	4,741.83	4,645.20
	conservative practices	0.00	127.31	154.07	160.08	98.55	157.00	247.51
	sustainable management	0.00	254.71	316.17	356.28	190.72	335.28	298.56
	organic	8.25	531.58	574.26	619.05	774.62	838.67	886.46

	set aside	596.27	375.30	376.15	376.99	377.83	377.83	377.83
	total	8,005.91	6,464.52	6,452.59	6,440.64	6,445.64	6,450.61	6,455.56
Woody Crops	conventional	2,721.25	1,959.61	1,931.06	1,885.12	1,976.92	1,827.37	1,833.03
	sustainable	0.00	226.67	279.16	310.18	144.52	254.90	239.85
	organic	2.36	348.97	336.98	363.83	432.71	466.90	471.34
	total	2,723.61	2,535.26	2,547.20	2,559.14	2,554.15	2,549.17	2,544.22
Total Cropland Management		10,729.52	8,999.78	8,999.78	8,999.78	8,999.78	8,999.78	8,999.78

Land subject to *grazing land management* (GM) have been assessed on the basis of the definition included in the Annex to the decision 16/CMP.1⁸; land subject to *grazing land management* in Italy are those predominantly covered by herbaceous vegetation (introduced or indigenous) for a period longer than five years, used for grazing or fodder harvesting and/or under practices to control the amount and type of vegetation. In the 2020 UNFCCC inventory submission, the land subject to *grazing land management* has been extended by the inclusion of all the managed grazing land of which the ‘improved grazing land’ or organic grazing land is a part. Data of the area of total managed grazing land are derived from Eurostat and ISTAT, while data of grazing areas managed with organic practices are derived from the National System on Organic Farming (SINAB) of the Ministry of Agriculture, Food and Forest Policies (MIPAAF). The total area subject to the *Grazing land management* activity has been disaggregated into Conventional grazing land (i.e. managed grazing land not subjected to organic practices) and Organic grazing land. The list of the management practices considered, as well as their definitions, the underlying CAP Regulations and data sources, is reported in Table .

Table 4: Summary of the adopted disaggregation of grazing land management areas into subcategories and management practices

management practices	definition	CAP regulations	Data source
grazing land	Renewal and/or thickening of crops	National decree on cross compliance implementation n. 30125/2009 and subsequent revisions; national decree 20/3/2020 on cross compliance implementation	ISTAT
organic grazing land	Renewal and/or thickening of crops; Connection to zootecnics	RDPs 2000-2006: Reg. (EC) n. 1257/1999; RDPs 2007 - 2013: Reg. (EC) n. 1998/2005 and Reg. (EC) n. 74/2009; Reg. (EC) n. 834/2007 and Reg. (EC) n. 889/2008; Reg. (EC) n. 1804/2007	National Information system on organic agriculture (SINAB)

The area subjected to grazing land management, for the period 1990-2018 is reported in Table 5.

Table 5: Area (in kha) of lands subject to GM under art. 3.4 activities.

management practice	1990	2013	2014	2015	2016	2017	2018
managed grazing land	3,818.48	3,369.20	3,539.29	3,517.17	3,436.78	3,398.69	3,402.79
organic grazing land	2.99	383.07	404.18	426.30	506.69	544.78	540.68
Total grazing land	3,821.47	3,752.27	3,943.47	3,943.47	3,943.47	3,943.47	3,943.47

In Table , the land use and land use changes areas for the period 1990-2018 have been reported.

⁸ *Grazing land management* is the system of practices on land used for livestock production aimed at manipulating the amount and type of vegetation and livestock produced.

Table 6: Land uses and land use changes areas (in kha) for the period 1990-2018

	1990	1995	2000	2005	2010	2011	2012	2013	2014	2015	2016	2017	2018
	<i>kha</i>												
LULUCF	30,134	30,134	30,134	30,134	30,134	30,134	30,134	30,134	30,134	30,134	30,134	30,134	30,134
A. Forest Land	7,590	7,980	8,369	8,759	9,032	9,087	9,142	9,196	9,251	9,305	9,360	9,415	9,469
<i>1. Forest Land remaining Forest Land</i>	6,901	7,056	7,117	7,183	7,558	7,633	7,707	7,782	7,857	7,932	8,007	8,082	8,157
<i>2. Land converted to Forest Land</i>	689	923	1,252	1,577	1,475	1,454	1,434	1,414	1,393	1,373	1,353	1,332	1,312
B. Cropland	10,841	10,924	10,487	9,879	9,159	9,096	9,033	8,971	8,908	8,845	8,883	8,920	8,958
<i>1. Cropland remaining Cropland</i>	10,704	10,704	10,403	9,795	9,075	9,029	8,983	8,937	8,891	8,845	8,845	8,845	8,845
<i>2. Land converted to Cropland</i>	136	220	84	84	84	67	50	34	17	0	37	75	112
C. Grassland	8,891	8,278	8,186	8,265	8,584	8,570	8,555	8,541	8,527	8,513	8,401	8,289	8,178
<i>1. Grassland remaining Grassland</i>	8,566	7,985	7,592	7,488	7,196	7,138	7,080	7,021	6,963	6,905	6,853	6,802	6,751
<i>2. Land converted to Grassland</i>	325	292	594	777	1,387	1,432	1,476	1,520	1,564	1,608	1,548	1,487	1,427
D. Wetlands	510	512	515	517	534	541	549	556	564	571	576	581	586
<i>1. Wetlands remaining Wetlands</i>	510	510	510	510	510	511	511	511	512	512	513	513	514
<i>2. Land converted to Wetlands</i>	0	2	5	7	24	31	38	45	52	59	63	68	72
E. Settlements	1,644	1,782	1,920	2,058	2,170	2,185	2,200	2,214	2,229	2,244	2,258	2,273	2,288
<i>1. Settlements remaining Settlements</i>	1,423	1,451	1,478	1,506	1,644	1,672	1,699	1,727	1,754	1,782	1,810	1,837	1,865
<i>2. Land converted to Settlements</i>	221	331	442	552	526	513	500	487	475	462	449	436	423
F. Other Land	658	657	656	656	655	655	655	655	655	655	655	655	655
<i>1. Other Land remaining Other Land</i>	658	657	656	656	655	655	655	655	655	655	655	655	655
<i>2. Land converted to Other Land</i>	0	0	0	0	0	0	0	0	0	0	0	0	0

3.2 Planned improvements⁹

Following its Communication "The Future of Food and Agriculture" [COM(2017)713], published on 29 November 2017, on 1 June 2018 the European Commission presented the legislative proposals for the reform of the Common Agricultural Policy. In the context of work on the new CAP, the 2014-2020 programming period has been extended to the next two years, until 31 December 2022, with the application of the n+3 rule. As a result the new CAP will cover the period 2023-2027. Therefore the rules of the CAP framework covering the period 2014 to 2020 will be applied during the transitional period in the years 2021 and 2022 until the date of application of the new legal framework covering the period starting on 1 January 2023.

In order to achieve the specific objectives of the EU, an important innovation will be introduced: each Member State will have to draw up a single strategy of intervention through a CAP strategic plan that will bring together the support instruments financed in the first pillar (under EAGF), including sectoral programmes currently covered by the CMO Regulation, and those financed under the second pillar (under EAFRD) through rural development measures.

The Strategic Plan proposes a new, more ambitious and result-oriented implementation model, which will enable Member States to achieve specific EU targets, including environmental and climate targets, by a combination of mandatory and voluntary first, and second, pillar measures, taking into account analyses, objectives and targets of other existing legislation.

⁹ Data used in this report, and/or used to make quantitative estimates, is taken from official source Mipaaf (SIAN), and related to the implementation of national and regional measures first and second pillar of the CAP, and national statistics are based on quantitative and qualitative information available at the time of processing. This implies that they are to be considered provisional and subject, in subsequent editions, or any review, even retrospectives, if there is the need to incorporate additional data and information, adjustments and updates statistical and administrative corrections or additions.

3.3 Key C pools and C sources in land based sectors

A key category analysis of the LULUCF categories has been carried out in the Italian national greenhouse gas inventory context, according to the Approach 1 and Approach 2 described in the 2006 IPCC Guidelines (IPCC, 2006). According to the IPCC guidelines, a key category is defined as an emission category that has a significant influence on a country's GHG inventory in terms of the absolute level and trend in emissions and removals, or both. Key categories are those which, when summed together in descending order of magnitude, add up to over 95% of the total emissions or 90% of total uncertainty.

The outcome of the key category analysis for 2018, according to level and/or trend assessment (*IPCC Approach 1 and Approach 2*), is listed in Table 7.

Table 7: Key categories identification in the LULUCF sector

	<i>gas</i>	<i>Categories</i>	2018
4.A.1	CO ₂	Forest land remaining forest land	key (L, T)
4.A.2	CO ₂	Land converted to forest land	key (L, T)
4.B.1	CO ₂	Cropland remaining cropland	key (L2, T)
4.B.2	CO ₂	Land converted to cropland	key (L2, T2)
4.C.1	CO ₂	Grassland remaining Grassland	key (L, T)
4.C.1	CH ₄	Grassland remaining Grassland	key (T2)
4.C.2	CO ₂	Land converted to Grassland	key (L, T)
4.E.2	CO ₂	Land converted to Settlements	key (L)

* *L* = key category in level assessment under both Approach 1 and 2

T = key category in trend assessment under both Approach 1 and 2

L2 = key category in level assessment under Approach 2 only

T2 = key category in trend assessment under Approach 2 only

Key category analysis for KP-LULUCF was carried out according to the section 2.3.6 of the 2013 KP Supplement (IPCC, 2014). In the following Table 8 a summary overview for key categories for LULUCF activities under Kyoto Protocol is reported.

Table 8: Summary overview for key categories for LULUCF activities under Kyoto Protocol

Key categories of emissions and removals	Gas	Criteria used for key category identification			2018
		Associated category in UNFCCC inventory is key	Category contribution is greater than the smallest key category in the UNFCCC inventory (including LULUCF)		
<i>Forest Management</i>	CO ₂	<i>Forest land remaining forest land</i>	Yes		key (L, T)
<i>Afforestation and Reforestation</i>	CO ₂	<i>Land converted to forest land</i>	Yes		key (L, T)
<i>Deforestation</i>	CO ₂	<i>Land converted to Settlements</i>	Yes		key (L)
<i>Cropland management</i>	CO ₂	<i>Cropland remaining cropland</i>	Yes		key (L2, T)
<i>Grazing land management</i>	CO ₂	<i>Grassland remaining Grassland</i>	Yes		key (L, T)

3.4 Main crop systems and grasslands that have links to key C pools and C sources

3.4.1 *Cropland*

Cropland includes all annual and perennial crops as well as temporary fallow land (i.e., land set at rest for one or several years before being cultivated again). Annual crops may include cereals, oils seeds, vegetables, root crops and forages. Arable land which is normally used for cultivation of annual crops but which is temporarily used for forage crops or grazing as part of an annual crop-pasture rotation is included under cropland. Temporary set aside of annually cropland (e.g. conservation reserves) is included in cropland category. Perennial crops include trees and shrubs, in combination with herbaceous crops (e.g. agroforestry) or as orchards, olive groves and vineyards. Different management practices, including crop type and rotation, tillage, drainage, residue management and organic amendments, are implemented on cropland areas, depending on crop, soil and climate variables. Carbon stock changes for living biomass and soils carbon pools are estimated and reported in UNFCCC context. Lands subject to cropland management activity are consistent with the cropland lands in the UNFCCC reporting. The same activity data deduced for UNFCCC reporting (cropland category) and estimation methods have been used to report carbon stock changes related to area subject to cropland management activities.

3.4.2 *Grassland*

Grassland includes grazing lands, forage crops, permanent pastures, and lands once used for agriculture purposes, but in fact set-aside since 1970. Grasslands generally have vegetation dominated by perennial grasses, with grazing as the predominant land use, and are distinguished from “forest” by having a tree canopy cover of less than the threshold used in the forest definition. Carbon stocks in permanent grassland are influenced by human activities and natural disturbances, including harvesting of woody biomass, rangeland degradation, grazing, fires, pasture management, etc. Carbon stock changes for living biomass, dead organic matter and soils carbon pools are estimated and reported in UNFCCC context.

Lands subject to *grazing land management* in Italy are those predominantly covered by herbaceous vegetation (introduced or indigenous) for a period longer than five years, used for grazing or fodder harvesting and /or under practices to control the amount and type of vegetation. The same activity data deduced for UNFCCC reporting (cropland category) and estimation methods have been used to report carbon stock changes related to area subject to cropland management activities.

4. Past emissions and removals

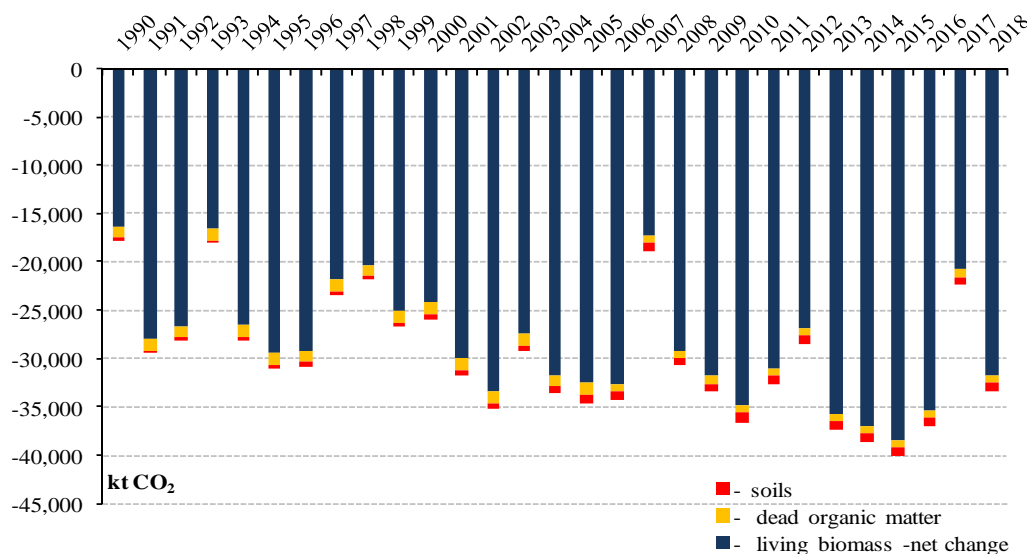
The IPCC default land use transition period of 20 years has been used to estimate carbon stock changes in mineral soils related to land use changes; the annual changes in carbon stocks in mineral soils have been reported for 20 years subsequent the conversion.

4.1 Forest Management

To model C stock changes in forest land Italy uses the *For-est* model together with data from NFIs. The model applies the IPCC classification and definitions for C pools: living biomass, both aboveground and belowground; dead organic matter, including dead wood and litter; and soil organic matter. Information on the model is reported in National Inventory Report (NIR), Annex 14 (ISPRA, 2020); additional information on methodological aspects can be found in Federici et al., 2008. Italy has decided not to account for the soil carbon stock changes from forest land remaining forest land and from activities under Article 3.4, providing transparent and verifiable information to demonstrate that soils pool is not a source in Italy, as required by par. 21 of the annex to decision 16/CMP.1.

Emissions and removals related to the category Forest land, for the period 1990-2018, are reported in Figure 4, disaggregated into the required carbon pools: *living biomass*, *dead organic matter* and *soils*.

Figure 4: Emissions and removals for the category forest land [kt CO₂ eq.]



In table 9, GHG emissions and removals related to the lands subject to the KP art. 3.3 activities (*Afforestation/Reforestation – AR* and *Deforestation – D*) and article 3.4 activity (*forest management – FM*) for the 2013-2018 period years reported.

Table 9: GHG emissions/removals from activities under Article 3.3 activities and from Forest Management under Article 3.4

kt CO ₂ eq.	2013	2014	2015	2016	2017	2018
art. 3.3 - AR	-7,993	-8,405	-8,861	-8,423	-5,230	-8,031
art. 3.3 - D	2,012	2,023	2,033	2,044	2,046	2,054
art. 3.4 - FM	-30,339	-31,360	-32,562	-29,446	-14,068	-25,914

4.2 Cropland Management

Lands subject to cropland management include annual and perennial crops; changes in the biomass C stock has been estimated for perennial crops, since, for annual crops, the increase in biomass stocks in a single year is assumed equal to biomass losses from harvest and mortality in that same year. Soil carbon stock changes have been estimated and reported for annual and perennial crops.

Methods for estimating carbon stock changes for lands subject to *cropland management* activity are the same as those used for the UNFCCC greenhouse gas inventory: a detailed description of the methods and parameters used in the estimation process are reported in NIR (ISPRA, 2020).

In line with the 2013 KP Supplement (IPCC, 2014) and 2006 IPCC Guidelines (IPCC, 2006), changes in carbon in perennial cropland biomass has been estimated on the basis of the annual rates of biomass gain and loss. The annual carbon stock in living biomass, the woody crops area annually undergoing to a woody biomass removal (e.g., biomass cleared and replanted with a different crop) has been estimated; in addition, the total woody crops area has been broken down into age groups, taking into account three main woody crops categories (i.e. olives, vineyards and other fruit). The estimation process has been carried out at NUTS2 (regional) level based on the available data from national statistics related to the different woody crops species, harvest/maturity cycles. The carbon stock change in living biomass during the plantation cycle is estimated on the basis of an annual constant net gain (accumulation rate), computed from the biomass C stock at maturity.

Tier 1 method has been followed for dead wood and litter, assuming that the abovementioned pools are at equilibrium, and no carbon stock changes are occurring.

Soils carbon stock changes have been estimated according a Tier 2 methodology based on the management practices, as reported in table 2, and the transition to and from different management practices (e.g. ordinary annual crops to organic annual crops, ordinary annual crops to sustainable annual crops, etc.). Changes in carbon stocks in mineral soils has been calculated by applying the equation 2.25 of the IPCC, 2006 (vol. 4, chapter 2), considering a transition period of 20 years (IPCC default value) to reach a new SOC stock equilibrium (steady state). The country specific SOC_{REF} have been deduced, on a regional (NUT2) basis, based on the IPCC default reference soil organic carbon stocks for mineral soils of table 2.3 of the 2006 IPCC Guidelines (Vol.4, Ch. 2), using the following layers: Climatic Zone layer¹⁰, Corine Land Cover 2006¹¹ and the Italian soil map¹². The stock change factors (F_{LU}, F_{MG}, F_I) adapted to the national circumstances, have been derived by the default values provided in table 5.5 of the 2006 IPCC Guidelines (vol.4, chapter 5), and are reported in the following table 10.

Table 10: Stock change factors for Cropland Management under Article 3.4

	Management practice	F _{LU}		F _{MG}		F _I	
		Moist	Dry	Moist	Dry	Moist	Dry
annual crops	Ordinary	0.69	0.8	1	1	0.92	0.95
	Organic	0.69	0.8	1	1	1.44	1.37
	Sustainable	0.69	0.8	1.08	1.02	1	1
	Set aside	0.82	0.93	1.15	1.1	0.92	0.95
	Conservative	0.69	0.8	1.15	1.1	1.11	1.04
woody crops	Ordinary	1	1	1	1	1	1
	Organic	1	1	1.08	1.02	1.44	1.37
	Sustainable	1	1	1.08	1.02	0.92	0.95

The SOC_s per hectare calculated on the basis of the abovedescribed procedure are shown in the table 11, per region and per management practices.

¹⁰ European Commission's Joint Research Centre (JRC): Climatic Zones <http://esdac.jrc.ec.europa.eu/projects/renewable-energy-directive>

¹¹ Corine Land Cover 2006: <http://sia.eionet.europa.eu/CLC2006>

¹² Costantini E.A.C., L'Abate G., Barbetti R., Fantappiè M., Lorenzetti R., Magini S. (2013) Carta dei suoli d'Italia, scala 1:1.000.000 - <http://www.soilmaps.it/>

Table 11: SOC's per region and management practice for Cropland Management under Article 3.4

SOC	annual crops					woody crops		
	Ordinary	Organic	Sustainable	Set aside	Conservative	Ordinary	Organic	Sustainable
	<i>t C ha⁻¹</i>					<i>t C ha⁻¹</i>		
Piemonte	49.04	74.86	56.02	65.64	65.18	72.91	109.79	71.92
Valle D'Aosta	57.29	89.45	67.07	78.13	79.15	89.72	139.09	89.08
Liguria	51.15	78.64	58.89	68.87	68.82	77.29	117.47	76.40
Lombardia	52.32	80.88	60.59	70.76	71.06	80.06	122.53	79.26
Trentino Alto-Adige	56.84	88.97	66.73	77.68	78.87	89.54	139.26	88.97
Veneto	46.88	71.05	53.14	62.38	61.55	68.60	102.36	67.53
Friuli - Venezia Giulia	55.94	87.56	65.67	76.45	77.62	88.12	137.05	87.56
Emilia - Romagna	40.13	59.60	44.50	52.53	50.87	56.17	81.60	54.94
Toscana	38.18	56.43	42.11	49.78	47.98	52.88	76.32	51.64
Umbria	46.72	70.81	52.96	62.17	61.34	68.37	102.01	67.30
Marche	39.05	57.86	43.18	51.02	49.29	54.36	78.72	53.14
Lazio	39.33	58.52	43.69	51.55	50.01	55.26	80.48	54.09
Abruzzo	40.97	60.98	45.54	53.72	52.13	57.61	83.93	56.39
Molise	32.74	47.67	35.52	42.18	40.09	43.94	62.20	42.72
Campania	31.64	45.99	34.26	40.71	38.63	42.31	59.75	41.11
Puglia	29.21	42.21	31.43	37.42	35.30	38.60	54.07	37.42
Basilicata	30.64	44.37	33.05	39.31	37.17	40.67	57.16	39.46
Calabria	34.42	50.34	37.53	44.51	42.48	46.63	66.39	45.39
Sicilia	28.70	41.38	30.81	36.69	34.56	37.76	52.77	36.59
Sardegna	30.11	43.56	32.44	38.60	36.47	39.89	55.99	38.69

CO₂ emissions from cultivated organic soils subject to CM activity have been estimated, using default emission factor for warm temperate, reported in Table 5.6 of 2006 IPCC Guidelines (vol.4, chapter 5). The area of organic soils, updated on the basis of the FAOSTAT database, have been assessed through the stratification of different global datasets (i.e. the area covered by organic soils have been defined by extracting the Histosols classes from the *Harmonized World Soil Database*¹³; the cultivated area from the global land cover dataset, GLC2000¹⁴).

Carbon stock changes in land subject to cropland management activity, for the different carbon pools, are reported in table 12.

Table 12: C stock changes related to the Cropland Management under Article 3.4

	1990	2013	2014	2015	2016	2017	2018
	<i>kt C</i>						
<i>aboveground biomass</i>	-295	-511	-506	-346	-147	-188	-218
<i>belowground biomass</i>	-110	-205	-232	-237	-102	-104	-116
<i>Mineral soils</i>	549	1,533	1,747	1,966	2,067	2,108	2,049
<i>Organic soils</i>	-212	-212	-212	-212	-212	-212	-212

In Table GHG emissions and removals related to land subject to cropland management are reported, for annual and wood crops.

Table 13: GHG emissions/removals from Cropland Management under Article 3.4

	1990	2013	2014	2015	2016	2017	2018
	<i>kt CO₂ eq.</i>						
Annual crops	-697.21	-1,404.80	-2,126.87	-2,840.19	-3,123.97	-3,410.94	-3,289.33
Woody crops	946.21	-812.70	-792.96	-1,457.89	-2,767.13	-2,473.25	-2,227.35
Total CM	249.37	-2,217.50	-2,919.84	-4,298.08	-5,891.09	-5,884.19	-5,516.69

¹³ FAO/IIASA/ISRIC/ISSCAS/JRC, 2012. Harmonized World Soil Database (version 1.2). FAO, Rome, Italy and IIASA, Laxenburg, Austria.

¹⁴ EC-JRC. 2003. Global Land Cover 2000 database. Available at <http://bioval.jrc.ec.europa.eu/products/glc2000/glc2000.php>

4.3 Grazing land management

Carbon stock changes related to land subject to *grazing land management* have been estimated on the basis of the guidance of 2013 KP Supplement (IPCC, 2014). In particular no change in carbon stocks in the living biomass pool has been assumed; Tier 1 method has been followed for dead wood and litter, assuming that the abovementioned pools are at equilibrium, and no carbon stock changes are occurring. Changes in carbon stocks in mineral soils have been estimated following the same procedure described for cropland management; The stock change factors (F_{LU} , F_{MG} , F_I) selected on the basis of national circumstances are reported in the table 14.

Table 14: Stock change factors for Grazing land Management under Article 3.4

Management practice	F_{LU}		F_{MG}		F_I	
	Moist	Dry	Moist	Dry	Moist	Dry
Ordinary	1	1	1	1	1.11	1.11
Organic	1	1	1.14	1.14	1.11	1.11

The SOC_s per hectare used in the estimation process are shown in the table 15, per region and per management practices.

Table 15: SOC_s per region and management practice for Grazing land Management under Article 3.4

SOC	grazing land	
	Ordinary	Organic
	t C ha ⁻¹	
Piemonte	91.78	104.62
Valle D'Aosta	77.1	87.9
Liguria	92.7	105.68
Lombardia	79.93	91.13
Trentino Alto-Adige	78.51	89.5
Veneto	101.54	115.76
Friuli - Venezia Giulia	99.93	113.92
Emilia - Romagna	91.11	103.87
Toscana	62.24	70.95
Umbria	91.28	104.06
Marche	91	103.74
Lazio	88.98	101.43
Abruzzo	99.01	112.87
Molise	75.28	85.82
Campania	64.66	73.72
Puglia	42.03	47.91
Basilicata	60.13	68.55
Calabria	65.84	75.05
Sicilia	46.5	53.01
Sardegna	56.91	64.88

In Table GHG emissions and removals related to land subject to grazing land management are reported.

Table 16: GHG emissions/removals from Grazing land Management under Article 3.4

	1990	2013	2014	2015	2016	2017	2018
	kt CO ₂ eq.						
grazing land	127.28	-147.32	-586.29	-208.21	-153.64	183.68	159.88
organic grazing land	-5.13	-607.36	-611.71	-625.71	-732.14	-673.21	-625.85
TOTAL GM	122.15	-754.67	-1198.00	-833.92	-885.78	-489.53	-465.97

The trend of emissions and removals in the categories of the LULUCF sector in 2018 is shown in the following table 17.

Table 17: Trend in greenhouse gas net emissions/removals (kt GHG) from the LULUCF sector in the period 1990-2018

GHG Source and Sink Categories	1990	1995	2000	2005	2006	2007	2008	2009	2010	2011	2012	2013	2014	2015	2016	2017	2018
CO₂	-5,662	-24,857	-22,322	-36,043	-36,904	-15,552	-32,536	-36,739	-42,713	-34,901	-26,572	-40,451	-41,710	-44,204	-40,960	-23,229	-36,909
A. Forest Land	-17,852	-31,122	-26,004	-34,662	-34,319	-18,991	-30,836	-33,479	-36,658	-32,732	-28,659	-37,537	-38,717	-40,113	-37,073	-22,500	-33,472
B. Cropland	2,293	1,057	-201	-1,679	-2,376	-2,466	-1,773	-2,102	-885	784	2,030	1,779	1,343	595	-759	-540	-96
C. Grassland	3,645	-2,363	-2,162	-6,494	-6,799	-664	-6,525	-7,304	-9,553	-7,633	-4,831	-9,619	-9,191	-9,449	-8,413	-5,218	-8,396
D. Wetlands	NE,NO	5	8	8	8	8	8	130	130	130	130	130	130	130	53	53	53
E. Settlements	6,639	8,272	6,491	7,287	7,296	7,299	7,338	6,335	4,394	4,401	4,405	4,413	4,421	4,438	5,176	5,178	5,185
F. Other Land	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO
G. HWP	-388	-706	-453	-503	-715	-738	-747	-318	-142	149	353	382	304	196	57	-201	-183
H. Other	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO
CH₄	47.26	11.22	27.33	11.23	9.11	54.05	17.85	20.66	12.37	19.92	40.52	5.67	10.52	10.68	11.85	53.89	6.82
A. Forest Land	19.60	3.94	11.14	4.25	3.08	21.99	6.38	6.17	2.79	6.26	17.03	2.84	3.96	6.64	7.14	42.78	3.16
B. Cropland	0.22	0.06	0.13	0.06	0.05	0.25	0.08	0.09	0.05	0.10	0.19	0.31	0.03	0.10	0.08	0.32	0.04
C. Grassland	27.44	7.22	16.06	6.93	5.97	31.82	11.40	14.41	9.54	13.56	23.30	2.52	6.52	3.94	4.63	10.78	3.62
D. Wetlands	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO
E. Settlements	NO,NE	NO,NE	NO,NE	NO,NE	NO,NE	NO,NE	NO,NE	NO,NE	NO,NE	NO,NE	NO,NE	NO,NE	NO,NE	NO,NE	NO,NE	NO,NE	NO,NE
F. Other Land	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO
G. HWP	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO
H. Other	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO
N₂O	3.10	3.12	2.47	2.21	2.16	2.96	2.29	2.15	1.44	1.53	1.81	1.12	1.21	1.10	1.45	1.75	1.59
A. Forest Land	0.01	0.00	0.00	0.00	0.00	0.01	0.00	0.00	0.00	0.00	0.01	0.00	0.00	0.00	0.00	0.01	0.00
B. Cropland	0.44	0.53	0.26	0.22	0.20	0.19	0.16	0.14	0.14	0.11	0.09	0.06	0.03	0.00	0.07	0.15	0.21
C. Grassland	0.86	0.23	0.50	0.22	0.19	1.00	0.36	0.45	0.30	0.43	0.73	0.08	0.21	0.12	0.15	0.34	0.11
D. Wetlands	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO
E. Settlements	1.70	2.25	1.65	1.72	1.72	1.72	1.73	1.52	0.97	0.97	0.97	0.97	0.97	0.97	1.22	1.22	1.22
F. Other Land	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO
G. HWP	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO
H. Other	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO
LULUCF (kt CO₂ equivalent)	-3,556	-23,647	-20,904	-35,104	-36,033	-13,319	-31,408	-35,581	-41,975	-33,946	-25,018	-39,975	-41,087	-43,610	-40,231	-21,360	-36,266

5. Projections

The key drivers for projections are the activity data linked to the LULUCF sector; in particular, those related to forest land (and related activity Forest Management), cropland and grassland constitute the key variables to project emissions by sources and removals by sinks.

5.1 Information on projections reported in UNFCCC and UE context

Forest management

Italy has submitted information on Forest Management Reference Level (FMRL¹⁵), equal to -22,166Mt CO₂ eq. per year applying a first-order decay function for harvested wood products (HWP) and -21,182 Mt CO₂ eq. per year assuming instantaneous oxidation of HWP. According to Decision 2/CMP.7, methodological consistency between the FMRL and reporting for forest management during the second commitment period of the Kyoto Protocol has to be ensured, applying technical correction if necessary; the methodological elements triggering the need for a technical correction are reported in the table 18.

Table 18: Elements triggering a methodological inconsistency between the FMRL and FM reporting

Criteria	Description
The method used for GHG reporting (for Forest land remaining forest land or Forest Management) changed after the adoption of FMRL	The FMRL has been calculated with the EU models G4M (IIASA) and EFISCEN (EFI). Estimates of emissions and removals under FM activities have been carried out with the growth model For-est, used to estimate the net change of carbon in the five reporting pools.
Forest characteristics and related management ¹⁶	Availability of new data resulting from the ongoing NFI and consequent recalculations of the reported data under FM and <i>Forest Land Remaining Forest Land used</i> to establish the reference level
Harvested wood products	The estimates have been carried out on the basis of the 2013 KP Supplement (IPCC 2014) methodology

The rationale for the calculating the FMRL_{corr} is basically to address the elements of methodological inconsistency as listed in the Table 9.13. The key element is the use, in the elaboration of the FMRL_{corr}, of the same model used in the FM reporting (i.e. the For-est model, as described in the NIR (ISPRA, 2020) paragraphs 6.2.4 and 9.3.1.1); in addition the latest available activity data (i.e. forest areas, harvest statistics, fires occurrences) have been used and the HWP have been estimated following the 2013 KP Supplement (IPCC, 2014) methodology.

The resulting FMRL_{corr} and the related technical correction is provided in the following table 19.

Table 19: Technical correction and FMRL_{corr}

	Emissions and removals (Gg yr ⁻¹)
FMRL	-22,166
FMRL _{corr}	-23,846
difference in %	8%
Technical Correction	-1,680
Accounting Parameter	23,846

¹⁵ Submission of information on forest management reference levels by Italy:

http://unfccc.int/files/meetings/ad_hoc_working_groups/kp/application/pdf/awgkp_italy_2011.pdf

Communication of 11 May 2011 regarding harvested wood products value by Italy:

http://unfccc.int/files/meetings/ad_hoc_working_groups/kp/application/pdf/awgkp_italy_corr.pdf

¹⁶ This includes, among others: age-class structure, increment, species composition, rotation lengths, management practices, etc.

In the framework of the Regulation (EU) 2018/841 on the inclusion of greenhouse gas emissions and removals from LULUCF sector in the 2030 climate and energy framework, and amending Regulation (EU) 525/2013 and Decision 529/2013/EU, Italy submitted the National Forestry Accounting Plan, containing the Forest Reference Level (FRL), for the period from 2021 to 2025, in accordance with paragraph 3 of article 8 of the Regulation (EU) 2018/841.

The Italian FRL for the period 2021-2025 is equal to -19,656.1 kt CO₂ eq. yr⁻¹. This corresponds to the annual average value of the aggregated CO₂, CH₄ and N₂O emissions and removals in Managed Forest Land (MFL) as reported in table 20:

Table 20: Forest Reference Level (FRL)

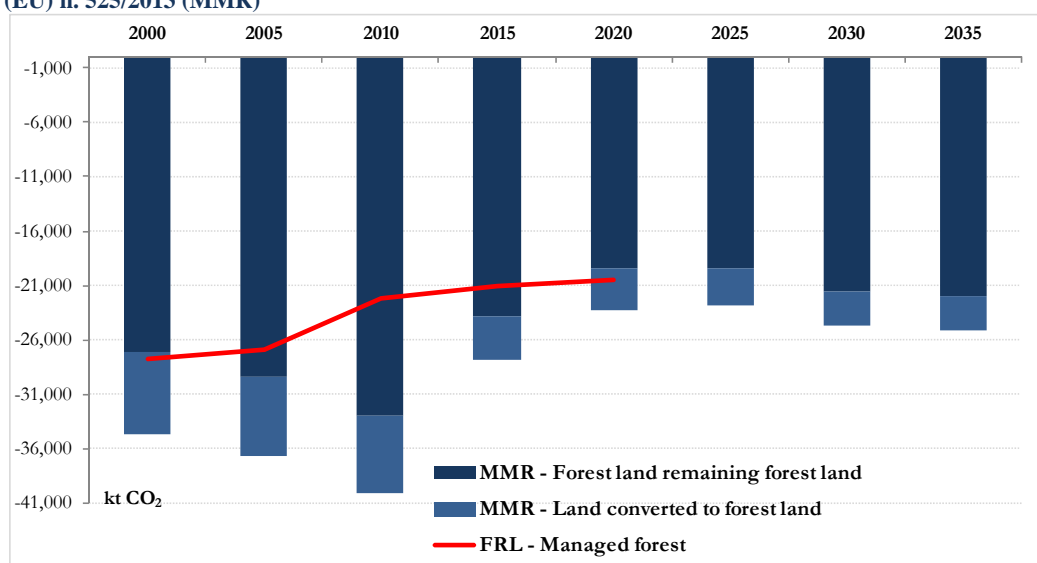
kt CO ₂ eq.	2021	2022	2023	2024	2025	average
CO ₂ (Living biomass pool)	-20,525.7	-19,985.7	-19,460.9	-18,950.9	-18,454.8	-19,475.6
CO ₂ (dead mass and litter pools)	0.0	0.0	0.0	0.0	0.0	0.0
CO ₂ (HWP_FOD)	-311.2	-316.3	-321.0	-325.4	-329.6	-320.7
CH ₄	139.7	139.7	139.7	139.7	139.7	139.7
N ₂ O	0.5	0.5	0.5	0.5	0.5	0.5
Total CO₂ eq. (HWP_FOD)	-20,696.7	-20,161.8	-19,641.8	-19,136.2	-18,644.2	-19,656.1
Total CO ₂ eq. (HWP_IO)	-20,385.5	-19,845.5	-19,320.8	-18,810.7	-18,314.7	-19,335.4

HWP_FOD: indicates that the HWP contribution is estimated using the First Order Decay (FOD) function under the production approach as described in Annex V of Regulation 2018/841

HWP_IO: indicates that the HWP contribution is estimated using the Instantaneous Oxidation (IO) approach.

The FRL has been estimated with the same model and the same datasets used to prepare the Italian GHG inventory, so ensuring complete consistency among the GHG inventory and the FRL estimates. In addition, the FRL is fully consistent with the national projections of anthropogenic greenhouse gas emissions by sources and removals by sinks reported under Regulation (EU) n. 525/2013. The modelling framework used to estimate and report under Regulation (EU) n. 525/2013 is the same used to estimate FRL (i.e. *for-est* model and NIR dataset, so that full consistency is ensured. In figure 5, the projections of CO₂ removals for forest land, as reported under Regulation (EU) n. 525/2013, is compared with the CO₂ removals for the managed forest for Forest Reference Level assessment.

Figure 5: CO₂ removals from Managed Forest – FRL versus CO₂ removals from forest land as reported under Regulation (EU) n. 525/2013 (MMR)



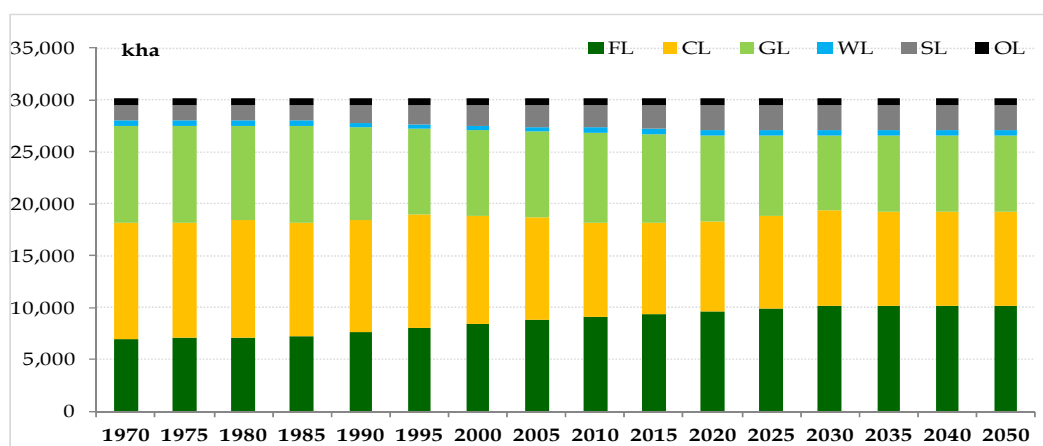
Additional information on the data and methods used to assess the FRL for the period 2021-2025 are available in the [National Forestry Accounting Plan](#).

Cropland and grassland

LULUCF projection of GHG emissions and removals have been estimated starting from the projections of land use and land use changes. The land uses trend, shown in figure 5, has been assessed on the bases of historical trends considering:

- a growing trend of agricultural areas¹⁷, assumed until 2040 followed by a stabilization. This profile is determined by the increase in cereal areas and a decrease in woody and industrial crops;
- a decrease of the forage areas (temporary and permanent)¹⁸, resulting from the forecast of a reduction in grazing animals;
- a substantial stability of the settlements area, in line with the goal of limiting land consumption
- a slight increase of forest area until 2030 and then remains constant.

Figure 5: land use trend



In the table 20, emissions projection for cropland and grassland categories have been reported. These projections have been carried out on the basis of 1990-2018 trend, subcategory by subcategory, considering a Business As Usual (BAU) scenario¹⁹.

Table 20: Projections for cropland and grassland categories (kt CO₂ eq.)

	1990	2000	2010	2015	2020	2025	2030	2035	2040	2045	2050
	<i>kt CO₂ eq.</i>										
Cropland	2,430	-122	-842	598	9,052	12,928	17,164	17,159	17,223	11,034	4,844
<i>cropland remaining cropland</i>	<i>911</i>	<i>-1,001</i>	<i>-1,330</i>	<i>598</i>	<i>528</i>	<i>518</i>	<i>518</i>	<i>514</i>	<i>514</i>	<i>529</i>	<i>545</i>
<i>land converting to cropland</i>	<i>1,518</i>	<i>879</i>	<i>489</i>	<i>0</i>	<i>8,524</i>	<i>12,409</i>	<i>16,645</i>	<i>16,645</i>	<i>16,709</i>	<i>10,505</i>	<i>4,300</i>
Grassland	4,589	-1,610	-9,225	-9,314	-7,361	-4,675	-1,893	-1,315	-722	-1,001	-1,281
<i>grassland remaining grassland</i>	<i>6,345</i>	<i>1,366</i>	<i>-1,789</i>	<i>-1,737</i>	<i>-504</i>	<i>-269</i>	<i>-279</i>	<i>-301</i>	<i>-313</i>	<i>-313</i>	<i>-313</i>
<i>land converting to grassland</i>	<i>-1,756</i>	<i>-2,976</i>	<i>-7,436</i>	<i>-7,576</i>	<i>-6,857</i>	<i>-4,406</i>	<i>-1,614</i>	<i>-1,015</i>	<i>-409</i>	<i>-689</i>	<i>-968</i>

¹⁷ For this assessment, the percentage change rates resulting from the FAO scenarios for Italy applied to the national historical series were used, for the macro-categories wood crops, cereals, industrial crops and more (legumes, vegetables, tubers), included in the cropland category. The projections of agricultural areas were developed starting from the FAO scenarios (FAO Global Agriculture Perspectives System (GAPS) in FAO. 2018. The future of food and agriculture - Alternative pathways to 2050 Rome; FAO Global Perspectives Studies. Data for 1961–2011 from FAO, 2016a; data for 2030 and 2050 from Alexandratos and Bruinsma, 2012), developed for Italy with the GAPS model (Global Agriculture Perspectives System); the GAPS is a partial market equilibrium model for primary equivalents of agricultural raw materials (commodities) and selected processed food products, and uses the FAOSTAT data sets, primarily agricultural production and food-balances; in particular it was calibrated with FAOSTAT data (FAOSTAT Food Balance Sheets: <http://www.fao.org/faostat/en/#data/FBS/report>) for the period 2011-2013; the estimates for the period 2030-2050 were made with data produced by Alexandratos, N. and J. Bruinsma 2012 (World agriculture towards 2030/2050: the 2012 revision. ESA Working paper No. 12-03. Rome, FAO)

¹⁸ The estimates are based on the 2012-2017 average of the head / hectare ratio (head consistency (LU) on total forage area

¹⁹ The BAU scenario has to be considered equivalent to the 'with measures' scenario, taking into account policies and measures already planned and implemented at national level

6. References

European Parliament and Council, 2013. Decision n. 529/2013/EU of the European Parliament and of the Council of 21 May 2013 on accounting rules on greenhouse gas emissions and removals resulting from activities relating to land use, land-use change and forestry and on information concerning actions relating to those activities

Federici S, Vitullo M, Tulipano S, De Lauretis R, Seufert G, 2008. An approach to estimate carbon stocks change in forest carbon pools under the UNFCCC: the Italian case. *iForest* 1: 86-95 URL: <http://www.sisef.it/forest@/show.php?id=466>

IPCC 2006, 2006 IPCC Guidelines for National Greenhouse Gas Inventories, Prepared by the National Greenhouse Gas Inventories Programme, Eggleston H.S., Buendia L., Miwa K., Ngara T. and Tanabe K. (eds). Published: IGES, Japan

IPCC 2014, 2013 Revised Supplementary Methods and Good Practice Guidance Arising from the Kyoto Protocol, Hiraishi, T., Krug, T., Tanabe, K., Srivastava, N., Baasansuren, J., Fukuda, M. and Troxler, T.G. (eds) Published: IPCC, Switzerland.

ISPRA, 2020. Italian Greenhouse Gas Inventory 1990-2018. National Inventory Report 2018. ISPRA Rapporti 318/20